(2) Environmental Management

Issues

1. Insuffficient mechanism and institutional capacity for environmental problem caused by rapid urbanization and development
2. Lack of clear environmental viewpont in planning
3. Behaviors of people and businesses are not environment-friendly
4. Public infrastructure investment in environmental conservation cannot catch up with the tourism boom

Photo II.5.1 Pump, Latrine and Garbage Dump being Side-by-side

Photo II.5.2 Drain filled with Garbage

Photo II.5.3 Drain polluted by Wastewater

Sector Objective

Making Siem Reap beautiful and sustainable in environment:

- Making a beautiful town in harmony with nature and Angkor heritage: targeting the town center and Angkor Heritage Park, and
- Making resource saving town minimizing environmental loads by 10 %

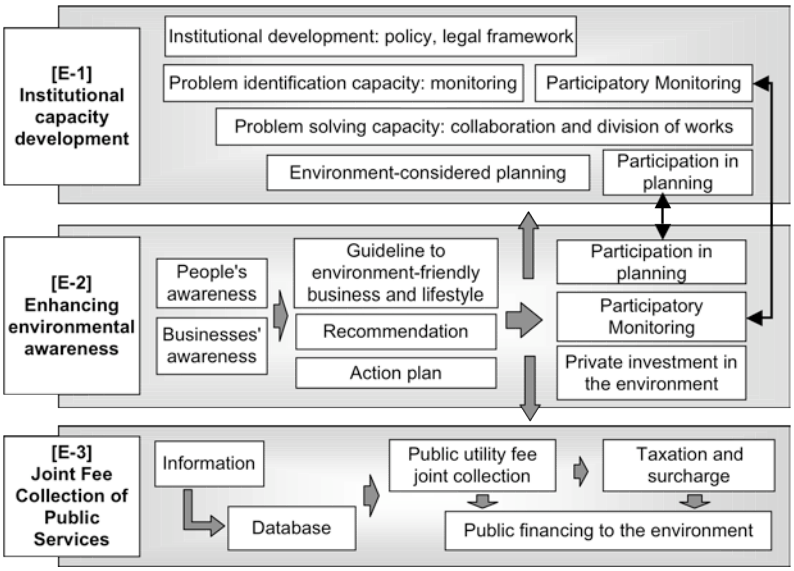
Sector Approach

1. Strengthening institutional capacity of environmental management to cope with the problems by the rapid development
2. Development planning to be environment-considered
3. Inducing a change of human behaviors to environment-friendly
4. Creating a financial system for environmental conservation

(See Figure II.5.6)

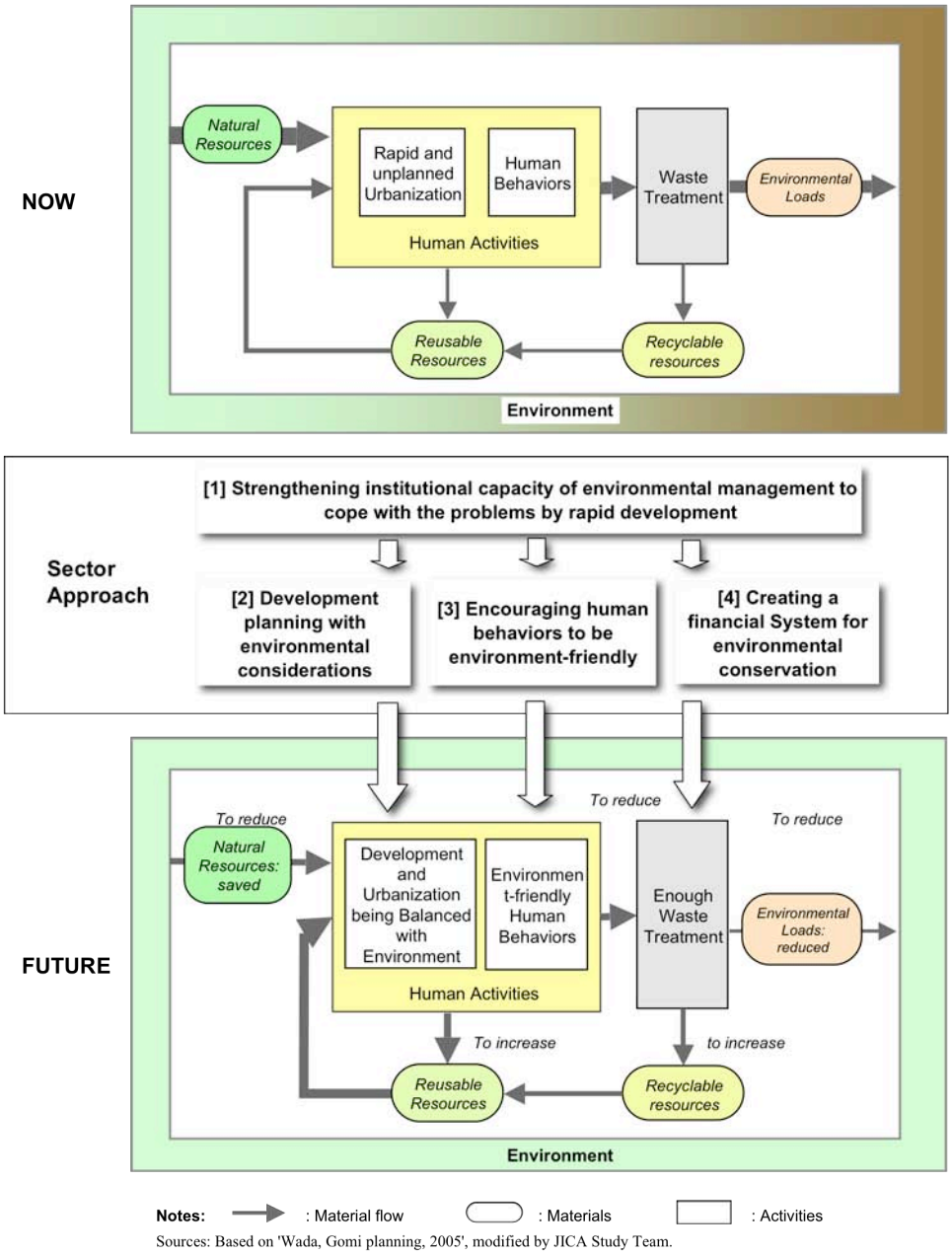
Project/ Programs

E-1 Strengthening Institutional Capacity
E-2 Enhancing Environmental Awareness
E-3 Joint Fee Collection of Public Services



Source: JICA Study Team

Figure II.5.5 Sector Objectives, Sector Approach and Program Sequence

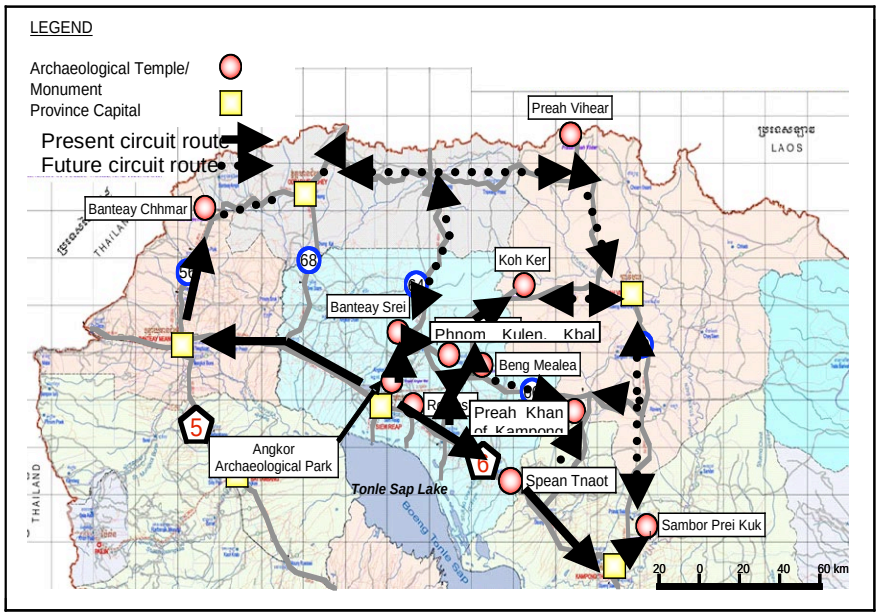


Sources: Based on 'Wada, Gomi planning, 2005', modified by JICA Study Team.

