National Dialogue
on
Water Environment partnership in Asia
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1. Introduction

- Siem Reap Province is located in the northwest of Cambodia.
- Area: 10,299 km²
  - Area approximately 6.6% of the nation’s land area.
- Population: 13,121,584. Female: 6,715,376
- 12 Districts in Siem Reap Province.
- Home to the Angkor World Heritage Site.
- Siem Reap socio-economic can develop through many sectors: agriculture including irrigation, fisheries, forestry and its sub-products, transport; mining; tourism; Urbanization; etc.

2 - Environmental Issues in Siem Reap

- Development activities through the various sectors and especially tourism sector can cause significant local and national impacts (and in some instances international issues).
- Development activities need to comply with environmental sound technology and practices.
- The DOE has identified ‘3’ major environmental issues in Siem Reap:
  1. Water quality / Sanitation Issues
  2. Solid waste management Issues
  3. Air and Noise Pollution (due to the new constructions activities, use of diesel generators, traffic etc.)
Water quality and Sanitary Issues in Siem Reap

In Siem Reap province, water sources are being contaminated gradually resulting from:

- The discharge of wastewater from household, factories, hotels, restaurants, guesthouse, hospitals,.. without treatment or with less effective treatment into water sources and urban sewages
- Many pollution sources (hotels, restaurants, guesthouse, hospitals, residences,) and in the town there are not wastewater treatment tank or not by standard.
- Lack of sewages and wastewater treatment tank

- People usually discharge wastewater into the ground (the area no sewages or canal)
- The disposal of solid waste in to water sources such as river, canal, pone, lake, and Waste often clogs drainage and it causes flooding and shortens the life of road.
- The disposal of liquid and solid wastes, especially human excrement into water source from anarchic settlement, floating houses, floating restaurants an so on. In the solid waste aspect consists bottle, tin, plastic bottle/bag...etc.
- Soil erosion from watershed by sand mining activities at upstream and local watershed. (Siem Reap river)
- The consumption of agro-chemical includes pesticide, herbicide and fungicide at agricultural areas as well as fertilizer uses.
Wastewater Discharge into Public Sources (river, pond, lake...)

Drainage Problems

Flooding Along Shivata Rd.

Drainage mixed with wastewater and clogged by garbage
Garbage/Solid Waste Problems in Siem Reap

Disposal of Waste into water sources

Discharge of Wastewater into water sources by floating houses
3. Plan and Implementing Activities for water quality management by DOE, local Authority, Line –Departments, Local and International NGO, that work involve with environmental water quality maintenance protection and education.

- JICA (Water Supply System)
- JICA (The study on Integrated Master Plan for Sustainable Development of Siem Reap / Angkor Town in the Kingdom of Cambodia)
- ADB (West Siem Reap Sewerage & Drainage Development)
- ADB (Chong Kneas Environmental Improvement Project)
- APSARA Authority (project introducing ISO 14001 to Angkor)
- APSARA Authority (East Siem Reap Sewerage & Drainage Development)
- INTERGRITAS (environmental information system, and provide capacity building to the DOE staffs for environmental management especially water pollution control.)
- CiDA waste-econ (waste collection community along Siem Reap river)
  - Wastewater treatment for fishing farming system project (fishing by wastewater treatment from reed bed)
- FACT (research for natural resource & education)
- PIU funded by UNDP (provide capacity building to the DOE staffs, and Natural resources protection and conservation)
JICA (The study on Integrated Master Plan for Sustainable Development of Siem Reap / Angkor Town in the Kingdom of Cambodia)

- November 2004 - March 2006
- Integrated Master Plan toward 2020
  - For sustainable development of Siem Reap/Angkor Town
  - Economic promotion lead by tourism
  - Capacity building

Project Related to Urban Environment

- City Center Area Improvement Project
- Water Quality of Siem Reap River
- Sewerage and Drainage Improvement Plan
- Programs for Environmental Management
Siem Reap in Future: Some Images

- An Urban Park
- A Bazaar
- Old Market Area
- Sivatha Street

Sewerage and Drainage Improvement Plan

Water Quality of Siem Reap River
Programs for Environmental Management

- 2 pilots project related to environmental management and education that Collaborate with DOE and Siem Reap Provincial Authority.
  1. Environmental campaign: in Siem Reap town specially along the Siem Reap river, aim to promote public participation and awareness on solid / and liquid waste management; and for local authorities manage solid waste by themselves, and make more beautiful Siem Reap.
  2. Environmental Education at Primary School: Spread out environmental knowledge to teacher, student, and father and mother of student.

