

Appendix-F
Environment

**THE STUDY
ON
BASIN-WIDE BASIC IRRIGATION AND DRAINAGE MASTER PLAN STUDY
IN
THE KINGDOM OF CAMBODIA**

FINAL REPORT

APPENDIX-F ENVIRONMENT

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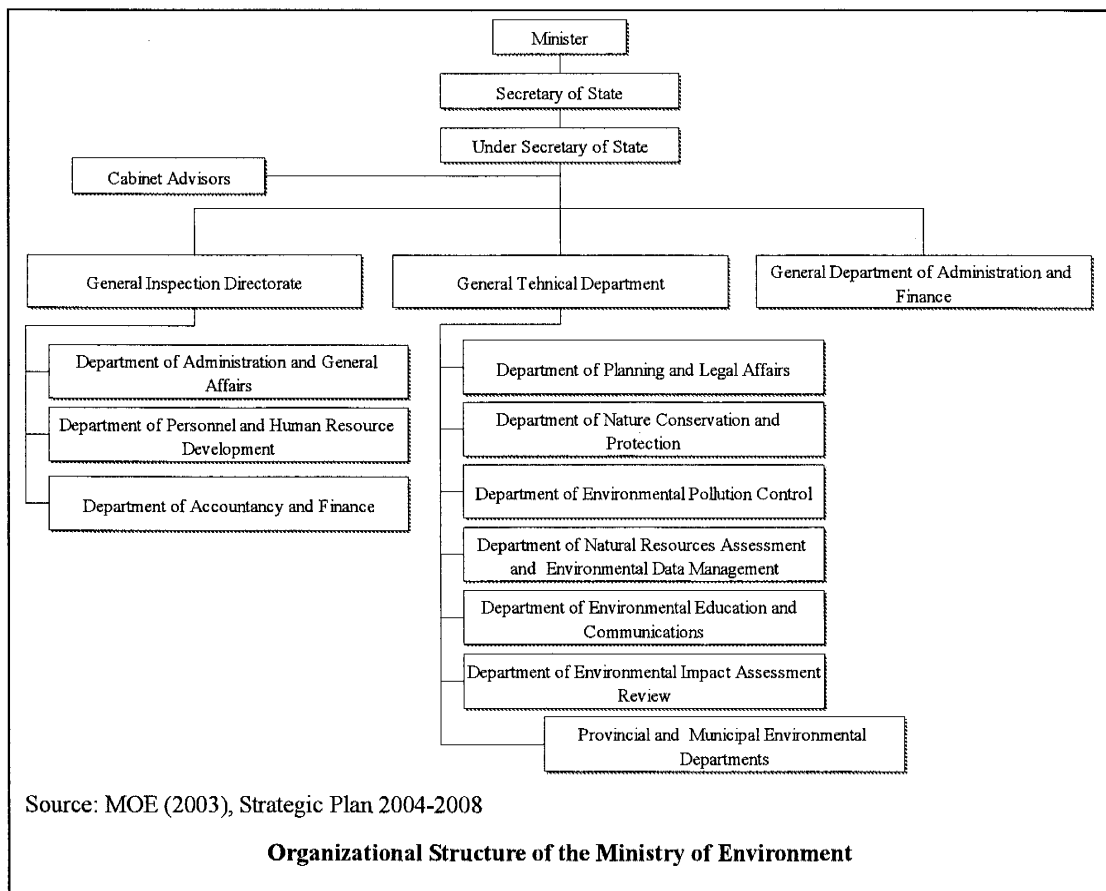
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CHAPTER F1 ORGANIZATIONS RELATED WITH ENVIRONMENTAL ADMINISTRATION

F1.1 Ministry of Environment

F1.1.1 Organization

The role and responsibilities of the Ministry of Environment (MOE) are stipulated in the Sub-decree No. 57 on the Organization and Functions of the Ministry of Environment, approved in 1997. The present organizational structure of MOE is shown as follows:



MOE under the Minister consist of three General Department (General Directorate), General Inspection Directorate, General Technical Department and General Department of Administration and Finance. The Department of Assessment (EIA) Review is in charge of EIA report review on the basis of the Sub-Decree on Environmental Impact Assessment Process.

F1.1.2 Strategic Goal

In the Third Strategic Plan (2004-2008), there are nine strategic goals as listed as follows:

- (1) Innovate institution arrangements for managing natural resource at the local level;
- (2) Advance legal mechanisms for both national and local government;
- (3) Establish networking among public and private institutions on scientific technical,

legal instruments, and economic aspects of environmental pollution, national regulation, and the implementation of international conventions;

- (4) Integrate enforcement programs in environmental protection and natural resource conservation sector;
- (5) Promote partnerships between levels of regional, government, public and private sectors, donor agencies and the local community;
- (6) Improve protected area zoning schemes, integrated into land use and management plans;
- (7) Manage oriented environmental pollution and monitoring programs;
- (8) Create information technology applications for local and sub-regional management situations; and
- (9) Promote investment opportunities in environmental pollution management.

In order to achieve such goals, however, as stated by MOE, several constraints are observed related with physical, institutional, legal and financial issues as follows:

Legal and Political Issues

- Environmental policy and legal framework requirement
- Lack of environmental policy and legal instruments
- Selective enforcement of environmental laws and instruments

Technical Issues

- Environmental technology and information management requirement
- Share information and technical transfer and exchange requirements
- Lack of technical documents in Khmer and foreign languages
- Lack of dissemination systems for environmental information, education, and awareness
- Inadequate environmental data and information
- Lack of equipment and other office supplies
- Lack of environmental laboratory
- Inadequate transport means for project implementation and communications

Institutional Issues

- Commitment of the Governmental Institutions on environmental protection and natural resources management requirement
- Environmental partnership and cooperation requirements (local, sub-region, region, international level)
- Staff postings are not always

- Staff postings are not always relevant to previous training or expertise, would be related with human resource issues as well
- Lack of coordination with other relevant institutions
- Lack of support and participation from other relevant institutions and the public

Human Resource Issues

- Human resource requirement
- Lack of human resources in environmental fields and management
- Low awareness by the Cambodian people on the environment

Financial Issues

- Financial requirement
- Lack of operational funds
- Inadequate funding from both the Government and international organizations

Others

- External requirements (services/technology required to be purchased or assisted from outside), which would be related with all the issues

The abovementioned constraints would be applicable also to other environment-related organizations, which needs to be improved so as to strengthen environmental administration in Cambodia.

F1.1.3 EIA Activities under MOE

According to the Strategic Plan, the projects reviewed and commented by MOE in 2003 are listed as follows:

- | | |
|---------------------------|-------------|
| • Textile | 26 projects |
| • Dry cleaning | 3 projects |
| • Clothing and Knitting | 1 project |
| • Printing | 3 projects |
| • Soya bean | 1 project |
| • Paper products | 1 project |
| • Electrical power supply | 1 project |
| • Plastic products | 1 project |
| • Hotel construction | 8 projects |
| • Cloth hanging products | 1 project |
| • Shoe production | 2 projects |
| • Pure drinking water | 1 project |

- Fertilizers and pesticides storage 5 projects
- Tobacco products 1 project
- Concrete materials 1 project

Other activities include: (i) EIA report review for 17 projects, (ii) field assessment during reviewing of EIA report for 5 project areas, (iii) advice for preparation of EIA report for 38 projects, (iv) advice to minimize environmental impact for 87 projects, and (v) provision of training courses on project monitoring, capacity building in EIA, and follow-up project implementation.