Figure II.5.6 Sector Approach and the Environment Management at Present and in the Future

(3) Tourism Development	
Issues	1. The tourism in Siem Reap is featured by short-stay concentrated tourism in terms of time and space. That is that the group tourists at middle class rushing the same routing in the peak season staying short, a typical mass-tourism; back-packers dominants in number among individual tourists; and limited number of tourists in the rainy season 2. A tourism boom, with this feature of mass-tourism, deteriorates the environment and threatening to the sustainability, while giving limited economic benefits on rural people with little cultural interaction. 3. Siem Reap/ Angkor Town is not NOT developed as ready to attract various types of tourists staying longer; weaknesses as a destination are:

	• Various tourism destinations not developed enough with weak infrastructure for tourism: limited access to remote tourism resources • Not giving tourists a experience of culture, history, art and traditional lifestyle • Limited services and hospitality • Not enough security and convenience for individual tourists to walk around 4. International tourism markets reconizes Siem Reap/ Angkor Town as a unveiled Angkor Wat tourism destination and not safe enough for individual tourists walking around 5. Weak marketing and promotion by private-public partnership • Limited human resources for tourism promotion • Limited experience of tourism promotion
Sector Objective	Creating a quality tourism destination in the context of Angkor history and culture *~ For making tourists exposed to Khmer culture, history, art, and traditional lifestyle harmonizing with the rich nature*
Sector Approach	1. Developing tourism destination and diversified routing • Angkor Heritage Park Area • Urban Amenity and Cultural Tourism Area • Tonle Sap Lake and Rural Area • Distant Angkor Monument Area 2. Giving tourists a taste of rich Khmer culture, history, art and the nature 3. Improving services and hospitality for a pleasant stay 4. Strengthening tourism marketing and promotion by public-private partnership targeting to up-markets.
Project/ Program	TO-1 Khmer Heritage Tourism Network and Tourism Facility Development Project TO-2 Night Market Development Project TO-3 Public-Private Partnership Tourism Quality Improvement Program TO-4 Development and Promotion of Community-based Eco and Village Tourism TO-5 Strengthening Tour Guide Training and Introduction of Advanced Tour Guide System TO-6 Comprehensive Study for Carrying Capacity and Site Management



Source: JICA Study Team

Figure II.5.7 Distant Angkor Monument Areas and Networking

(5) Agricultural Diversification and Local Product Promotion	
Issues	1. Emerging group activities among farmers, especially community business. 2. Limited linkage between local products and the tourism sector: small share of local products in the tourism market of Siem Reap 3. Diversified agricultural products have a potential in the local and the tourism market, while farmers have constraints of lack of experiences of new agribusiness such as cash crops, livestock and agricultural marketing. 4. Locally-made handicraft and souvenir products have the potentials in growing local boutique market and the export market. 5. Limited supporting activities by province due to limited information of rural industries, weak human resources, and limited experiences. 6. Successful experience of Pilot Project 'Angkor Products Fair 2005' revealing a potential of growing local middle ranged market, as well as giving a confidence to counterpart personnels (See Figure II.5.9).
Sector Objectives	Expanding local products supply in order to increase local economic benefit from tourism by creating Angkor Brand
Sector Approach	1. Creating a support system for agricultural diversification and local product promotion. 2. Targeting the tourism market as well as the growing local middle-ranged market (See Figure II.5.9). 3. Strengthening the linkage between tourism and rural economy 4. Strengthening infrastructure for agricultural diversification and local product promotion.
Project/ Program	A-1 Human Resource Development and Establishing Angkor Products Promotion Center (APPC) A-2 One Village One Product (OVOP) A-3 Production Village Development A-4 Angkor Products Fair

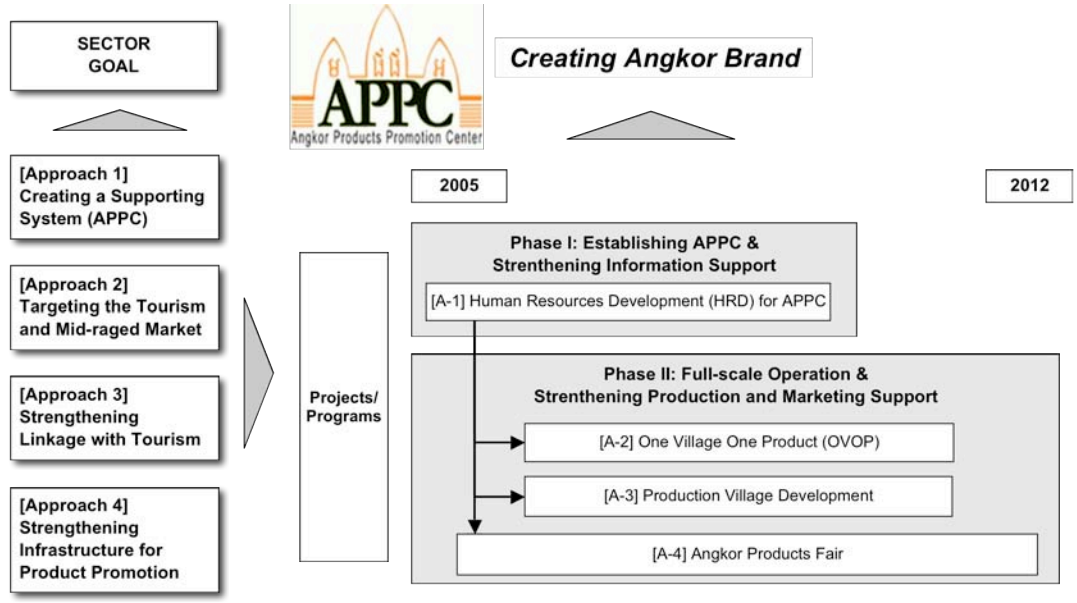
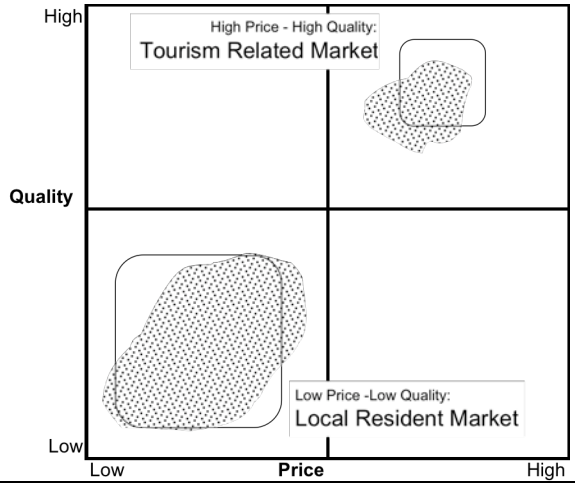


Figure II.5.8 Sector Objective, Sector Approach, APPC and Projects/ Programs

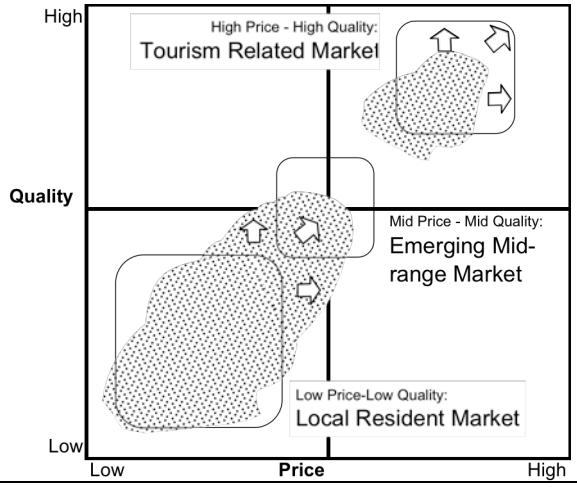
PAST:
Two Enclaves of Market
(No Mid-Range)

There were two isolated markets. One was for the low income local residents and the other was for the foreign tourists.



PRESENT:
Emerging Mid- Range and
Growing Tourism Market

There is an emerging mid-range market as income level goes up. Tourism related market is also growing.