Activities of Environmental campaign
Activities of Environmental Education at Primary school

The main focus

- Develop an "Environmental Information System"
- Whilst the main aim of INTERGRITAS is to develop an EIS, as aside component of INTERGRITAS we have looked implement a few practical application relating to environmental management in Siem Reap.

1. Model Reed Bed Pilot – DOE
2. Reed Bed Pilot – Angkor Village Hotel Resort and Spa
3. Tourism Certification Scheme – Green Flag Pilot – Monoreach Hotel
4. Environmental Awareness and Education Pilot – A visitor Code of Conduct to be piloted via the DOE, APSARA, DoT, CHA Hotel, Guesthouses, Restaurants, Souvenir Shops, and other tourism hotspots.
5. Composting Pilot

INTERGRITAS is an EU funded and comes under the EU- ASIA PRO ECO PROGRAMME.

- Corporation with DOE and Siem Reap Provincial Authority
- The main focus
Another main aim of INTERGRITAS is to provide capacity building to the DOE staff via extensive training. Training to DOE staff involves, (1) pollution measurement and monitoring techniques (2) familiarization with existing environmental regulatory framework, (3) basic EIA techniques, (4) data collection and manipulation techniques.

Model Reed Bed at DOE

Water pollution control by DOE staffs

Waste generation by DOE staffs
JICA Water Supply System

- Water supply system has a close and direct relation with the sewerage generation. This has a potential for enhanced risk to health if on-site disposal is inadequate and off-site treatment is not provided. The existing water supply system has a capacity of 1,400m³/d, which only serves 10% of the population of the Siem Reap town. Under this condition, JICA conducted “The Study on Water System for Siem Reap Region in Cambodia” over the period of 1996 to 2000, in order develop a sector master plan for the water supply system. This M/P identified and conducted a Feasibility Study for an urgent upgrading plan with capacity of 8,000m³/d. Later JICA also conducted a Basic Design Study for this identified project in 2003. From February 2004, the implementation work (including detail design) started under JICA Grant Aid and construction stared from November, 2004. Though total implementation will end in February, 2006, initially partial service will start (60%) in 2006 and full operation is planned from 2008. The important features of this project are as follow:

- **Target Year 2008**
- **Service area 425 ha**
- **Design coverage 65% of domestic & public and 40% of tourism demand**
- **population served 26,000 (in2008)**
- **Unit water demand 120 lpcd (domestic, 2008), 500 lpcd (tourism,2008)**
- **Water source Ground Water (1100m³/dX8 wells)**
- **Peak factor 1.2 (domestic/public),1.75 (tourism)**
- **NRW 15%(2008)**
ADB is now financing “Mekong Tourism Development Project” in three countries, namely, Cambodia, Vietnam and Laos. Though main focus is sustainable tourism development, there are components of environmental improvement and human resource development. Cambodia portion of the project (CAM-1969), loan agreement signed in February, 2003) is implemented by Ministry of Tourism (MOT) and included environmental improvement, airport and road development, among other. The estimated cost of the Cambodia portion is US$ 20.7 million. One of the sub projects is West Siem Reap Sewerage Development covering 17,000 residents who live in the right bank of the Siem Reap river. The estimated cost of this sub project is US$ 3.53 million.

It is expected that the project implementation will start from first quarter of 2005 and will be completed over a period of 5 years. A Project Management Unit (PMU) is established to manage the project in Phnom Penh, headed by one director of Ministry of Tourism. In Siem Reap, a Project Implementation Unit (PIU) is established comprising staff from DOT and DPWT.