As decentralization process is being applied at Provincial level also within the administration of environmental management, EIA process is not left out. In the case of projects with the cost of less than US\$ 2 million Provincial Environmental Department (DOE) is responsible for EIA approval while others with the cost of more than US\$ 2 million must be reviewed and approved by MOE Central. Under decentralized mechanism, MOE also focus on devolving to DOE environmental monitoring through technical support and capacity development of DOE as well.



**Provincial Department of
Environment Newly
Established
(Battambang Province)**

F1.2 Ministry of Water Resources, Meteorology and Hydrology

F1.2.1 General

Resettlement under Project Management Unit (PMO) was established with the assistance of Asian Development Bank (ADB) to be in charge of resettlement matters in water resource development project. Sub-decree on resettlement is drafted and currently waiting for approval process, contents of which are as follows:

- General provisions
- General public interest and national interest
- General principles and requirements
- Procedures for Determining specific Nature of a Proposed Project
- Planning to Address Project Social Impacts
- Compensation and Rehabilitation Assistance
- Complaints and Judicial Review
- Budget
- Institutional Arrangements
- Final Provisions

It has been drafted up based on the Resettlement Guideline by ADB.

On the other hand, there is no Department or unit taking charge of EIA within the organizations at present. One of the important institutional development target stated by

MOWRAM is to establish framework on EIA by MOWRAM themselves.

Box-1: Some of the key elements of good practice in resettlement planning and implementation

- Take all steps to minimize or eliminate involuntary resettlement where feasible by exploring viable alternative design options.
- Define the parameters of likely resettlement at the ISA stage, and include appropriate TORs in the PPTA Feasibility Study.
- Conceptualize and implement resettlement measures as development programs, to be part of all projects, including sector, private sector and co-financed projects, and loans to development finance institutions.
- Complete socioeconomic surveys and census people affected early in the project preparation to identify all losses from land acquisition and all affected persons, and to avoid an influx of outsiders or speculators.
- Involve all stakeholders in a consultative process, especially all affected persons, including vulnerable groups.
- Compensate all affected persons, including those without title to land, for all their losses at replacement rates.
- Where relocation of housing is required, develop relocation options in consultation with affected persons and host communities, in order to restore living standard.
- Where people will lose income and livelihoods, establish appropriate income restoration programs with objectives to improve, or at least restore, their productive base.
- Provide a social preparation process for people affected when they are vulnerable, or when there is social tension associated with displacement.
- Provide a social preparation process for people affected when they are vulnerable, or when there is social tension associated with displacement.
- Prepare a time-bound Resettlement Plan with appropriate provisions and sources of funding before appraisal, with a summary Resettlement Plan before Management Review Meeting (MRM). Include a summary resettlement plan in the draft Refugee Resettlement Program (RRP) to the Board.
- Involve specialists in resettlement and social sciences, and people affected, in the planning, implementation, and monitoring of the Resettlement Plan.

Source: ADB (1998), Summary of the Handbook on Resettlement A Guide to Good Practice

F1.2.2 Institutional Development in Environmental Management

In the Strategic Development Plan 2006-2010 (Draft), one of the institutional goals elaborated is *“MOWRAM has a comprehensive capacity to develop and apply procedures for social and environmental impact assessment and mitigation.”* Within this goal, MOWRA is planning to build Social and Environmental Management Unit aiming to manage projects in sustainable, and natural and social environment-friendly manner. It is required to upgrade capability on social and environmental management in water resource sector through the implementation of on-going projects, institutional development programs and promotion of inter-coordination among relevant agencies.

F1.3 Ministry of Agriculture, Forestry and Fisheries

Ministry of Agriculture, Forestry, and Fisheries (MAFF) has an EIA Office under the Department of Planning and Statistics. The office was originally established with the support by the Institutional Strengthening and Expanding EIA Capacity in Cambodia Project in 1997-1999.

CHAPTER F2 SOCIAL AND ENVIRONMENTAL CONDITIONS IN THE FOUR RIVER BASINS

F2.1 Protected Areas

The Cambodian Government has already ratified several international environmental conventions. On the basis of such conventions as well as legislative framework, the Government in 1993 issued the Royal Decree of Protected Areas as defined four categories of protected areas in the country: (i) National Park, (ii) Wildlife Sanctuary, (iii) Protected Landscape and (iv) Multiple Use Areas. At present, there are 23 sites of protected areas in the country occupying approximately 3.3 million ha (18 % of total area).¹

Protected areas in the Study area is illustrated in Figure F2.1-1. In the Four River Basins, five protected areas are partly encompassed: (i) Aural Wildlife Sanctuary, (ii) Phnom Samkos Wildlife Sanctuary, (iii) Samlaut Multiple Use Area, (iv) Tonle Sap Multiple Use Area, and (v) Cardamom Protected Forest, characteristics of which are tabulated as follows:

Box:	Category of Protected Areas
1.	National Parks: Areas reserved for nature and scenic views to be protected for scientific, educational and entertainment purposes
2.	Wildlife Sanctuary: Natural areas preserved at their natural conditions in order to protect wildlife, vegetation and ecology balance
3.	Protected Landscape: Areas to be maintained as scenic views for pleasure and tourism
4.	Multiple Use Areas: Areas necessary for the stability of the water, forestry, wildlife, and fisheries resource, for pleasure, and for the conservation of nature with a view of assuring economic development
Source: Royal Decree on the Protection of Protected Areas	

Protected Areas in the Four River Basins

Protected Area	Province	Total Area (ha) and Area in Basin	Relevance with Basin Irrigation	Some Unique Characteristics
Aural Wildlife Sanctuary	Pursat Province	253,750	The upstream of irrigation systems in southern basin area	Highest mountain (1743m) in Cambodia with a wide diversity of vegetation ranging from dry Dipterocarpus / Podocarpus forest to medium altitude evergreen forest.
Phnom Samkos Wildlife Sanctuary	Crossing Battambang and Pursat Province	333,750	The upstream of irrigation systems	High altitude area with a wide diversity of forest types. Supports a range of threatened birds in the area
Samlaut Multiple Use Area	Crossing Paillin and Battambang Province	60,000	The upstream of irrigation systems	An evergreen forest area within the watershed of the Sangke river. It has been denuded by mining operations causing severe erosion and increased sedimentation of the river, which flows into the Tonle Sap Lake.
Tonle Sap Multiple Use Area	Battambang Province	316,250	The downstream of irrigation	Long-standing ichthyological reserve. Great biological,

¹ Royal Decree on the Protection of Protected Areas and Ministry of Environment (2004), State of Environment Report 2004

Protected Area	Province	Total Area (ha) and Area in Basin	Relevance with Basin Irrigation	Some Unique Characteristics
Area			systems	hydrological and cultural/economic importance.
Cardamom Protected Forest	Pursat Province	401,300	The upstream of systems in south-east basin area	Known to contain almost all the country's known mammals, birds, reptiles and amphibians. This is partly due to the very high diversity of habitats, some of which occur nowhere else in Cambodia such as large expanses of fire-regulated ferns, upper montane forest, high elevation marshes and blackwater rivers.