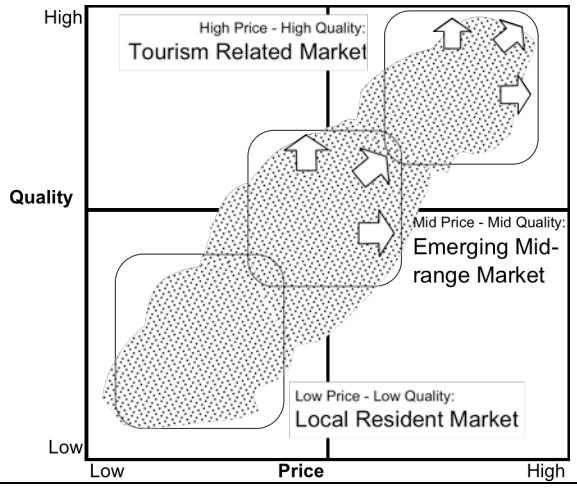


FUTURE:
Grown Mid- Range and
Tourism Market

Eventually a mid-range market becomes dominant. Tourism related market will be integrated as part of wide ranged local market.

: Products

: Market



Source: JICA Study Team

Figure II.5.9 Evolving Market Segments (Conceptual Model)

(6) Transportation

Issues

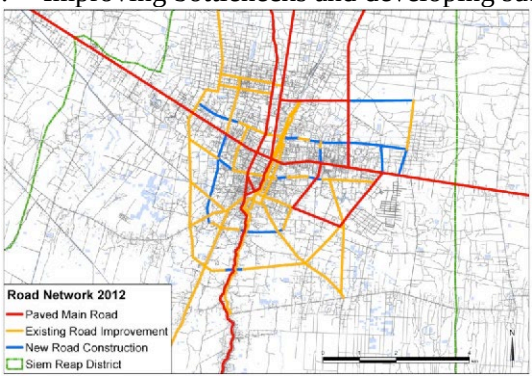
1. Insufficient trunk road network, and traffic concentration on the NR 6 in the urban area
2. Traffic control in Angkor Archeorogical Park
3. Limited accessibility to remote heritage
4. Lack of amenity and safety of roads
5. Public awareness of legislations on road traffic
6. Insufficient road maintenance

Sector Objectives

- Providing the sufficient road network and function for smooth transportation.
- Satisfying tourists in visiting Angkor Heritages and stayin in Siem Reap.
- Leading urbanization following the urban planning.

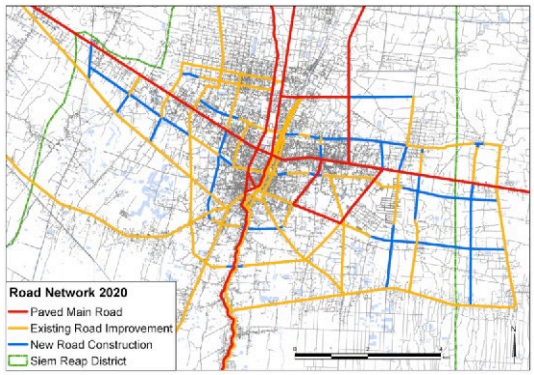
Sector Approach

1. Improving bottlenecks and developing sub-arterial road network in the urban area



Source: JICA Study Team

Figure II.5.10 Principal Road Network (2012)



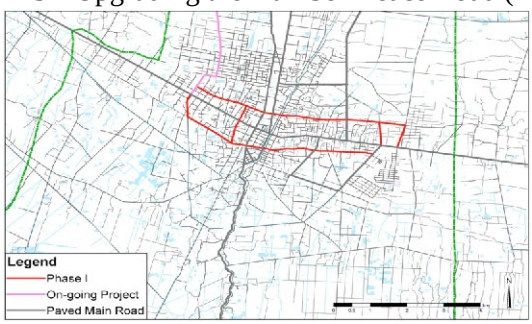
Source: JICA Study Team

(2020)

2. Improving the road condition and facility in the urban area
3. Developing road netwok for the future urbanization area
4. Improving access to Angkor Heritages
5. Establishing an efficient road maintenance system

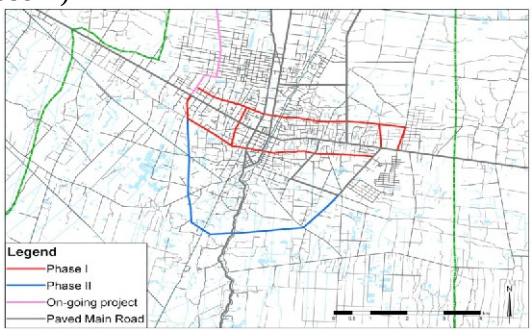
Project/ Program

TR-1 French Bridge improvement project
TR-2 Sub-arterial road parallel to the NR6 (Phase I)
TR-3 Upgrading the Hun Sen Peace Road (Phase II)



Source: JICA Study Team

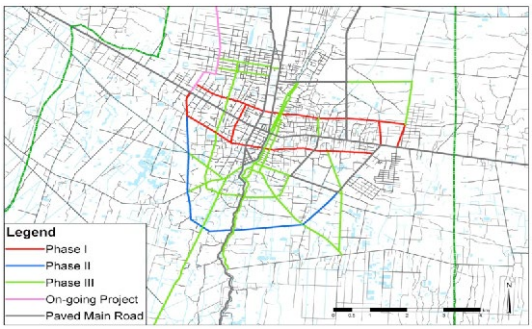
Figure II.5.11 TR-2 (Phase I)



Source: JICA Study Team

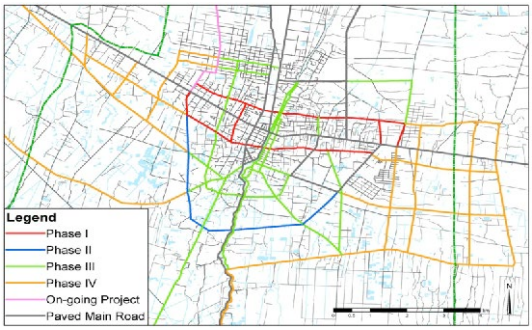
Figure II.5.12 TR-3 (Phase II)

TR-4 Completion of sub-arterial road network in the urban area up to 2012 (Phase III)
TR-5 Completion of sub-arterial road network in the urban area up to 2020 (Phase IV)



Source: JICA Study Team

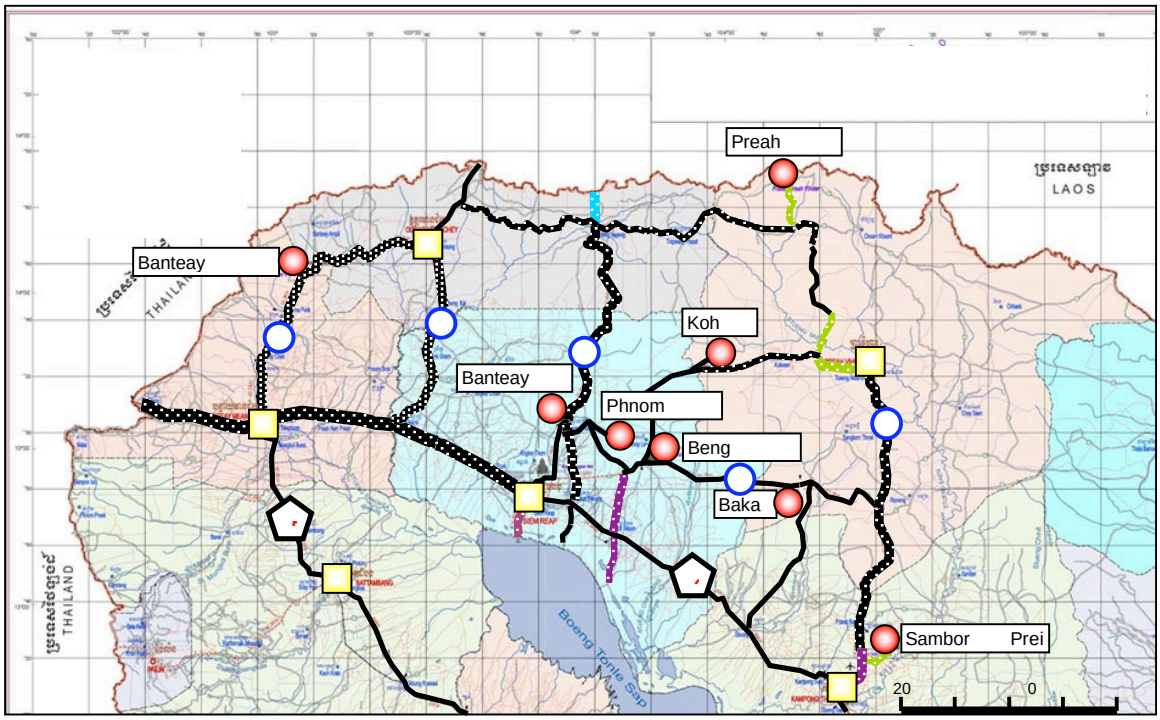
Figure II.5.13 TR-4 (Phase III)



