

ANNEX 4.5.2
PRELIMINARY COST ESTIMATES
FOR MASTER PLAN

**THE STUDY ON WATER SUPPLY SYSTEM
FOR SIEM REAP REGION IN CAMBODIA**

**FINAL REPORT
Vol. III SUPPORTING REPORT**

ANNEX 4.5.2 PRELIMINARY COST ESTIMATES FOR MASTER PLAN

Table of Contents

	<u>Page</u>
1. Basis of Cost Estimates	A4.5.2-1
2. Preliminary Cost Estimates	A4.5.2-1
2.1 Construction Costs	A4.5.2-1
2.2 Operation and Maintenance Costs	A4.5.2-5
2.3 Project Costs	A4.5.2-5
2.3.1 Land acquisition Cost.....	A4.5.2-5
2.3.2 Administration Cost	A4.5.2-5
2.3.3 Engineering Service Cost	A4.5.2-5
2.3.4 Physical Contingency	A4.5.2-5
2.3.5 Price Contingency	A4.5.2-6

List of Tables

	<u>Page</u>
Table 1.1 Source of Unit Cost Data.....	A4.5.2-1
Table 2.1.1 Breakdown of Estimated Construction Cost.....	A4.5.2-2
Table 2.1.2 Construction Cost of Pipeline	A4.5.2-4
Table 2.2.1 Operation and Maintenance Cost.....	A4.5.2-7
Table 2.2.2 Estimation of Personnel Cost.....	A4.5.2-8
Table 2.3.1 Summary of Project Cost for Master Plan	A4.5.2-8

ANNEX 4.5.2 PRELIMINARY COST ESTIMATES FOR MASTER PLAN**1. Basis of Cost Estimates**

Price Level: Base year for the cost estimation is 1999 and all costs are shown in US\$.

Unit Cost: Unit cost data in this cost estimation are collected from government offices, local consultants and manufacturers as shown on Table 1.1. These information are also checked against costs used in recent similar projects in Cambodia.

Table 1.1 Source of Unit Cost Data

Source of Unit Cost Data	Item
Provincial Department of Industry, Mines and Energy (PDIME)	Cost for house connection, chemicals costs and land acquisition, etc.
Electricity de Siem Reap	Power cost
Phnom Penh Water Supply Authority (PPWSA)	Salary of staff, chemical costs, etc.
JICA Project: The Study on Phnom Penh Water Supply System in the Kingdom of Cambodia, 1993	Costs of pipe and civil work, etc.

2. Preliminary Cost Estimates**2.1 Construction Costs**

A survey concerning unit costs of labor, materials, machines and equipment in Siem Reap Town and Phnom Penh is carried out and unit costs referred in this Annex are shown in Annex 4.3.1. Based on the results of the survey, construction costs are preliminary estimated as shown on Table 2.1.1.

Breakdown of the costs for distribution Pipeline, service Mains and rehabilitation of existing pipeline costs is shown on Table 2.1.2.

Table 2.1.1 (1/2) Breakdown of Estimated Construction Cost

Description	Unit	Stage 1 Quantity	Stage 2 Quantity	Total Quantity	Stage 1 Amount (US\$)	Stage 2 Amount (US\$)	Total Amount (US\$)
1. Intake Facilities					2,432,000	1,218,000	3,650,000
1.1 Deep Wells (450 mm × H 50 m, Q 800 m ³ /d)	well	10	5	15	500,000	250,000	750,000
Submergible Pump (0.56 m ³ /min×H 13 m, 2.2 kW)	set	3	1	4	87,000	29,000	116,000
Submergible Pump (0.56 m ³ /min × H 18 m, 3.7 kW)	set	7	4	11	210,000	120,000	330,000
1.2 Connecting Pipelines							
DIP 250mm	m	2,000	1,000	3,000	469,000	235,000	704,000
DIP 200mm	m	1,600	800	2,400	323,000	162,000	485,000
DIP 150mm	m	1,000	500	1,500	157,000	79,000	236,000
1.3 Generator House (50 m ² × 3 houses)	m ²	100	50	150	200,000	100,000	300,000
Generator (3P 75 KVA/W Fuel Tank)	set	4	2	6	234,000	117,000	351,000
1.4 Well House (25 m ² × 15 houses)	m ²	250	125	375	252,000	126,000	378,000
2. Disinfection, Reservoir, Power Facilities and Pump Station					2,669,000	489,000	3,158,000
2.1 Receiving Well (H 3 m×Area 14 m ²)	m ³	42	0	42	92,000	0	92,000
2.2 Chlorinator House (W 7 m×L 15 m)	m ²	105	0	105	181,000	0	181,000
2.3 Clear Water Reservoir (W 15 m×L 25 m×H 3.5 m×3 basins)	m ³	2,625	1,313	3,938	671,000	336,000	1,007,000
2.4 Generator House (150 m ²)	m ²	150	0	150	42,000	0	42,000
Generator (3P 150 KVA/W Fuel Tank)	set	4	1	5	355,000	89,000	444,000
2.5 Instrumentation System etc.	L.S.	1	1	2	733,000	39,000	772,000