Prepared by JICA Study Team based on Ministry of Environment (2004), State of Environment Report and Fauna and Flora International

F2.2 Social and Natural Environmental Conditions based on Environmental Questionnaire

In order to understand social and natural environmental conditions related with irrigation, questionnaire survey was carried out during the workshop at sample irrigation systems as follows:

List of Irrigation Systems Surveyed Under Environmental Questionnaire Survey

No.	Irrigation Scheme	River Basin	Province	District	Commune
1	Vat Balat Sytem	Battambang	Battambang	Sang Ker	Norea
2	Thmat Pong System		Battambang	Sang Ker	Wat Tameim and O Dambang 1
3	Bot Sala Sytem		Battambang	Sang Ker	Wat Tameim and Bay Damram
4	Prek Chik System	Moung Russey	Battambang	Moung Russey	Prek Chik
5	Po Canal System		Battambang	Moung Russey	Chrey
6	Ream Kon System		Battambang	Moung Russey	Ta Laos and Chrey
7	Wat Loung System	Pursat	Pursat	Sampov Meas	Lolok Sar
8	Boeung Preah Ponley System		Pursat	Kravang	Preh Ponley
9	Wat Chre System		Pursat	Bakan	Boeung Khnar
10	Taram System	Boribo	Kampong Chhnang	Teuk Phos	Kbal Teuk
11	Khvet System		Kampong Chhnang	Teuk Phos	Kbal Teuk
12	Lum Hach System		Kampong Chhnang	Boribo	Anh Chanh Rong

Prepared by JICA Study Team

The results are explained as follows and illustrated in Figure F2.2-1.

F2.2.1 Natural Environment

(1) Deforestation in the Watershed (N-1)

Forest cover in the Four River Basins ranges from 30 % in the Boribo River Basin to 69 % in the Pursat River Basin. Deforestation in the watershed in the Boribo River Basin is more significant than other Basin since all most all the participants pointed out. Bot Sala Irrigation Systems in the Battambang River Basin and the Boeung Preah Ponley in the Pursat are not

negligible either.

(2) Quality Problem on Irrigation Water (N-2)

Water quality monitoring is presently carried out only at Bac Plea Station of Battambang River since 2004 August by the Water Quality Analysis Office of Hydrology and River Works Department under MOWRAM. According to the interview, quality problem on irrigation water is observed especially due to urbanization of the surrounding areas of irrigation systems. Such situation is evident primarily in the Vat Balat in the Battambang and the Ream Kon in the Moung Russey.

(3) Water Pollution in the Downstream (N-3)

Water pollution in the downstream of irrigation systems such as eutrophication is caused by excessive application of chemicals and fertilizers. Such situation is observed mainly in the Battambang River Basin

(4) Ground Water Pollution (N-4)

In particular, nearly 60 % of the participants pointed out this issue.

(5) Soil Erosion (N-5)

Soil erosion is to some degrees common issue at most of the irrigation systems which needs to be considered.

(6) Water Logging, Drainage Problems in the System (N-6)

Water logging and drainage problems are also related with flooding presented afterward. Out of 12 irrigation systems, 7 irrigation systems are facing some problems according to the participants.

(7) Water-borne Disease (N-7)

There are no analyzable and quantifiable data for status on water-borne disease in the statistics, however, water-borne disease cannot be ignored as one of the negative impact for irrigation development. Water-borne disease such as Malaria and dengue is perceived as problems in irrigation development. Four irrigation systems consisting of the Vat Balat, the Por Canal, the Lum Hach and the Khvet shows higher percentage as more than 50 % of the participants pointed out.

(8) Soil Contamination in the field (N-8)

Soil contamination is caused due to excessive application of chemicals and fertilizers and/or any other substances. The Batatmbang and the Moung Russey shows higher than the remaining two River Basins.

(9) Salinity Problems in the Field (N-9)

At present, no participants raised this issue.

F2.2.2 Social Environment

(1) Conflict of Water Right with Other Systems (S-1)

Water right in Cambodia is still not clear, instead, customary water right is common. Until now, water law has not been officially enacted. Under such situation, some conflicts on water rights with other irrigation systems are observed particularly at the systems in the Battambang River Basin and the Moung Russey River Basin.

(2) Conflict of Water Distribution Between the Upstream and the Downstream in the System (S-2)

Resource allocation related with the conflict of water distribution within the system is frequently observed at many irrigation systems. This would be caused due to scarcity of water resources as well as insufficient institutional maturity in the system. In the 12 sample irrigation systems, two River Basins consisting of the Battambang and the Moung Russey, in particular, shows higher percentage than others. According to the inventory survey, the Boribo lag behind in the progress of FWUCs establishment, however, conflict of water distribution is lower. Since the Boribo is major in small scale irrigation systems, traditional group cohesion is frequently found contributing to amicable resource allocation in the systems.

(3) Conflict of Land Allocation (S-3)

Except for the Prek Chik and the Khvet Irrigation System, no conflict of land allocation is common in sample irrigation systems.

(4) Illegal Cropping (S-4)

Illegal cropping and encroachment in the public area, particularly reservoir and canals areas, is one of the important issues in the irrigation systems. Such situation mainly is caused by insufficient land and water resources together with population pressures. Highest percentage is observed in the Prek Chik in the Moung Russey System followed by the Khvet System in the Boribo. Consensus building is required for resettlement during plan and design stage of rehabilitation works.



Illegal Cropping in the Reservoir Area (Pursat Province)

(5) Flood Damage in the System (S-5)

Flood damage particularly along the Tonle Sap Lake in the eastern part of river basin is observed in every wet season. In addition, flooding from its tributaries are also not negligible issues. Although details are not known, nine out of twelve systems are currently facing flooding problems in the rainy season.

F2.2.3 Other Important Issues

(1) Historical/Cultural Heritage in the System (O-1)

Existence of historical and cultural heritage in the irrigation systems is surveyed. Accordingly, there are something pointed out in all the irrigation systems which needs to be checked in the next phase of the Study.

(2) Protected Areas in the System (O-2)

Participants from all the irrigation systems pointed out the existence of protected areas in the irrigation systems. Although the meaning would be different from the one stipulated by the Royal Decree, the issue must be confirmed in details during Pre-Feasibility Study.

(3) Endangered Species (O-3)

There are no detailed data on endangered species under the irrigation systems in the Four River Basins. As similar tendency to protected areas, participants pointed out that there are endangered species in the system. This should be checked in the next phase.

On the contrary, Tonle Sap Multiple Use Areas located at the downstream of irrigation systems in the Basins have great biodiversity with over 100 species fish including 11 globally threatened and 4 near-threatened species such as Spot-billed Pelican, Greater Adjutant, Bengal Florican, Oriental Darter and so forth. It also supports important populations of reptiles such as Siamese Crocodiles. Although irrigation systems are located in the upstream of Tonle Sap, significant adverse environmental impacts are not expected from activation of existing system without large scale of expansion. Environmental monitoring plan must be considered as one of the project components so as to minimize negative impact against Tonle Sap Area.