Source: JICA Study Team

Figure II.5.14 TR-5 (Phases IV)

TR-6 Institutional improvement and campaigns for road safety
TR-7 Rural heritage network rehabilitation project
TR-8 Introduction of environmental public transport in the Angkor Archeological Park
TR-9 Bicycle track construction in the Angkor Archeological Park
TR-10 Institutional improvement for efficient road maintenance



Legend:

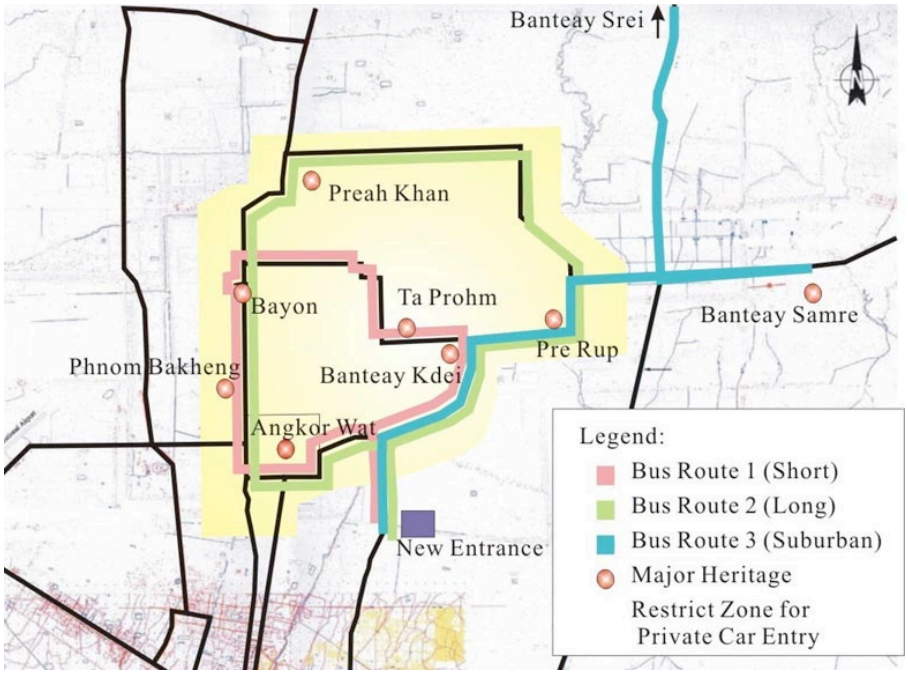
Funded by ADB
- Asphalt Concrete
- Bridge Rehabilitation

Funded by Thai Gov.
- DBST
- Emergency Maintenance (Laterite grading & Bridge maintenance)

Funded by WB (PRIP)
- Rehabilitation (DBST)
- Routine

Source: JICA Study Team

Figure II.5.15 Rural heritage network (TR-7)



Source: JICA Study Team

Figure II.5.16 Proposed Bus Route and Restricted Zone against Private Car Entry

(7) Water Resources and Water Supply	
Issues	1. Lack of water resources management: lack of basic information for plannng base, monitoring data, management & operation plan, and legal framework 2. Concentration of groundwater intake at the town center area may cause groundwater declination and land subsidence. 3. Weak public water supply services causing small coverage ratio
Sector Objectives	1. Developing water resources for water supply, agriculture and environment 2. Increasing capacity and coverage ratio of public water supply service 3. Managing and conserving groundwater
Sector Approach	<u>Water Resources Approaches</u> 1. Water resources development in consideration ob sustainability 2. Efficient water resources development plan 3. Improving river sanitation and water environment of Ankor heritage <u>Water Supply Approaches</u> 4. Providing sufficient water to the people and businesses 5. Efficient water supply management for narrowing gap between the peak and off-peak demands 6. Improving water supply services to enlarge coverage ratio through costomer satisfaction

Project/ Program

Water Resources Development Plan

- Tonle Sap groundwater for water supply
- West Baray for irrigation water and river environmental flow
- North East Baray for irrigation

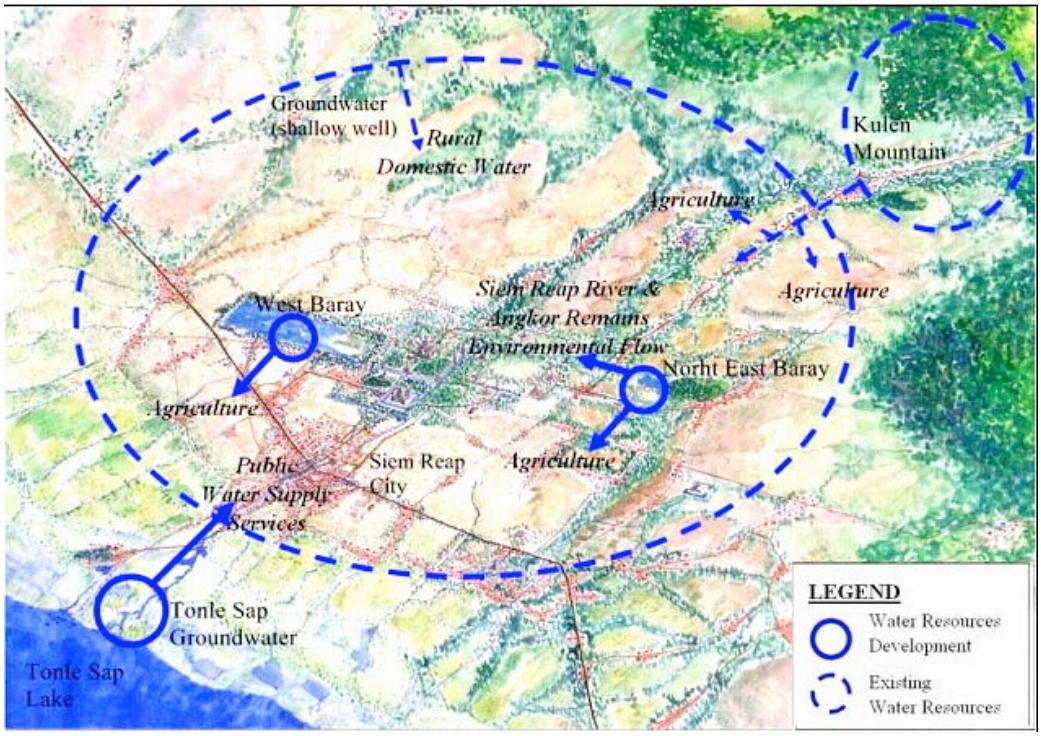


Figure II.5.17 Preliminary Demarcation on Utilization of Water Resources

Water Supply Development Plan

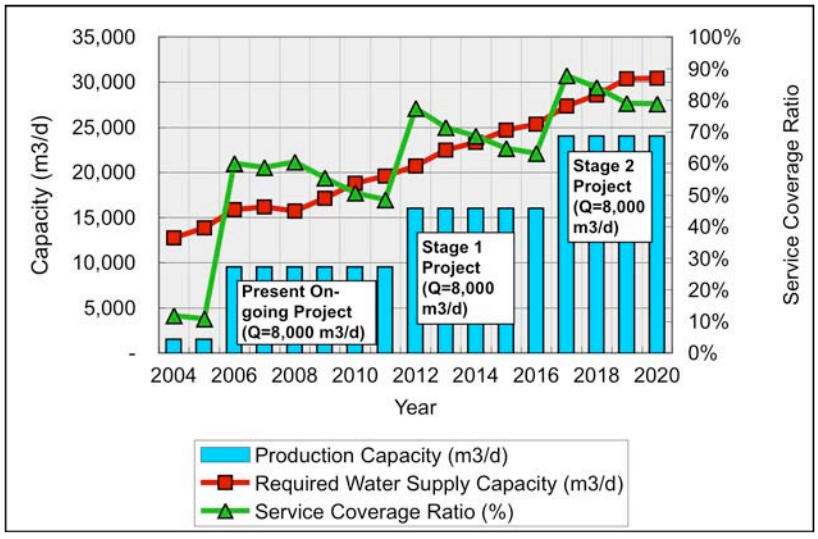


Figure II.5.18 Proposed time schedule and capacity of stage wise development

Project/ Program Proposed

W-1 Provincial regulation on registration of commercial well

W-2 Ministerial sub-decree on groundwater

	W-3 Replacement of old pipeline W-4 The strategic study on integrated water resources management for Siem Reap River Basin and Roluos River Basin W-5 Water supply system development of Siem Reap City (Stage 1) W-6 Water resources development of North East Baray W-7 Water supply system development of Siem Reap City (Stage 2)