Table 2.1.1 (2/2) Breakdown of Estimated Construction Cost

Description	Unit	Stage 1 Quantity	Stage 2 Quantity	Total Quantity	Stage 1 Amount (US\$)	Stage 2 Amount (US\$)	Total Amount (US\$)
2.6 Pump Station (240 m ²)	m ²	240	0	240	434,000	0	434,000
Distribution Pump (1.0 m ³ /min × H 35 m, 11 kw)	set	3	0	3	61,000	0	61,000
Distribution Pump (1.82 m ³ /min × H 35 m, 18.5 kw)	set	4	1	5	100,000	25,000	125,000
3. Distribution Pipeline, Service Mains and Rehabilitation of Existing Pipeline					6,141,000	256,000	6,397,000
New Distribution Pipelines 75 ~ 500 mm (DIP and PVC/PE)	m	17,025	3,310	20,335	4,924,000	256,000	5,180,000
Rehabilitation of Existing Pipeline 100 ~ 400 mm (DIP and PVC/PE)	m	6,310	0	6,310	885,000	0	885,000
Service Mains 50 ~ 75 mm (PVC/PE)	m	6,200	0	6,200	332,000	0	332,000
Total Cost					11,242,000	1,963,000	13,205,000

Exchange Rate: 1 US\$= 120 Yen

L.S.: Lump Sum

Table 2.1.2. Construction Cost of Pipeline

Diameter and Material	Length of Distribution Pipeline		Rehabilitation of Existing Pipeline	Service Mains	Sub-total Cost			
	Stage 1 (2006)	Stage 2 (2010)	Stage 1 (2006)	Stage 1 (2006)	New Pipeline Stage 1	New Pipeline Stage 2	Rehabilitation Stage 1	Service Mains (Stage 1)
	(m)	(m)	(m)	(m)	US \$	US \$	US \$	US \$
700 DIP								
600 DIP								
500 DIP	7,450				3,556,000			
450 DIP	710				299,000			
400 DIP			166				60,000	
350 DIP			254				79,000	
300 DIP			230				63,000	
250 DIP	360		900		85,000		211,000	
200 DIP	2,630		92		531,000		19,000	
150 PVC*	765	410	1,169		88,000	48,000	135,000	
100 PVC*	1,860	1,100	3,499		170,000	100,000	318,000	
75 PVC*	3,250	1,800		3,100	195,000	108,000		186,000
50 PVC*				3,100				146,000
Sub-total	17,025	3,310	6,310	6,200	4,924,000	256,000	885,000	332,000
Total	32,845				6,397,000			

* : Materials for the Secondary Mains and the Service Mains (dia. 150 – dia. 50) will be PVC or PE. For the cost estimation, unit cost of PVC is used for these mains.

2.2 Operation and Maintenance Costs

Operation and maintenance costs are calculated for the Stage 1 of which capacity is 8,000 m³/day and for the Stage 2 of which capacity is 12,000 m³/day. Method of calculation of the costs is described in Annex 4.3.1.

Estimated operation and maintenance costs are as shown on Table 2.2.1 and breakdown of the personnel cost is shown on Table 2.2.2.