(4) Precious Ecology (O-4)

There are no specific data regarding precious ecology affected by irrigation systems in the Basins. However, as similar to O-2 and O-3 introduced above, all the participants raised this issue observed in the system.

(5) Environmental Management Activities (O-5)

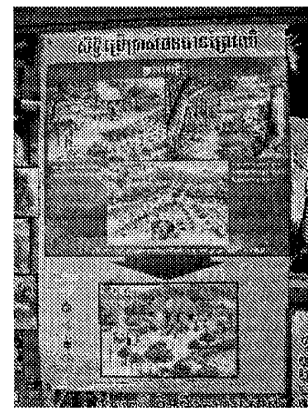
Environmental management under the irrigation system in effectively carried out for sustainable resource mobilization if awareness among communities is high. According to the result, although showing some different degrees, all the participants are currently doing regular environmental management activities either by group or individuals. The activities listed are: (i) controlling fishing yield, and (ii) tree planting in the system as well as watershed.

(6) Member of Farmer Water Users' Community

Progress of FWUC establishment in Cambodia is still challenging although MOWRAM and other relevant institutions have been making great effort to support establishment and registering together with strengthening. FWUC would be one of the important keys to carry out effective resource allocation among community members under irrigation system. At present, only two irrigation systems in the Battambang River Basin have FWUC while others do not.

(7) Participants Interest in the Establishment of FWUC

All the irrigation systems have high percentage of participants interested in the establishment



Environmental Awareness Campaign Poster Prepared by PDE with the Assistance of NGOs (Kampong Chhnang Province)

and management of FWUCs, which are good indications as a prerequisite for the improvement of system O&M by farmers' themselves. The support will be required from relevant organization.

Box-3: Resettlement Example at Stung Chinit Irrigation and Rural Infrastructure Project

Stung Chinit Irrigation Project in Kampong Thom Province assisted by ADB is one of the successful projects in resettlement. The project consisted of the rehabilitation of irrigation systems and the associated upgrading of its infrastructure covering 2,960 ha as a priority area.

The Project involved an iterative process of survey and design requiring for some of the irrigation system an inventory of losses and consultation with affected persons and resettlement measures agreed and carried out during implementation. On the basis of ADB's resettlement guideline, loss of agricultural land will, at the choice of Affected Persons, be compensated by land for land of equal productive capacity or compensation in cash permitting land purchase by APs of equal quality and productivity to that lost. This entitlement will apply to all land lost in the COI of secondary canals and drains. Losses of land in tertiary canals and drains, as well as losses to quaternary systems and to ox-cart tracks, are voluntarily lost in the self-managed creation of the tertiary block irrigation system, and will be voluntarily replaced through the farmer managed process of land adjustment.

The resettlement plan was based on institutional collaboration through consultation with the Inter-Ministerial Resettlement Committee (IRC) of RGC, Ministry of Economy and Finance (MEF) and the Ministry of the Interior, with other concerned ministries, and with people affected by the Project. Such consultations also included the Provincial Governor's Office, Provincial Resettlement Sub-Committee of the Province of Kampong Thom and the Provincial Project Steering Committee, which is represented in the IRC, and PDOWRAM Project Implementation Unit (PIU).

Source: ADB (2004), Resettlement Planning Document, Stung Chinit Irrigation and Rural Infrastructure Project (Loan No. 1753-CAM (SF))

CHAPTER F3 RESULT OF INITIAL ENVIRONMENTAL EXAMINATION

F3.1 Screening of the Projects and Supporting Programs Proposed in the Master Plan

In the Master Plan, 21 projects, components of which are primarily civil works are proposed while 4 project supporting programs are listed. Component of project supporting program is particularly: (i) awareness program, (ii) module development, (iii) training and (iv) small-scale pilot exercises in agriculture and irrigation rehabilitation, therefore, adverse potential impact toward environment is completely none or negligible small. Thus project supporting programs are screened out from IEE. Initial screening results are tabulated as follows:

Result of Screening for Initial Environmental Examination

No.	Code	Project Name	Component	Proposed Irrigation Area(ha)	Result of Screening
1	BTB-01	Kong Hort Rehab. Project (Phase I)	Weir, canals	10,040	IEE (EIA is required)
2	BTB-01	Kong Hort Rehab. Project (Phase II)	Weir, canals	2,733	IEE
3	BTB-02	Sala Taon Weir Rehab. Project	Weir, canals	10,400	IEE (EIA is required)
4	BTB-03	Ratanak-Battambang Water Harvesting Pjt.	Reservoir, canals	580	IEE
5	MRB-01	Bassac Irrigation System Rehab. Project	Canals	3,500	IEE
6	MRB-02	Ream Kon Rehab. Project	Weir, canals	2,300	IEE
7	MRB-03	Por Canal Rehab. Project	Canals	1,200	IEE
8	MRB-04	Nikom/Dai Ta Chan Rehab. Project	Weir, canals	600	IEE
9	PRB-01	Beoun Preah Ponley Rehab. Project	Weir, canals	8,500	IEE (EIA is required)
10	PRB-02	Damnak Ampil Ext. Project	Gate, Canals	8,000	IEE (EIA is required)
11	PRB-03	Wat Loung Rehab. Project	Canals	3,940	IEE
12	PRB-04	Wat Chre Rehab. Project	Weir, canals	1,000	IEE
13	PRB-05	Anlong Knouchi, Wat Leal, Kosh Khsach Water Harvesting and Recession Rice Rehabilitation Project	Reservoir, Canals	2,602	IEE
14	BRB-01	Lum Hach Rehab. Project	Weir, canals	3,700	IEE
15	BRB-02	7 th January Canal Rehab. Project	Canals	2,000	IEE
16	BRB-03	Khvet Rehab. Project	Weir, canals	250	IEE
17	BRB-04	Ta Ram Rehab. Project	Weir, canals	180	IEE
18	BRB-05	Chak Teum, Trapeang Khlong, Don Pov Rehab. Pjt.	Canals	980	IEE
19	BRB-06	Teuk Laak, Trapeang Thlan Rehab. Project	Canals	230	IEE
20	BRB-07	Toul Champey Rehab. Project	Canals	360	IEE
21	BRB-08	Chan Keak Rehab. Project	Canals	110	IEE
Project Supporting Program					

No.	Code	Project Name	Component	Proposed Irrigation Area(ha)	Result of Screening
1		Meteorological and Hydrological Observation strengthening Program			Screen out
2		Capacity Building Support Program for MOWRAM Staff			Screen out
3		Capacity Building Support Program for PDOWRAM Staff			Screen out
4		Upland Crops Production Promotion Programs (Phase-I and Phase-II)			Screen out

Prepared by JICA Study Team

It should be noticed that four projects: (i) Kong Hort Rehabilitation Project (Phase I), (ii) Sala Taon Waeir Rehabilitation Project, (iii) Beoun Preah Ponley Rehabilitation Project and (iv) Damnak Ampil Extension Project need EIA in accordance with the Sub-Decree on Environmental Impact Assessment Process.