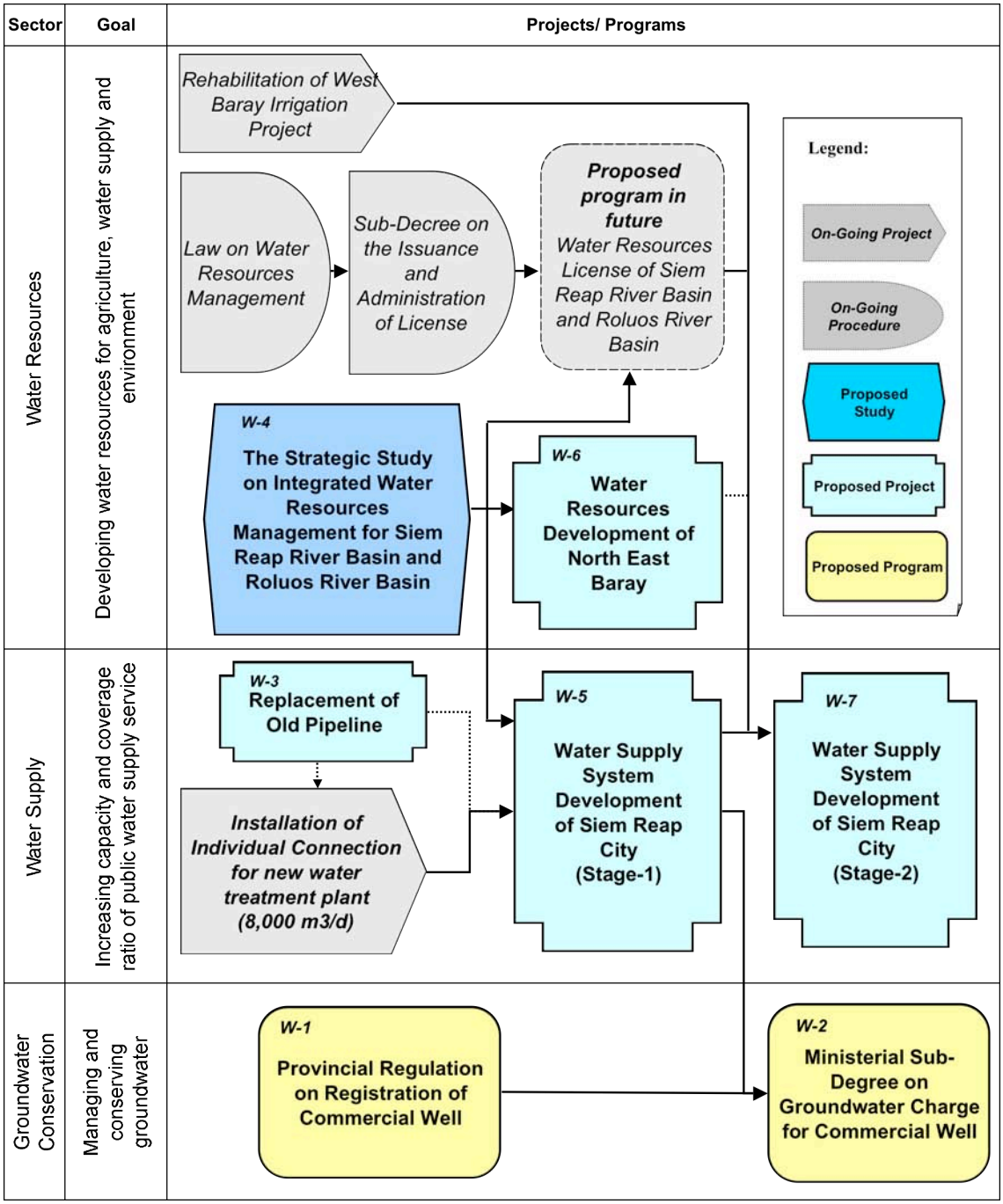
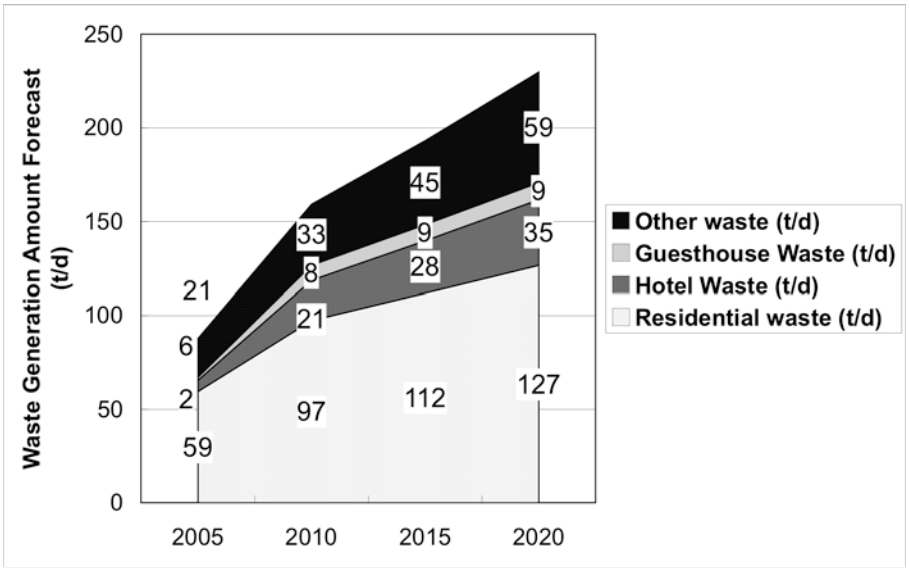
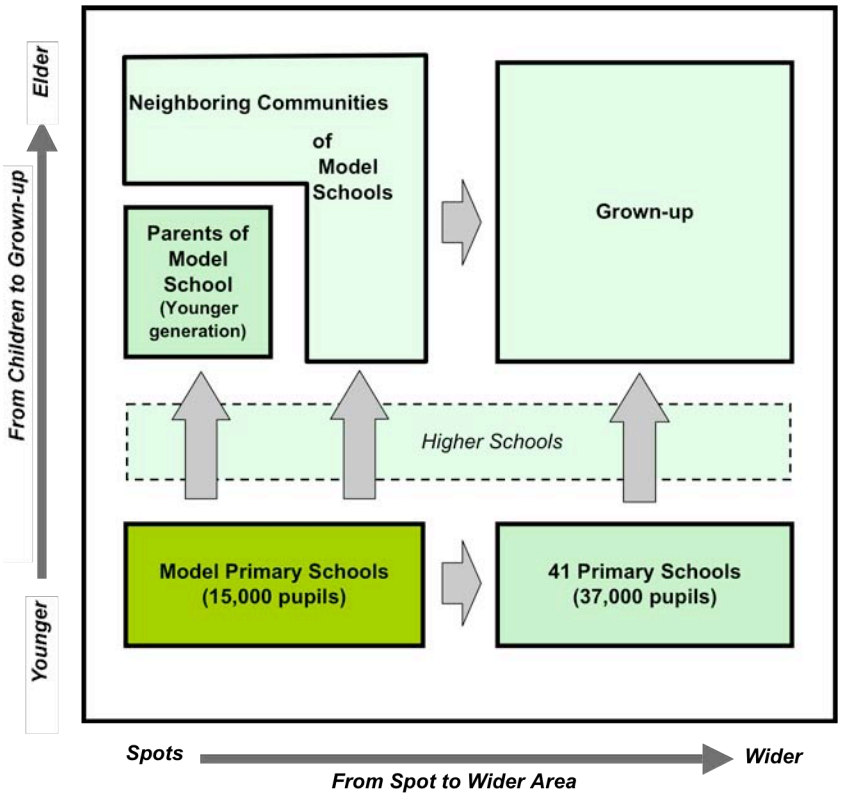