2.3 Project Costs

For the implementation of the Project, other related costs such as land acquisition cost, engineering service and administrative costs, physical and price contingencies will be required besides construction costs. In addition, cost allocation of foreign and local currency portions is also carried out.

2.3.1 Land acquisition Cost

No costs will be required for the lands of well facilities and transmission lines, because these facilities and pipelines will be constructed in the road shoulder where the Government owns. The land acquisition cost for distribution center site is estimated based on the unit price of the land and space required.

The costs of engineering services and administrative costs, physical and price contingencies are estimated as a percentage of construction costs.

2.3.2 Administration Cost

Administrative cost which will be required among Cambodian government is estimated to be 2% of construction costs.

2.3.3 Engineering Service Cost

The cost of engineering services, which includes detailed design, soil investigation and field survey, and construction supervision, is commonly estimated at about 10% of construction costs. This percentage is influenced by local conditions and the size of the Project, with higher percentages for smaller projects. Taking account of the scale of this Project, the cost of engineering service is estimated to be 15% of the construction costs.

2.3.4 Physical Contingency

10% of the sum of the construction costs, administration cost and the engineering

service cost has been added to finance unforeseen expenditure, such as unanticipated rock excavation or site dewatering.

2.3.5 Price Contingency

Considering the inflation rates in Cambodia in past five years, 10% of the sum of all above costs has been added to include inflation of costs during construction period.

The estimated project costs including the related costs are summarized in Table 2.3.1.

Table 2.2.1 Operation and Maintenance Cost

	Item	Value	Value
1	Design Maximum Daily Supply (Qmax)	8,000 m ³ /d	12,000 m ³ /d
2	Operation Rate (Peak Factor=1.2)	83 %	83 %
3	Design Average Daily Supply	6,667 m ³ /d	10,000 m ³ /d
4	Annual Average Supply [(3)×365]	2,433,333 m ³ /year	3,650,000 m ³ /year
5	Fuel Cost	0.3 US\$/λ	0.3 US\$/λ
6	Unit Fuel Cost for Intake Facilities (75 KVA Generator)	0.110 US\$/kWh	0.110 US\$/kWh
7	Intake Pump Facilities Capacity	32.5 kW	49.5 kW
8	Annual Consumed Electric Power (83% operation rate)	237,250 kWh/year	361,350 kWh/year
9	Unit Fuel Cost for Distribution Facilities and Others (150 KVA Generator)	0.107 US\$/kWh	0.107 US\$/kWh
10	Distribution Pump Facilities + Other Capacity	85.5 kW	108.0 kW
11	Annual Consumed Electric Power (83% operation rate)	624,150 kWh	788,400 kWh
12	Annual Fuel Cost for Electric Power [(6)×(8) +(9)×(11)]	93,004 US\$/year	124,275 US\$/year
13	Annual Maintenance Cost of Generator (=Generators Initial Investment×10%)	58,900 US\$/year	79,500 US\$/year
14	Annual Electric Power Cost [(12)+(13)]	151,904 US\$/year	203,775 US\$/year
15	Average Annual Chemical Cost (83% operation rate)	17,033 US\$/year	25,550 US\$/year
16	Dosage of Chlorine	4.0 mg/l	4.0 mg/l
17	Annual Consumption of Chlorine [(16)×(4)÷1,000,000]	10 ton/year	15 ton/year
18	Unit Cost of Chlorine	1,000 US\$/ton	1,000 US\$/ton
19	Annual Chlorine Cost [(17)×(18)]	9,733 US\$/year	14,600 US\$/year
20	Dosage of Lime	20.0 mg/l	20.0 mg/l
21	Annual Consumption of Lime [(20)×(4)÷1,000,000]	49 ton/year	73 ton/year
22	Unit Cost of Lime	150 US\$/ton	150 US\$/ton
23	Annual Lime Cost [(21)×(22)]	7,300 US\$/year	10,950 US\$/year
24	The number of employees	19 Person	25 Person
25	The average salary per month per employee*	208 US\$/person/month	190 US\$/person/month
26	Annual Salary [(24)×(25)]	47,400 US\$/year	57,000 US\$/year
27	Annual Operation Cost [(14)+(15)+(26)]	216,337 US\$/year	286,325 US\$/year
28	Annual Maintenance Cost [=Construction Cost×1%]	112,420 US\$/year	132,050 US\$/year
29	Annual Operation and Maintenance Cost	328,757 US\$/year	418,375 US\$/year
30	Operation and Maintenance Cost per m ³	0.135 US\$/m ³	0.115 US\$/m ³
31	Among which		
32	Maintenance Cost per m ³	0.046 US\$/m ³	0.036 US\$/m ³
33	Operation Cost per m ³	0.089 US\$/m ³	0.078 US\$/m ³
34	Among which Power Cost per m ³	0.062 US\$/m ³	0.056 US\$/m ³
35	Chemical Cost per m ³	0.007 US\$/m ³	0.007 US\$/m ³
36	Personnel Cost per m ³	0.019 US\$/m ³	0.016 US\$/m ³