F3.2 Result of Initial Environmental Examination

Results of Initial Environmental Examination for 21 proposed projects are explained in this section, contents of which consist of: (i) Project Description, (ii) Environmental Impact Matrix, (iii) Mitigation Measures and (iv) Conclusion.

(1) Kong Hort Rehabilitation Phase I

(i) Project Description

Item	Description			
	District	Commune	Village	UTM Reference
1.1 Location	Banan, SangKe	Kan Teur Mouy-Peir, Reang Kessei, Tourl Thnornng Mouy, and other 3 communes	Wat Kandal, Tourl Thnornng, and other 17 villages	298625 1423219
1.2 River basin/ water source	Battambang river basin/ Battambang river			
1.3 Target group	1) Number of household = 6,554 (Wet season medium- paddy) 2) Staff of PDOWRAM and DPA			
1.4 Objective of the project or program	1) Enhancement of rice production through construction of weir and rehabilitation of existing irrigation system			
1.5 Type of project or program	1) Rehabilitation of existing irrigation system			
1.6 Objective area	10,040 Ha			
1.7 Necessity of project/program	The Phase I project consists of 3 existing systems. The Kong Hort Irrigation system is located at upstream reaches of the Battambang river. Irrigation service started in 1978. After a few years' operation, the Kong Hort weir was completely washed away by a series of floods, and then the system lost the water source. The system requires weir re-construction, and rehabilitation of abandoned canals and structures to recover the original system function.			

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	-/C	X	<p><u>Construction</u></p> <ul style="list-style-type: none"> Domestic wastewater and refuse will increase due to increase of labor for construction works.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/B	<p><u>Construction</u></p> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <p><u>O&M</u></p> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/B	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/B	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
29. Sedimentation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
30. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note - : Adverse Impact
X : No Impact

- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	construction works should involve mitigation measures on environmental impact including construction waste disposal.		
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

- (1) Kon Hort Rehabilitation Phase I Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.
- (2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Kon Hort Rehabilitation Phase I Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.
- (3) Mines and UXO risk in the Project is high according to the data from the Cambodian Mine Action Center (CMAC). Security of the site needs to be ensured prior to the Project implementation.

(2) Kong Hort Rehabilitation Phase II Project

(i) Project Description

Item	Description				
	District	Commune	Village	UTM Reference	
1.1 Location	Banan, SangKe, Battambang	KanTeurPeir, RangKessei, Tapon, WatKor, and other 8 communes	ChhayRumPeat, PreyTotoeng, PreySvay, RangKessei, And other 32 villages	298625	1423219
1.2 River basin/ water source	Battambang river basin/ Battambang river				
1.3 Target group	Number of household = 3,070 (Wet season medium- paddy)				
1.4 Objective of the project or program	Enhancement of rice production through rehabilitation of existing irrigation system and water supply from the Kong Hort weir				
1.5 Type of project or program	1) Rehabilitation of existing irrigation system 2) Construction of canals				
1.6 Objective area	2,733 Ha				
1.7 Necessity of project/program	<p>Thirty existing irrigation systems in the project area rely on pump system, unstable floodwater along the Battambang river, and rainfall in flat area. Consequently, irrigation systems are suffering from unstable water supply. On the other hand, available water resources in the Battambang river are enough to supply water to existing irrigation area in the basin. In order to utilize available water source from the Kong Hort weir by gravity, rehabilitation of the existing systems would be necessary.</p>				

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				existing social networks.
6. The poor, indigenous and minority group	X	X	X	• No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	• No impact will be expected.
8. Cultural Heritage	X	X	X	• No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<u>Construction</u> • Conflict among labors and farmers, security deterioration would be expected. <u>O&M</u> • Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	• Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	• No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	• This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	• No impact will be expected.
14. Soil Erosion	X	X	X	• Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	• No impact will be expected.
16. Hydrology	X	X	X	• No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	• Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	• Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u>

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
29. Sedimentation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
30. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	awareness of labors.		
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Kon Hort Rehabilitation Phase II Project are not expected to raise great magnitude of

negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Kon Hort Rehabilitation Phase II Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(3) Mines and UXO risk in the Project is high according to the data from the Cambodian Mine Action Center (CMAC). Security of the site needs to be ensured prior to the Project implementation.

(3) Sala Taon Weir Rehabilitation Project

(i) Project Description

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	SangKe, AekPhnum, Battambang	NoRea, PeamAek, SamRongKnung, Prek Kpob, and other 3 communes	KorHa, TaKok, OTrea NoRea, and other 38 villages	306849	1450839
1.2 River basin	Battambang river basin/ Battambang river				
1.3 Target group	Number of household = 4,648 (Wet season medium- paddy)				
1.4 Objective of the project	Enhancement of rice production through re-construction of Sala Taon weir and rehabilitation of existing irrigation system				
1.5 Type of project	Rehabilitation of existing irrigation system				
1.6 Objective area	10,400Ha				
1.7 Necessity of project	<p>The Sala Taon weir is located at 5 km downstream from Battambang city center. Construction work of the weir commenced in 1994 and the work was suspended at the completion rate of 20%.</p> <p>Irrigation of the existing systems in the project area relies on pump system or unstable floodwater. In this regard, construction of Sala Taon weir is strongly requested by farmers for stable and low cost water supply. After construction of the weir, seventeen existing systems could receive irrigation water by gravity.</p>				

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/A	-/A	-/A	<ul style="list-style-type: none"> Resettlement is required for the people living along the river side in the upstream of proposed weir site. In addition, illegal farming within existing canals must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
3. Land Use and Resource Mobilization	+/B	X	+/B	<u>Preparation</u> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <u>O&M</u> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <u>O&M</u> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	-/C	X	<u>Construction</u> <ul style="list-style-type: none"> Domestic wastewater and refuse will increase due to increase of labor for construction works.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
and Tidal Area				
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/B	<p><u>Construction</u></p> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <p><u>O&M</u></p> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/B	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/B	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
29. Sedimentation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
30. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. Particularly, compensation would be required for the people currently along the river. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> Site Supervision
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	mitigation measures on environmental impact including construction waste disposal.		
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	• Soil sampling and analysis	• O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	• Site Supervision	• Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	• Site Supervision	• Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	• Site Supervision	• Construction Phase

(iv) Conclusion

(1) Sala Taon Weir Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Sala Taon Weir Rehabilitation Project are not left out. Although people staying along the river is not many, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.



Some Houses Observed Along the River at the Upstream of Proposed Weir Site

(4) Ratanak-Battambang Water Harvesting Rehabilitation Project

(i) Project Description

Item	Description			
1.1 Location	District	Commune	Village	UTM Reference
	Banan, RatanakMondol	Sdao, Treng, Sneung, hlovMeas, and other 2 communes	BaosPor, BaosKnor, Sdao, Roung, and other 9 villages	291681 1419667
1.2 River basin	Battambang river basin/ Battambang river			
1.3 Target group	Number of household = 677 (Wet season medium- paddy)			

Item	Description
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing pond irrigation system
1.5 Type of project	Rehabilitation of existing irrigation system
1.6 Objective area	580 Ha
1.7 Necessity of project	The proposed project consists of thirteen (13) water harvesting systems in the upper basin. Irrigation ponds are only solution to secure water supply in irrigation and in daily life in the area. The capacities of irrigation ponds have been reduced due to deterioration of dyke banks and outlet structures. Consequently, water shortage problems are prone to occur. In order to improve the water shortage situation, rehabilitation works would be necessary.