Figure II.5.19 Programs/projects sequence

(8) Solid Waste Management (SWM)	
Issues	1. Solid waste scattered in public space giving negative impacts such as: • Deteriorating the environment such as groundwater pollution, smoking, many vermin, and offensive order, • Damaging aesthetic views and infrastructures as well as giving serious negative impacts on the tourists, • Social problems associated with the increase of waste pickers in town, and • Possibly serious negative environmental impacts on the surroundings of the disposal site in future. 2. Solid waste scattered because of: • Lack of people's awareness of waste issue and a change of their lifestyle to 'throwaway', • Insufficient capacity of the responsible authority for solid waste management • Low collection rate of residential waste due to high cost of fee collection • Over reliance on the private sector in SWM • Poor financial system for SWM
Sector Objective	SECTOR OBJECTIVES Making the town "LOVELY" for everybody • Siem Reap Town Area: Beautification of town • Angkor Heritage Area: A model of environmental management in Cambodia Targets of SWM • Waste collection coverate: 100% for urban residents and busines entities. • Final disposal system: Sanitary landfill • Waste discharging amount: Less than 600 g/person/day for residential waste and less than 1,200 g/person/day for total waste • Recycle target: More than 20% for in-organic recyclables by 3Rs measures • SWM cost: 30 USD/ton  Source: JICA Study Team **Figure II.5.20 Waste generation amount targeted with 3Rs measures**

Sector Approach	1. Strengthening people's awareness of the environment • From target sites to wider areas • Trageting various age groups by different approaches • Untilization of social capital 2. Establising a sound solid waste management sysem by creating a responsible institution in provincial governmnet and developing their capacity for planning and managing 3. Establishing a sound financial system for solid waste management by shouldered by tax or joint billing with other utility fee 4. Strengthening public private partnership • Public sector: Planning, coordination, and supervision works; other difficult work for the private sector • Private sector: SWM works  **Figure II.5.21 Approach to the expansion of target groups**

Concept of SWM System

Concept of the proposed SWM system: minimizing the waste generation amount

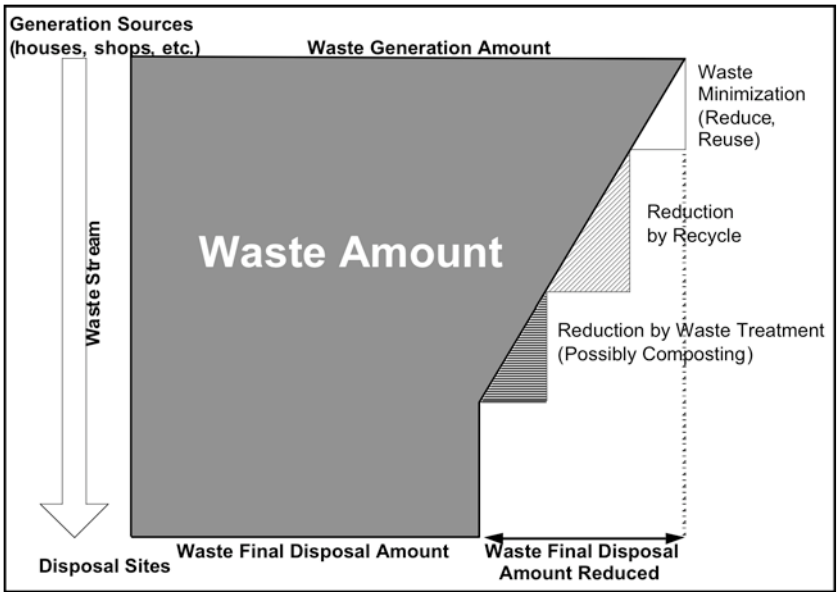


Figure II.5.22 Concept of proposed SWM system

Project/ Program

Institutional Plan

Administrative system

- The Provincial Department of Public Works and Transportation in the Provincial government: implementation of SWM and supervision of the contractors
- The Provincial Department of Environment: checking the environmental requirements.

Execution system

	Financial source	Waste collection	Waste disposal
Residential waste	Provincial government is responsible for financial source. (including the option of contracting out the fee collection)	Contracting out to private companies	Provincial government owns it and contracts out the operation work.
Non-residential waste	Private company is responsible for financial source.	Private company	Ditto
Public waste (road, river, park, etc.)	Provincial government is responsible for financial source.	Contracting out to private companies	Ditto

Project/ Programs Proposed

SW-1 Sound SWM system development

SW-2 Strengthening the waste collection system

SW-3 Sanitary landfill development

(Please see the related program E-2 Enhancing environmental awareness among people and business)

(9) Drainage and Sewerage

Issues

1. Frequent flooding in the central commercial and tourist accommodation area due to:

- Open drains have insufficient capacity for stormwater, and
- Open drains filled with garbage.

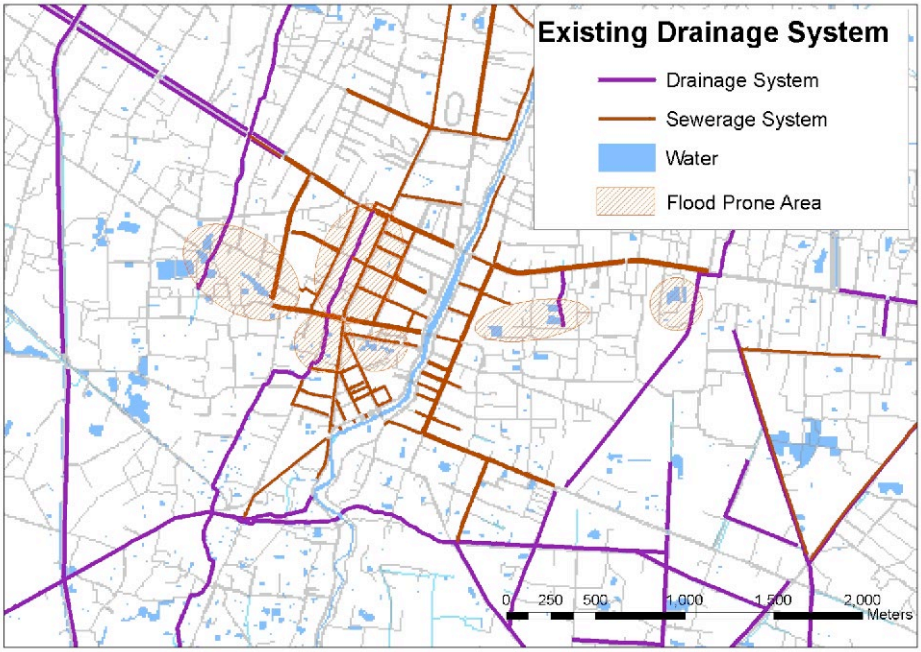
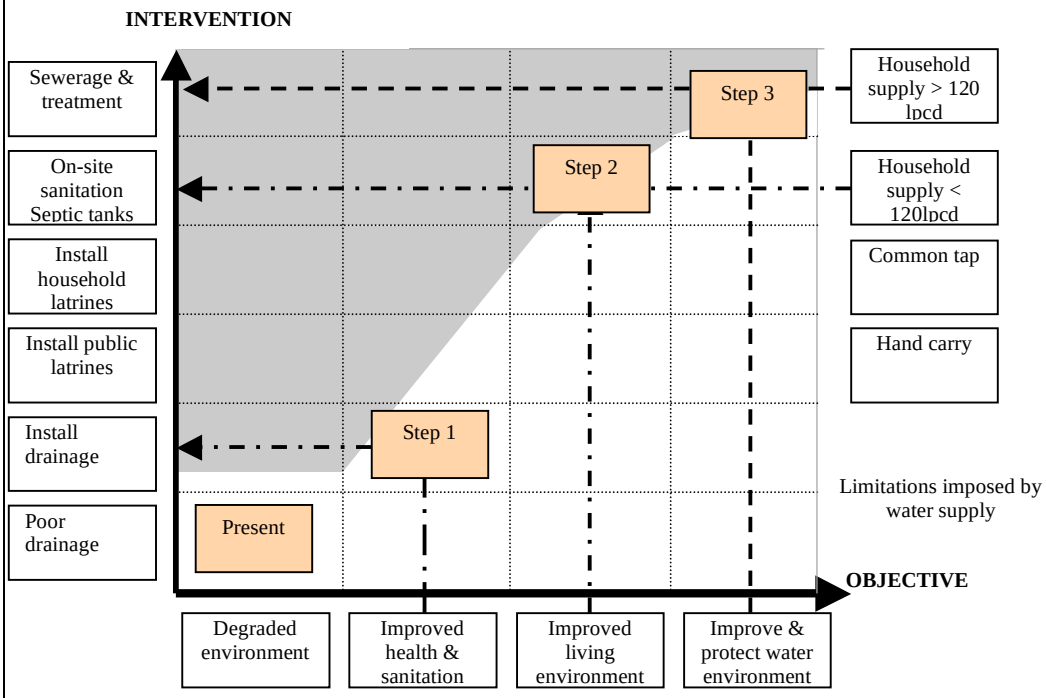


Figure II.5.23 Existing Drainage System

Photo II.5.4 Flooding along Sivatha Rd (September 2005)

2. Flooding causes the following sanitation/ health problems:

- Inundation of streets and properties by combined storm water and sanitary wastewater during heavy rainfall,
- Effluent from septic tanks discharged directly to drains, creating disease vectors, and
- Health and aesthetic problems caused by inadequate sanitaion in high density and low income areas.