*: See the Table 2.2.2

Table 2.2.2 Estimation of Personnel Cost

Item	Unit	Stage 1 Qmax=8,000m ³ /d	Total Qmax=12,000m ³ /d
Director	Person	1	1
Monthly Salary	US\$/man· month	450	450
Dep. Director	Person	2	2
Monthly Salary	US\$/man· month	350	350
Engineer	Person	2	2
Monthly Salary	US\$/man· month	350	350
Clerk	Person	2	2
Monthly Salary	US\$/man· month	200	200
Technician	Person	5	7
Monthly Salary	US\$/man· month	200	200
Assist. Technician	Person	7	11
Monthly Salary	US\$/man· month	100	100
Total Number of Staff	Person	19	25
Annual Salary	US\$/year	47,400	57,000
Average Salary	US\$/man· month	208	190
Unit Personnel Cost	US \$/m ³	0.019	0.016

Table 2.3.1 Summary of Project Cost for Master Plan

(Unit: US\$ 1,000)

	Description	Stage 1	Stage 2	Total
A	Construction Costs	11,242	1,963	13,205
B	Land Acquisition Cost	250	-	250
C	Administration Cost (2% of A)	225	40	265
D	Engineering Services (15% of A)	1,687	295	1,982
E	Physical Contingency (10% of A+C+D)	1,316	230	1,546
F	Price Contingency (10% of A to E)	1,472	253	1,725
	Total	16,192	2,871	18,973

ANNEX 4.7.1
ECONOMIC AND FINANCIAL ANALYSIS
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ANNEX 4.7.1 ECONOMIC AND FINANCIAL ANALYSIS

Table of Contents

	<u>Page</u>
1. Introduction.....	A4.7.1-1
2. Economic Conditions	A4.7.1-1
2.1 Administration.....	A4.7.1-1
2.2 National Accounts.....	A4.7.1-2
2.3 Financial Situation.....	A4.7.1-6
2.3.1 Public Finance.....	A4.7.1-6
2.3.2 Balance of Payment.....	A4.7.1-6
2.3.3 Foreign Assistance and Debt	A4.7.1-9
2.4 Foreign Trade.....	A4.7.1-9
2.5 Inflation and Prices	A4.7.1-13
2.6 Employment and Wages.....	A4.7.1-13
2.7 Household Income and Expenditure	A4.7.1-17
2.8 Health Situation.....	A4.7.1-21
2.9 Regional Economy.....	A4.7.1-23
2.9.1 Agriculture	A4.7.1-23
2.9.2 Tourism.....	A4.7.1-25
2.9.3 Infrastructure.....	A4.7.1-25
2.10 Development Programs	A4.7.1-27
2.10.1 National Development Plan	A4.7.1-27
2.10.2 Provincial Development Plan.....	A4.7.1-29
3. Financial Status of Waterworks.....	A4.7.1-29