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<u>O&M</u> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	+/B	<ul style="list-style-type: none"> Soil erosion will be mitigated by applying water harvesting method as well as drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder.		
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

- (1) Ratanak-Battambang Water Harvesting Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.
- (2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Ratanak-Battambang Water Harvesting Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus

building process.

- (3) Mines and UXO risk in the Project is high according to the data from the Cambodian Mine Action Center (CMAC). Security of the site needs to be ensured prior to the Project implementation.

(5) Bassac Irrigation System Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>MoungRussey</td> <td>PrekChik</td> <td>PrekTaVen, PrekChik</td> <td>318474</td> <td>1389697</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		MoungRussey	PrekChik	PrekTaVen, PrekChik	318474	1389697
	District	Commune	Village	UTM Reference							
MoungRussey	PrekChik	PrekTaVen, PrekChik	318474	1389697							
1.2 River basin/ water source	Moung Russey river basin/ Moung Russey river										
1.3 Target group	1) Number of household = 2,670 (Potential, Wet season medium-paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project or program	1) Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project or program	1) Rehabilitation of existing irrigation system										
1.6 Objective area	3,500 Ha										
1.7 Necessity of project/program	The Bassac irrigation system was designed to take water from the Bassac reservoir. However, the dam construction has been left uncompleted since the late 1970's. Consequently, the system has not been irrigated. According to the latest information, the dam is scheduled to be rehabilitated by the assistance of Japanese government by 2008. In this connection, rehabilitation of existing irrigation system would be necessary to utilize storage water in the reservoir effectively.										

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<u>Preparation</u> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <u>O&M</u> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Traditional Institutions				would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
29. Sedimentation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
30. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	management skills are also necessary to equally share common goods.		
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction

	Mitigation Measures	Monitoring	
		Method	Timing
	skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders.		Phase

(iv) Conclusion

- (1) Bassac Irrigation System Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.
- (2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Bassac Irrigation System Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.
- (3) Mines and UXO risk in the Project is high according to the data from the Cambodian Mine Action Center (CMAC). Security of the site needs to be ensured prior to the Project implementation.

(6) Ream Kon Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>MoungRussey</td> <td>Kea, Chrey, Prey Svay</td> <td>6 villages</td> <td>318474</td> <td>1389697</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		MoungRussey	Kea, Chrey, Prey Svay	6 villages	318474	1389697
District	Commune	Village	UTM Reference								
MoungRussey	Kea, Chrey, Prey Svay	6 villages	318474	1389697							
1.2 River basin/ water source	Moung Russey river basin/ Moung Russey river										
1.3 Target group	1) Number of household = 405 (Potential, Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project or program	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project or program	1) Rehabilitation of existing weir and irrigation system										
1.6 Objective area	2,300 Ha										
1.7 Necessity of project/program	The Ream Kon irrigation system was constructed in the late 1970's as a dyke irrigation project, having a weir together with an intake structure in the source river. At present, the system almost lost the function because of destruction of intake structure and deterioration of canals. Rehabilitation of the Bassac reservoir could regulate river flow of the Moung Russey to a certain degree. In order to utilize the regulated flow effectively and to recover the system function, re-construction of weir and intake structure, and rehabilitation of canals would be necessary.										

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
14. Soil Erosion	X	X	X	• Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	• No impact will be expected.
16. Hydrology	X	X	X	• No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	• Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	• Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	disposal.		
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Ream Kon Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Ream Kon Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(7) Por Canal Rehabilitation Project

(i) Project Description

Item	Description			
1.1 Location	District	Commune	Village	UTM Reference
	Moung Russey	Chrey, Taloas	ChreyI, ChreyII, Traos, Chon Samnab, and other 9 villages	332439 1412586
1.2 River basin	Moung Russey river basin/ Moung Russey river			
1.3 Target group	Number of household = 350 (Potential, Wet season medium- paddy)			
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation canals			
1.5 Type of project	Rehabilitation of existing irrigation system			
1.6 Objective area	1,200Ha			
1.7 Necessity of project	The system was constructed in the late 1970's, and experienced rehabilitation works twice in 1995 and 2005. Despite of rehabilitation			

	works, the system works limitedly. After rehabilitation work of the Bassac reservoir, the system could receive regulated flow. In this connection, comprehensive rehabilitation of irrigation system would be necessary to utilize regulated water effectively.
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(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered. In addition, some houses along the canals need to be carefully considered for the rehabilitation of canals.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				through the project.
11. Sanitation	X	X	X	• No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	• This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	• No impact will be expected.
14. Soil Erosion	X	X	X	• Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	• No impact will be expected.
16. Hydrology	X	X	X	• No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	• Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	• Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
30. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide 	<ul style="list-style-type: none"> Training of 	<ul style="list-style-type: none"> Construction

	Mitigation Measures	Monitoring	
		Method	Timing
	sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery.	operators for construction machinery	Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Por Canal Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Por Canal Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.



Houses along the Canals to be Considered for Canal Rehabilitation Works (Por Canal System Area)

(8) Nikom/Dai Ta Chan Rehabilitation Project

(i) Project Description

Item	Description				
1.1 Location	District	Commune	Village	UTM Reference	
	Moung Russey	Prek Chik	PrekTa Ven, PrekChik	352689	1401179
1.2 River basin	Moung Russey river basin/ Svay Don Keo river				
1.3 Target group	1) Number of household=560 (Potential, Wet season medium- paddy) 2) Staff of PDOWRAM and PDA				
1.4 Objective of the project	Enhancement of rice production through construction of Dai Ta Chan weir and rehabilitation of existing irrigation system				
1.5 Type of project	Rehabilitation of existing irrigation system				
1.6 Objective area	600Ha				
1.7 Necessity of project	<p>The Nikom Le and the Dai Ta Chan systems were constructed in the late 1970's. The Nikom Le system was rehabilitated in 2005 by MOWRAM and the Dai Ta Chan was in 2002 by SEILA program. However, the systems have remained at "partly function" level because of limited rehabilitation works.</p> <p>In order to secure irrigation water supply, construction of a weir, re-construction of intake structures, and rehabilitation of the existing canals would be crucially important.</p>				

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and	X	X	X	<ul style="list-style-type: none"> No impact will be expected.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
minority group				
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <u>O&M</u> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
29. Sedimentation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
30. Accidents	X	-/C	X	<ul style="list-style-type: none"> This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> Education Programs FWUCs strengthening program 	<ul style="list-style-type: none"> Construction Phase Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Nikom/Dai Ta Chan Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation

measures proposed are concurrently carried out.