	3. Negative impacts of flood on the environment such as: • Increasing pollution levels in Siem Reap River, drains and irrigation canals, and • Drainage ditches and groundwater increasingly contaminated by wastewater and infiltration of runoff
Sector Objective	Creating sustainable drainage and sewerage systems for hygienic and beautiful town: 1. Improving health and sanitation 2. Improving healthiness and urban hygiene at the neighbourhood level 3. Preventing environmental degradation and improving water quality in Siem Reap river
Sector Approach	1. Introducing integrated waste management such as: 2. Stormwater management, and • Restoring capacity of existing drains • Providing additional drainage capacity • Treating urban stormwater channeled to detention ponds • Redirecting stormwater from the urban core away from the Siem Reap River • Providing storage in upstream reaches to minimize the impact of runoff on down stream areas. 3. Wastewater management. • Separate wastewater collection system introduced into the urban center where medium to high population density, water serviced, and hotels/guesthouses concentrated.
Project/ Program	<u>STEPS of Objectives and Intervention</u>  **Figure II.5.24 Objectives/Intervention Matrix**

1. STEP 1: Improving health and sanitation by a drainage system improvement which removes stagnant pools of wastewater away from dwelings and reduces flooding incidence.
2. STEP 2: Improving the living environment in low-density urban areas (Zone 2 & 3) by ensuring proper septic tanks installation and maintenance at households and hotels/guesthouses.
3. STEP 3: Protecting water quality and preventing environmental degradation by implementation of a centralized sewerage system in Zone 1 extended to Zone 2.

Drainage Improvement Plan

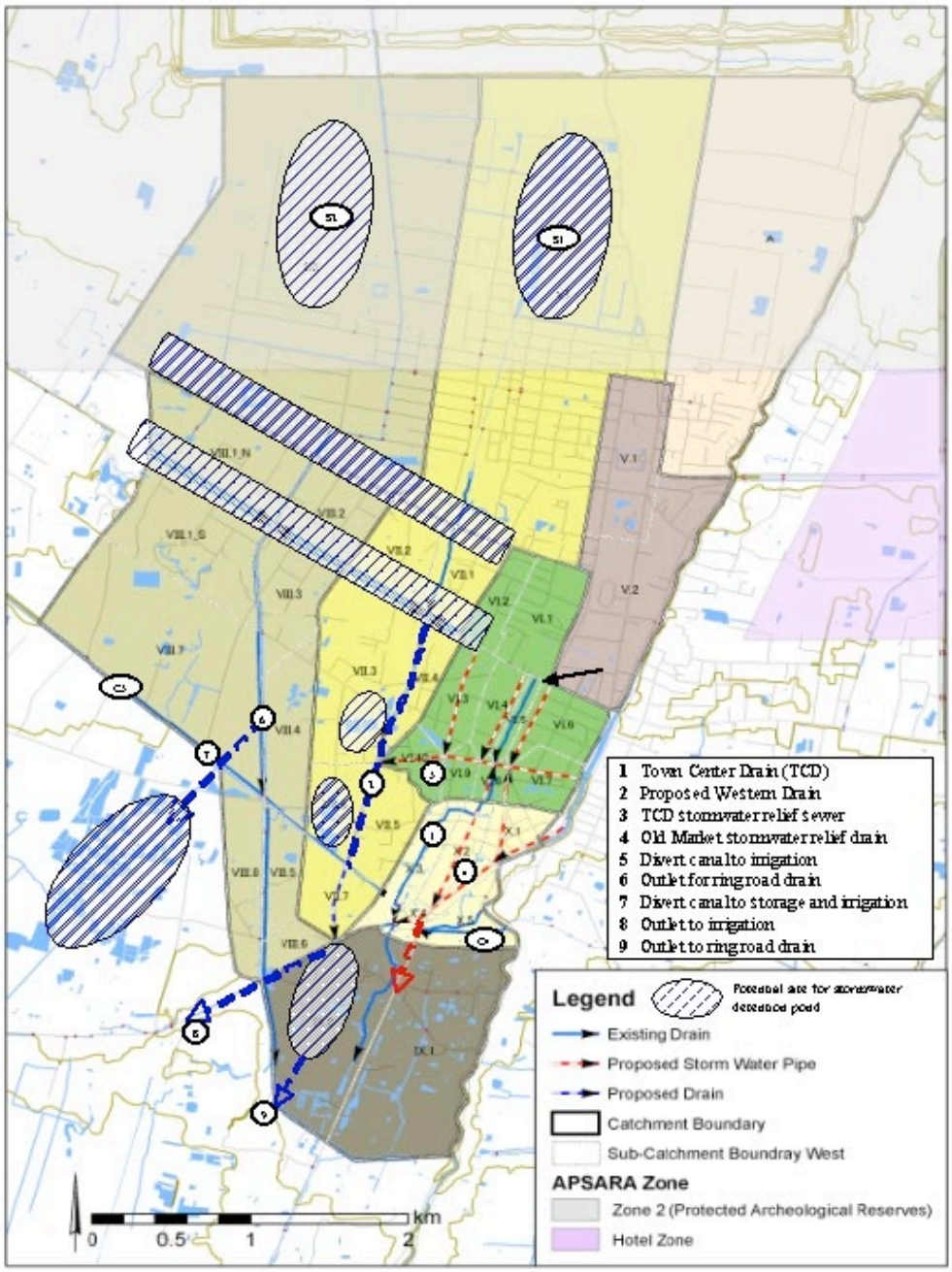


Figure II.5.25 Proposed drainage improvements: West sector

Table II.5.2 Proposed Drainage Improvements - West

Catchment	Proposed improvements
Upstream NR6	• Provide stormwater storage facilities to relieve peak flows and protect downstream areas.
VI	• Provide stormwater relief sewer along Samdach Tep Vong St to divert flows away from the Town Center Drain
VII	• Provide new West Drain to increase storm drainage capacity and provide an outlet for Catchment VI. • Provide offline storage to reduce peak flows and control runoff
VIII	• Divert canal C3 before it reaches the ring road • Divert excess stormwater from the ring road drain to storage pond
X	• Provide new storm relief sewers in the old market area to divert flows away from Siem Reap River. Outlet to existing irrigation canal C4
At NR6	• Provide large box culverts at three locations to relieve flooding on north side • Provide smaller culverts at 250m intervals. • Provide storage ponds along NR6 within the 50m allowance.
Downstream	• Provide stormwater control structure to distribute flow at outlet of western drain • Divert irrigation canal C4 to catchment IX

Wastewater management Plan

Table II.5.3 Proposed Servicing Arrangement

	2012	2020
Zone 1	Centralized	Centralized
Zone 2	On-site	Centralized
Zone 3	On-site	On-site
APSRA hotel zone	On-site or Cluster	On-site or Cluster