- The basic scope is to develop a formal sewerage system on the west side of the town. This includes, among other,
- Rehabilitation of canal
- New connections
- Separation of storm water run-off
- Treatment Plant (Waste Stabilization Pond )
- Sludge disposal system
There is also a proposal to develop sewerage and drainage in East Siem Reap. For this finance is not secured yet. Siem Reap province (DPWT) applied to Japan for JICA grant aid finance, which for the same project APSARA applied to AFD, France.

Main features of the proposal are as follows:
- Rehabilitation of sewer 24 km
- Improvement of sewer 10 km
- Transit manhole 8 km
- Collecting manhole 680 km
- Transmission main 4 km
- Treatment system 1 (capacity 50,000 m³/d)

However, one idea is that instead of separate treatment plant, transfer the collected wastewater to West treatment plant through lift pump and river crossing.

This ADB TA was completed in February 2004. Near the harbor area of Lake Tonle Sap, many people live in movable houses. As the shore line moves about 6 km between wet and dry season, these people constantly change their housing. To improve the environmental condition of this environmentally protected lake, one of the steps proposed is to relocate these persons, these people constantly and providing with sanitation facilities. In addition to proposing various activities, this TA also proposed sewerage and drainage improvement for the Chong Kneas Commune.

There is currently no system for collection of wastewater at the harbor area. A number of option were consideration during the course of the TA including transferring wastewater to the proposed municipal sewerage system. Finally, the TA proposed a hybrid system comprising the following:

Chong Kneas Environmental Improvement Project
Condominium sewer: collecting from up to 3 plots and discharging to an interceptor tank
Interceptor tank: single chamber septic tank with 12 hours storage, to remove 60 to 70% of the solid and reduce BOD concentrations by 30 to 40%
Simplified sewerage: between interceptor tank and treatment plant
Major features of the project are as follows:
- Domestic wastewater production is 80% of the water use.
- Harbor facilities wastewater production is 100% of the waste use.
- Infiltration 5 to 15% depending on age of the sewer system
- One lift pump
- Water Stabilization Pond system of 3,538 m³/d
- Septic collection and treatment.

4. Environmental plan and Implementing Activities by DOE for water quality management

The plan aims at providing the environment education and natural resources conservation in order to environment under the recognition that the rapid growth of tourism industry has a negative impact on natural resources and solid/liquid waste disposal, with make the Siem Reap province facing threat to harm forest, wildlife, floated forest, water resources, and environmental pollution.

The Management of water quality
The related works of DoE activities for water quality management include as follows:
- monthly freshwater monitoring at public areas,
- routine control/monitoring at pollution sources;
- evaluating the environmental pollution level entire the province.
Increasing public awareness through media systems and the like that aims at promoting public participation.

In collaboration with inter-departments, the DOE determines that any kinds of wastes should be managed with environmental sound manner, including industrial effluents must be treated before discharging into receiving sources and abide by the National effluent standard of the Sub-Decree on Water Pollution Control.

Fining violators who committed opposing the environmental legal instruments.

Permitting for (i) treated wastewater discharging into receiving sources; (ii) sludge disposal at landfills based on environmental manner; etc.

Strengthening the implementation of environmental law and its related statutes.

Strengthening and promoting the monitoring programme of environmental pollution at point and non-point sources.

5- Future Perspective and Strategic Vision for the Environment

Issues for Environmental management
- Creating the system for environmental management with broader participation of people, businesses, and government for the further enforcement of environmental strategic and plan.

Perspective for Natural Resources Management
- Sustainable management of the natural resources, (forest, water resources, water quality, soil, ...)

Perspective for Urban Environment
- Avoiding water contamination and improvement of sanitary condition of the people in Siem Reap through upgrading the sewage and drainage network and the water treatment at individual household.
嵋 Perspective for Solid waste management
  - Avoiding scattered garbage and improvement of landfill
  - The beautification of the townscape and streets: creating beautiful and green city suitable for the garden city
  - Traffic safety and air pollution
嵋 Perspective for Social and Culture Environment
  - Poverty alleviation and reducing income disparity among the people for the public security through local economy promotion
  - Rediscovery and preservation of Khmer and traditional culture and value, and refinement of the culture through integration with various culture.

THANKS FOR YOUR ATTENTION