- (2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Nikom/Dai Ta Chan Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(9) Beoung Preah Ponley Rehabilitation Project

(i) Project Description

Item	Description							
1.1 Location	District		Commune		Village		UTM Reference	
	Phnom Vanh	Kra	Sam Rong, Phtas Rong	Prek Rong	I, Phtas	341435	1381043	
1.2 River basin/ water source	Pursat river basin/ Pursat river							
1.3 Target group	1) Number of household=7,141 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA							
1.4 Objective of the project or program	1) Enhancement of rice production through re-construction of weir and rehabilitation of existing irrigation system							
1.5 Type of project or program	1) Rehabilitation of existing irrigation system							
1.6 Objective area	8,500 Ha							
1.7 Necessity of project/program	The proposed project consists of two irrigation systems, namely the Beoung Preah Ponley reservoir and the Domnak Chheu Kram. The weir located at the uppermost flat area commenced irrigation water supply to two systems in the late 1970's. At present, floods destroyed the weir, and irrigation canals lost their capacity. In order to recover stable water supply and to irrigate the irrigation systems, rehabilitation of dyke and canals, and re-construction of weir are of crucial importance.							

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				<p>building should be carefully carried out.</p> <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	-/C	X	<p><u>Construction</u></p> <ul style="list-style-type: none"> Domestic wastewater and refuse will increase due to increase of labor for construction works.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/B	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/B	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/B	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	• This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support	• Workshop, • stakeholder meeting	• Design and Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	programs and so forth, which contribute to maintain living condition of farmers.		
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal.		
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	• Site Supervision	• Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	• Site Supervision	• Construction Phase

(iv) Conclusion

- (1) Beoung Preah Ponley Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.
- (2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Beoung Preah Ponley Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(10) Damnak Ampil Extension Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>SamPovMeas</td> <td>LorLokSar</td> <td>DamNakAmPil</td> <td>370829</td> <td>1380406</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		SamPovMeas	LorLokSar	DamNakAmPil	370829	1380406
	District	Commune	Village	UTM Reference							
SamPovMeas	LorLokSar	DamNakAmPil	370829	1380406							
1.2 River basin/ water source	Pursat river basin/ Pursat river										
1.3 Target group	<ol style="list-style-type: none"> 1) Number of household = 33,790 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA 										
1.4 Objective of the project or program	Enhancement of rice production through rehabilitation of existing irrigation system										
1.5 Type of project or program	<ol style="list-style-type: none"> 1) Improvement of existing automatic gate 2) Rehabilitation of existing irrigation system/ Construction of canals 										
1.6 Objective area	8,000 Ha										
1.7 Necessity of project/program	Damnak Ampil weir commenced the service in 2007. The main canal was rehabilitated for 7 km, and remaining main canal section of 13 km, and construction of the whole length of secondary and tertiary canals were left. The extension project would rehabilitate remaining main canal section and construct secondary and tertiary canals for effective use of diverted water at the weir.										

	The weir has a high potential to irrigate existing systems located in the downstream area. In order to secure the potential, improvement of the weir would be necessary.
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(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would possibly happen.
10. Water Use	X	X	+/A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
diseases				during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	• No impact will be expected.
14. Soil Erosion	X	X	X	• Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	• No impact will be expected.
16. Hydrology	X	X	X	• No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	• Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	• Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	• No impact will be expected.
20. Landscape	X	X	X	• No impact will be expected.
21. Global Warming	X	X	X	• No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	• Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<u>Construction</u> • Increase of waste water will possibly happen due to inflow of labor for construction. <u>O&M</u> • Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	• Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	• Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	• Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	• No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note - : Adverse Impact

- X : No Impact
 + : Positive Impact
 A : Great Impact
 B : Medium Impact
 C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In addition, facilities design needs to consider fish habitat including fish ladder. 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal.		
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

(1) Damnak Ampil Extension Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.

(2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Damnak Ampil Extension Project is not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.

(11) Wat Loung Rehabilitation Project

(i) Project Description

Item	Description										
1.1 Location	<table border="1"> <thead> <tr> <th>District</th> <th>Commune</th> <th>Village</th> <th colspan="2">UTM Reference</th> </tr> </thead> <tbody> <tr> <td>Sam Pov Meas, Ba Kan</td> <td>Lor Lok Sar, Tra Peang Chorong</td> <td>Wat Lournng, Kosh, Ba Kan</td> <td>375467</td> <td>1382469</td> </tr> </tbody> </table>	District	Commune	Village	UTM Reference		Sam Pov Meas, Ba Kan	Lor Lok Sar, Tra Peang Chorong	Wat Lournng, Kosh, Ba Kan	375467	1382469
District	Commune	Village	UTM Reference								
Sam Pov Meas, Ba Kan	Lor Lok Sar, Tra Peang Chorong	Wat Lournng, Kosh, Ba Kan	375467	1382469							
1.2 River basin	Pursat river basin/ Pursat river										
1.3 Target group	1) Number of household = 1,724 (Wet season medium- paddy) 2) Staff of PDOWRAM and PDA										
1.4 Objective of the project	Enhancement of rice production through rehabilitation of existing irrigation system										

1.5 Type of project	Rehabilitation of existing irrigation system
1.6 Objective area	3,940Ha
1.7 Necessity of project	<p>The system construction was completed excluding intake weir in the late 1970's, and the system lost its function after a few years' operation.</p> <p>In order to secure water source, utilization of Damnak Ampil weir would be a highly possible alternative. In order to receive water from the weir, a channel connecting the weir to the Wat Loung main canal would need to be constructed.</p> <p>In addition, existing irrigation system is seriously deteriorated, and lack of canals at the secondary and tertiary levels. Rehabilitation and additional construction of canals would be necessary.</p>

(ii) Environmental Impact Matrix

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
Social Environment				
1. Involuntary Resettlement	-/C	-/C	X	<ul style="list-style-type: none"> No impact will be expected since there is no large scale new expansion of the area. Illegal farming within existing canals, however, must be considered.
2. Local Economy (Employment and Income Generation)	X	+/B	+/B	<ul style="list-style-type: none"> New job opportunity as well as production increase will give positive impact.
3. Land Use and Resource Mobilization	+/B	X	+/B	<p><u>Preparation</u></p> <ul style="list-style-type: none"> Land acquisition must be considered for promoting construction of tertiary canals and structures. Consensus building should be carefully carried out. <p><u>O&M</u></p> <ul style="list-style-type: none"> There will be no potential to newly extend areas, therefore, large scale expansion is not included by this plan.
4. Social capital and Traditional Institutions	X	X	X	<ul style="list-style-type: none"> Traditional social institutional system would be carefully considered by the change of water use.
5. Social Infrastructure and Services	X	X	X	<ul style="list-style-type: none"> Communication and socialization among existing groups would be disturbed if canals, drains and appurtenant structures are newly constructed or expanded to block existing social networks.
6. The poor, indigenous and minority group	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
7. Unequal Distribution of Damage and Benefit	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
8. Cultural Heritage	X	X	X	<ul style="list-style-type: none"> No impact will be expected if confirmation of existence of cultural heritage, together with relevant organizations, within irrigation systems.
9. Local conflict over interest	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Conflict among labors and farmers, security deterioration would be expected. <p><u>O&M</u></p> <ul style="list-style-type: none"> Conflict over unequal water use would