3.1	Present Situation of Water Supply	A4.7.1-29
3.2	Water Tariffs	A4.7.1-30
3.3	Financial Performance of Old Waterworks.....	A4.7.1-33
3.4	Financial Performance of New Waterworks	A4.7.1-33
	3.4.1 Present Situation of New Waterworks.....	A4.7.1-33
	3.4.2 Financial Performance of New Waterworks	A4.7.1-35
4.	Financial Analysis	A4.7.1-37
4.1	Overview of Financial Analysis.....	A4.7.1-37
4.2	Revenue from Water Supply Services	A4.7.1-38
4.3	Cost for Water Production.....	A4.7.1-39
4.4	Financial Efficiency.....	A4.7.1-40
5.	Economic Analysis	A4.7.1-45
5.1	Overview of Economic Analysis.....	A4.7.1-45
5.2	Assumptions for Economic Evaluation.....	A4.7.1-47
5.3	Economic Benefits	A4.7.1-52
	5.3.1 Benefits of Proposed Project	A4.7.1-52
	5.3.2 Quantifiable Direct Benefits.....	A4.7.1-52
	5.3.3 Estimate of Unit Economic Benefits	A4.7.1-53
	5.3.4 Estimate of Economic Benefit	A4.7.1-63
5.4	Economic Costs	A4.7.1-63
5.5	Economic Efficiency.....	A4.7.1-64
6.	Socioeconomic Impacts.....	A4.7.1-66
6.1	Impact on Regional Economy.....	A4.7.1-66
6.2	Impact on Public Finance	A4.7.1-66
6.3	Impact on Household Economy	A4.7.1-67

List of Tables

	<u>Page</u>
Table 2.2.1	GDP by Major Industrial Sector: 1998A4.7.1-2
Table 2.2.2	GDP by Economic Sector at Current Prices: 1993-1998A4.7.1-3
Table 2.2.3	Percentage Distribution of GDP at Factor Cost by Economic Sector: 1993-1998.....A4.7.1-3
Table 2.2.4	GDP Real Growth for Latest Five YearsA4.7.1-4
Table 2.2.5	GDP by Economic Sector at 1993 Constant Prices: 1993-1998A4.7.1-5
Table 2.2.6	Real Growth of GDP by Economic Sector: 1993-1998A4.7.1-5
Table 2.3.1	Percentage Share of Public Expenditure to GDPA4.7.1-6
Table 2.3.2	Statistics of State Financial Operation: 1996-1999A4.7.1-7
Table 2.3.3.	Balance of Payment: 1992-1997A4.7.1-8
Table 2.3.4	Official Development Assistance: 1992-1996.....A4.7.1-10
Table 2.3.5	External Debt: 1991-1996A4.7.1-11
Table 2.4.1	Foreign Trade: 1996-1998A4.7.1-12
Table 2.5.1	Consumer Price Indices and Foreign Exchange: 1991-1999A4.7.1-14
Table 2.6.1	Labor Force Distribution and Employment Conditions in Cambodia, Phnom Penh, Urban and Rural Areas: 1997.....A4.7.1-15
Table 2.6.2	Distribution of Labor Force: 1998.....A4.7.1-16
Table 2.6.3	Labor Force Distribution and Employment Conditions in Phnom Penh: 1997-1998.....A4.7.1-18
Table 2.7.1	Average Monthly Household Expenditure by Major Group: 1997..A4.7.1-19
Table 2.7.2	Average Monthly Household Expenditure by Item and by Capita Expenditure Decile in Urban Areas Excluding Phnom Penh: 1997 .A4.7.1-20
Table 2.7.3	Health Statistics during Reference Period of Four Weeks: 1997A4.7.1-22
Table 2.8.1	Number of Patients Suffering from Water Borne Diseases: 1998A4.7.1-23
Table 2.8.2	Public Health Conditions in Siem Reap Province: 1996-1998A4.7.1-24
Table 2.9.1	Number of Tourists Visiting Siem Reap: 1994-1998A4.7.1-25
Table 2.9.2	Water Bottlers Registered to MIME in Siem Reap Province: 1999.....A4.7.1-26
Table 2.10.1	GDP Projection by Industrial Origin: 1996-2000A4.7.1-28