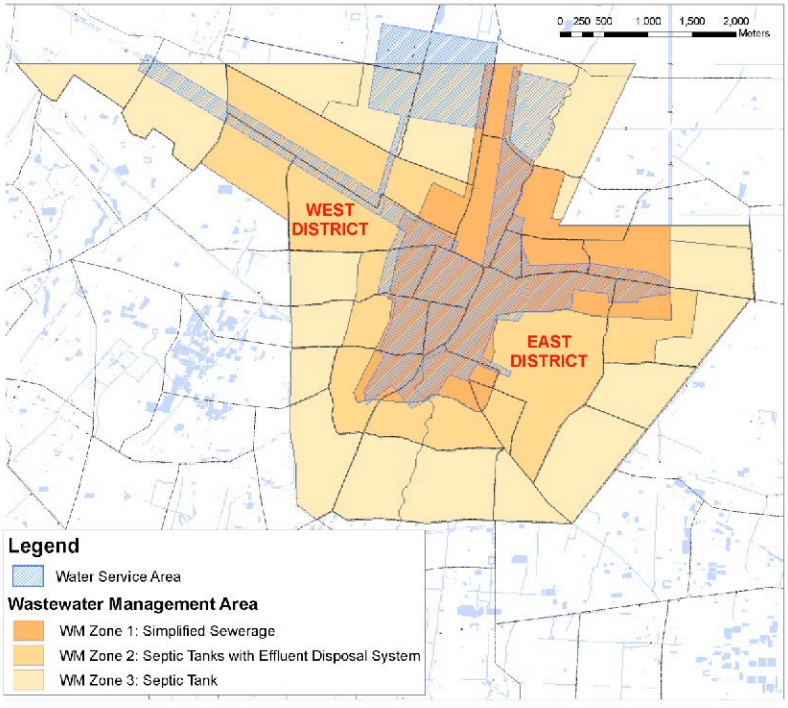


Figure II.5.26 Proposed Wastewater Management

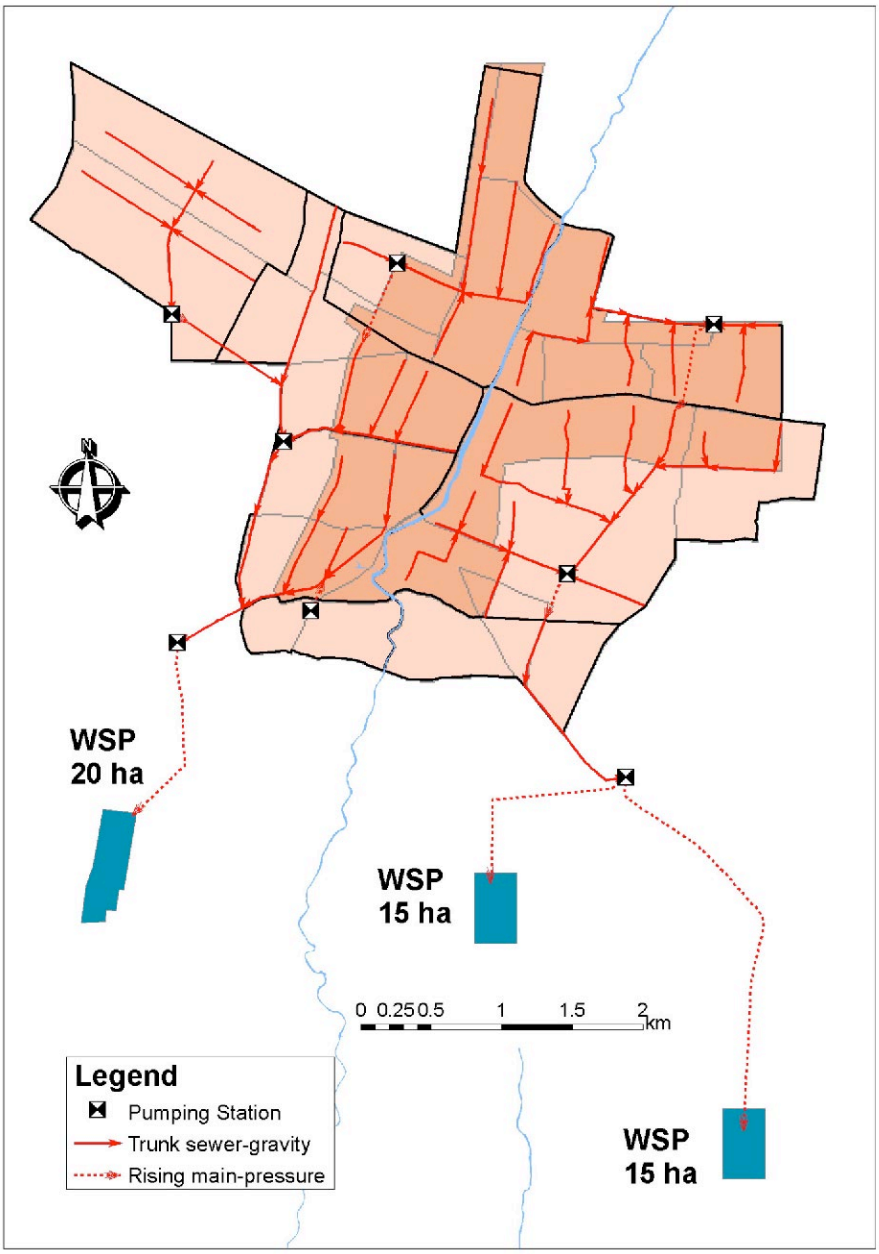


Figure II.5.27 Proposed Wastewater System Layout

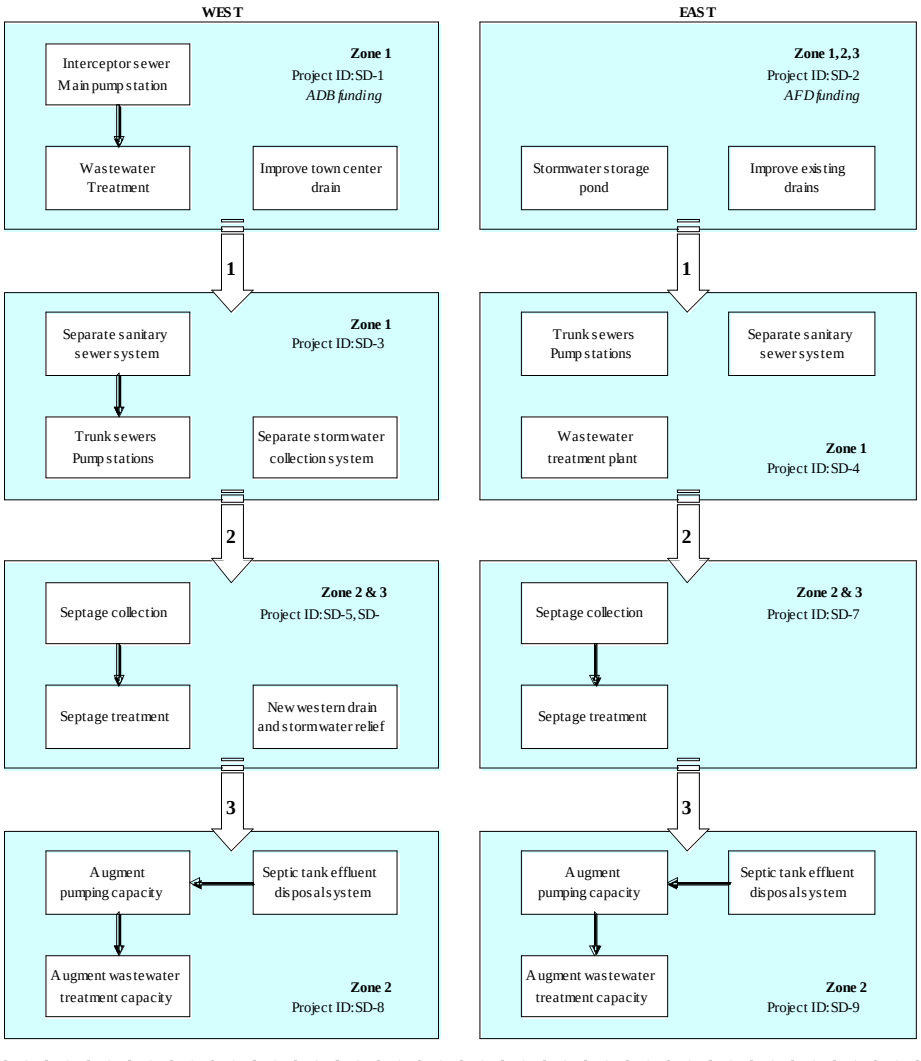


Figure II.5.28 Project Implementation Sequence

SD-1 Mekong Tourism Development Project Part A1: Drainage and sewerage improvement in West District Zone 1.

SD-2 Urban Development Project Siem Reap-Angkor: Drainage in East District

SD-3 Siem Reap Sewerage Project-Phase I: sewerage and drainage in West District Zone1

SD-4 Siem Reap Sewerage Project-Phase II: Sewerage East District Zone 1

SD-5 Siem Reap Town Center Stormwater Relief Project: Drainage West District

SD-6 Siem Reap Septage Management Project-Phase I: Septic sludge disposal West District

SD-7 Siem Reap Septage Management Project-Phase II: Septic sludge disposal East District

SD-8 Siem Reap Septic Tank Effluent Disposal Project- Phase 1: Septic tank effluent disposal West District Zone 2

SD-9 Siem Reap Septic Tank Effluent Disposal Project- Phase 1I: Septic tank effluent disposal East District Zone 2