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				possibly happen.
10. Water Use	X	X	+A	<ul style="list-style-type: none"> Water use for other sectors is considered for the planning. Water resource utilization will be effectively carried out through the project.
11. Sanitation	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
12. Risk against infectious diseases	X	-/C	X	<ul style="list-style-type: none"> This would be due to inflow of labor during construction stage.
Natural Environment				
13. Topography and Geographical Features	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
14. Soil Erosion	X	X	X	<ul style="list-style-type: none"> Soil erosion will be mitigated by drainage improvement.
15. Groundwater	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
16. Hydrology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	X	X	-/C	<ul style="list-style-type: none"> Increase in chemical and fertilizer would affect water quality of Tonle Sap.
18. Flora, Fauna and Biodiversity	-/C	-/C	-/C	<ul style="list-style-type: none"> Rehabilitation of existing facilities would disturb existing biotope if proper measures are not taken.
19. Meteorology	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
20. Landscape	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
21. Global Warming	X	X	X	<ul style="list-style-type: none"> No impact will be expected.
Pollution				
22. Air Pollution	X	-/C	X	<ul style="list-style-type: none"> Not more than serious impact will be expected since structures under the plan are not large scale. But machinery use during the construction shall be considered.
23. Water Pollution	X	-/C	-/C	<p><u>Construction</u></p> <ul style="list-style-type: none"> Increase of waste water will possibly happen due to inflow of labor for construction. <p><u>O&M</u></p> <ul style="list-style-type: none"> Inappropriate use of chemical and fertilizer, if farming improvement and extension is not properly carried out, would increase to affect water quality.
24. Soil Contamination	X	X	-/C	<ul style="list-style-type: none"> Misuse and/or excessive use of fertilizer would contaminate soil in command area under irrigation system.
25. Waste	X	-/C	X	<ul style="list-style-type: none"> Waste from construction would be expected.
26. Noise and Vibration	X	-/C	X	<ul style="list-style-type: none"> Noise and vibration through construction works would be expected.
27. Ground Subsidence	X	X	X	<ul style="list-style-type: none"> No impact will be expected since no large scale new facilities are included under the plan. In addition, scooping up of great amount of groundwater will not

Item	Stage and Impact			Reason
	Preparation	Construction	O&M	
				be carried out.
28. Offensive Odor	X	X	X	• No impact will be expected.
29. Sedimentation	X	X	X	• No impact will be expected.
30. Accidents	X	-/C	X	• This would be due to increase of vehicle and construction machinery during construction stage.

Note

- : Adverse Impact
- X : No Impact
- + : Positive Impact
- A : Great Impact
- B : Medium Impact
- C : Small Impact

(iii) Mitigation Measures

	Mitigation Measures	Monitoring	
		Method	Timing
Social Environment			
1. Involuntary Resettlement	<ul style="list-style-type: none"> This issue must be considered from design phase of the project. Stage-wise discussion is required on canal alignment, reservoir locations, compensation measures, support programs and so forth, which contribute to maintain living condition of farmers. 	<ul style="list-style-type: none"> Workshop, stakeholder meeting 	<ul style="list-style-type: none"> Design and Construction Phase
9. Local Conflict Over Interest	<ul style="list-style-type: none"> Education programs are necessary for both labors and community members to raise awareness so as to maintain security in the community during construction. 	<ul style="list-style-type: none"> Education Programs 	<ul style="list-style-type: none"> Construction Phase
	<ul style="list-style-type: none"> FWUCs should be established and strengthened to prepare irrigation service plan and its implementation. Group management skills are also necessary to equally share common goods. 	<ul style="list-style-type: none"> FWUCs strengthening program 	<ul style="list-style-type: none"> Design, Construction and O&M Phase
11. Sanitation	<ul style="list-style-type: none"> It is important for Contractors to prepare proper accommodation with sanitary facilities including toilet and water supply for construction labors. Education and training program is also required to raise awareness of labors. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
12. Risk against Infectious Disease	<ul style="list-style-type: none"> This also requires education program to raise awareness among construction labors. 	<ul style="list-style-type: none"> Stakeholder Meeting Site Supervision 	<ul style="list-style-type: none"> Construction Phase
Natural Environment			
17. Coastal Area such as Mangrove, Coral Reef and Tidal Area	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Site reconnaissance Water Quality Sampling and Analysis 	<ul style="list-style-type: none"> O&M Phase
18. Flora, Fauna and Biodiversity	<ul style="list-style-type: none"> Although direct beneficiaries are irrigation farmers, construction schedule should be prepared considering fish habitat such as spawning as well as fishing season of fish farmers surrounding irrigation systems. In 	<ul style="list-style-type: none"> Site Reconnaissance 	<ul style="list-style-type: none"> Construction and O&M Phase

	Mitigation Measures	Monitoring	
		Method	Timing
	addition, facilities design needs to consider fish habitat including fish ladder.		
Pollution			
22. Air Pollution	<ul style="list-style-type: none"> During earth works, it is effective to provide sprinkling to mitigate dust. In addition, reducing idling time of construction machinery is essential to minimize exhaust gas from construction machinery. 	<ul style="list-style-type: none"> Training of operators for construction machinery 	<ul style="list-style-type: none"> Construction Phase
23. Water Pollution	<ul style="list-style-type: none"> Education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Water sampling Quality analysis 	<ul style="list-style-type: none"> Design and Construction Phase
24. Soil Contamination	<ul style="list-style-type: none"> In order to avoid excessive utilization of fertilizer and chemicals, some supporting programs are essential such as introduction of integrated pest management (IPM). 	<ul style="list-style-type: none"> Soil sampling and analysis 	<ul style="list-style-type: none"> O&M Phase
25. Waste	<ul style="list-style-type: none"> As well as mitigation of water pollution, education programs should be carried out for construction labors to raise their awareness on proper disposal treatment. In addition, technical specification of the construction works should involve mitigation measures on environmental impact including construction waste disposal. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
26. Noise and Vibration	<ul style="list-style-type: none"> Working hour needs to be agreed through stakeholder meetings so as not to disturb living condition of communities. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase
30. Accidents	<ul style="list-style-type: none"> Training programs are organized to upgrade skills of operators. In addition, regular stakeholder meetings are arranged to raise awareness among stakeholders. 	<ul style="list-style-type: none"> Site Supervision 	<ul style="list-style-type: none"> Construction Phase

(iv) Conclusion

- (1) Wat Loung Rehabilitation Project are not expected to raise great magnitude of negative environmental impact toward in and around Projects' sites if mitigation measures proposed are concurrently carried out.
- (2) Among others, measures for involuntary resettlement are of importance recently in irrigation development in Cambodia and Wat Loung Rehabilitation Project are not left out. Although potential impact in this matter is not so high, judged small impact, according to IEE, it should be emphasized that resettlement process is to pursue careful stepwise approach gradually to build consensus among stakeholders. Since irrigation development gives an impact to local economy, not only irrigated agriculture, various stakeholders needs to be involved in this consensus building process.