Table 2.10.2	Development Plan of Water Supply System in Siem Reap.....	A4.7.1-29
Table 3.2.1	Water Tariff in 1995.....	A4.7.1-30
Table 3.2.2	Water Tariff in 1999.....	A4.7.1-31
Table 3.2.3	Water Cost and Tariff for Siem Reap Water Supply Scheme.....	A4.7.1-32
Table 3.3.1	Management Performance of Water Supply Services: 1991-1994	A4.7.1-33
Table 3.3.2	Financial Performance of Water Supply in Siem Reap: 1991-1994	A4.7.1-34
Table 3.3.3	Records of Water Charge Collection: 1992 and 1993	A4.7.1-34
Table 3.4.1	Operational Performance of New Water Works	A4.7.1-35
Table 3.4.2	Operation Losses of New Water Works.....	A4.7.1-35
Table 3.4.3	Performance of Water Supply in Siem Reap.....	A4.7.1-36
Table 3.4.4	Net Operation Loss of New Waterworks.....	A4.7.1-37
Table 4.2.1	Average Water Consumption and Water Charge	A4.7.1-38
Table 4.2.2	Annual Revenue of Water Supply Services: 2002 and 2010	A4.7.1-39
Table 4.3.1	Investment Costs of Proposed Project	A4.7.1-39
Table 4.4.1	Financial Expenditure and Revenue Stream of Proposed Project ...	A4.7.1-41
Table 4.4.2	Financial Expenditure and Revenue Stream of Proposed Project: Case 1.....	A4.7.1-42
Table 4.4.3	Financial Expenditure and Revenue Stream of Proposed Project: Case 2.....	A4.7.1-43
Table 4.4.4	Financial Expenditure and Revenue Stream of Proposed Project: Case 3.....	A4.7.1-44
Table 5.2.1	Standard Conversion Factor.....	A4.7.1-48
Table 5.2.2	Crop Production Data in Land Purchased for Distribution Center.....	A4.7.1-49
Table 5.2.3	Farmgate Price of Paddy Derived from International Market: 1999.....	A4.7.1-50
Table 5.2.4	Retail Prices and Farmgate prices of Paddy in Local Market: 1998.....	A4.7.1-50
Table 5.2.5	Production Cost of Paddy in Irrigated Fields: 1998-1999.....	A4.7.1-51
Table 5.2.6	Cropping System of Paddy Production in Irrigated Fields.....	A4.7.1-51
Table 5.3.1	Benefits Accruing from Water Supply Project.....	A4.7.1-52
Table 5.3.2	Systems' Specification of Potable Water Source Production in	

	Residence in Siem Reap	A4.7.1-54
Table 5.3.3	Water Source Cost of Potable Water in Residence by Type.....	A4.7.1-56
Table 5.3.4	Household Medical Expenses and Losses due to Ill Health in Urban Areas.....	A4.7.1-58
Table 5.3.5	Systems' Specification of Potable Water Source Procurement in Hotels in Siem Reap	A4.7.1-60
Table 5.3.6	Water Source Cost of Potable Water in Hotels.....	A4.7.1-62
Table 5.3.7	Estimate of Economic Benefits	A4.7.1-63
Table 5.4.1	Economic and Financial Costs of Proposed Project.....	A4.7.1-64
Table 5.5.1	Economic Cost and Benefit Stream of Proposed Project.....	A4.7.1-65

List of Figures

		<u>Page</u>
Figure 2.6.1	Income Distribution in Phnom Penh: 1998	A4.7.1-17
Figure 5.1.1	Procedure of Economic and Financial analysis.....	A4.7.1-46
Figure 5.3.1	Water Unit Cost of Domestic Use by Type.....	A4.7.1-55
Figure 5.3.2	Water Source Costs of Hotels	A4.7.1-61

ANNEX 4.7.1 ECONOMIC AND FINANCIAL ANALYSIS FOR MASTER PLAN

1. Introduction

Socioeconomic information in Siem Reap Region and the nation is compiled in this Annex. The socioeconomic information is essential for estimating project benefits in financial and economic terms. In this connection, Chapter 2 gives the present socioeconomic conditions in relation to water supply development. The components of socioeconomic conditions include the following issues: (1) administration, (2) national accounts, (3) financial situation of the central government, (4) foreign trade, (5) inflation and prices in market, (6) employment and wages, (7) household income and expenditure in project areas, (8) health situation, (9) regional economy in Siem Reap and (10) existing development programs in the nation and in Siem Reap. These are fundamental pictures for socioeconomic analysis.

In this Study, socioeconomic analysis presents mainly project evaluation of a project. The project is proposed through the least-cost method among several alternatives. The viability of the proposed project is evaluated from three socioeconomic viewpoints: (1) economic aspect, (2) financial aspect, and (3) social aspect in the Study Area. The economic aspect is to evaluate viability of social investment in the national economy. The financial aspect is to evaluate the earning capacity and fund management. The social aspect describes socioeconomic issues and recommendations for agencies concerned and people in the areas of the proposed project.

2 Economic Conditions

2.1 Administration

Cambodia administratively consists of 24 Provinces. Among 24 Provinces, Phnom Penh and Sihanouk Ville Provinces are called as City. These Provinces are further divided into Districts, the Districts into Communes, and the Communes into Villages. As of 1998, there were 24 Provinces, 182 Districts, 1,608 Communes and 13,016 Villages.

Siem Reap Province is one of these 24 Provinces, which is located in northwestern part of the country. The Province comprises 14 Districts, 108 Communes and 921 Villages. The project site of this current Master Plan Study Area is involved in Siem Reap District completely. It spreads over the following three Communes: Sala Kamraeuk, Sla Kram and Svay Dangcum. Furthermore, it spreads over 14 Villages in these three Communes.

The head of provincial government, Governor, is dispatched from Ministry of

Interior, who controls all regional branches of Ministries of the central government. Although water supply schemes fall under jurisdiction of Ministry of Industry, Mines and Energy (MIME), the Governor has been influential in management of the schemes. At present, the water supply business in Siem Reap Town is managed by Provincial Department of Industry, Mines and Energy (PDIME). From the privatization policy of the national government, however, its management is expected to be carried out by an autonomous undertaker in the future.

2.2 National Accounts

Gross domestic product (GDP) in Cambodia was 10.24 trillion Riels at market prices in 1998. It was broken down into gross value added (GVA) of main economic sectors as follows: 3.98 trillion Riels in the agricultural sector, 1.88 trillion Riels in the industrial sector, and 3.80 trillion Riels in the services sector at factor cost. These sectors were composed of 41%, 20% and 39% respectively, as shown in Table 2.2.1. A trend of GDP for the last six years was tabulated in Tables 2.2.2 and 2.2.3.

Table 2.2.1 GDP by Major Industrial Sector: 1998

Item	GDP (in Trillion Riels)	Percentage
Agriculture	3.98	41.2%
Industry	1.88	19.5%
Services	3.80	39.4%
GDP at Factor Cost	9.66	100.0%
Indirect Taxes & Subsidies	0.58	-
GDP at Market Prices	10.24	-

Per capita GDP was 0.90 million Riels, equivalent to approximately US\$ 240 in 1998. Although this value is slightly lower than that of Viet Nam (about US\$ 300), Cambodia is considerably backward in per capita GDP of ASEAN countries, such as, Thailand of US\$ 2,500, Philippines of US\$ 1,100, Indonesia of US\$ 1,000 and Malaysia of US\$ 4,500.

GDP by economic sector at 1993 constant prices between 1993 and 1998 increased from 6.08 trillion Riels at market prices to 7.40 trillion Riels, i.e., an average growth rate of 4.0% per annum in real terms. The real growth of the main economic sectors was calculated as shown Table 2.2.4. The industrial sector grew at remarkable high rate of 15% per annum for the recent five years. The details of the GDP trend for the last six years were enumerated in Tables 2.2.5 and 2.2.6.

Table 2.2.2 GDP by Economic Sector at Current Prices: 1993-1998

Economic Sector	(Unit: Billion Riels)					
	1993	1994	1995	1996	1997 ^{*1}	1998 ^{*2}
1. Agriculture	2,556	2,614	3,453	3,471	3,604	3,975
1) Crop Production	1,132	1,146	2,004	1,965	2,030	2,325
2) Livestock & Poultry	529	483	478	551	618	603
3) Fishery	610	464	471	555	570	708
4) Forestry	285	522	500	400	386	339
2. Industry	756	806	986	1,212	1,570	1,880
1) Mining	11	11	12	13	14	15
2) Manufacturing	490	522	580	754	1,100	1,381
3) Electricity, Gas & Water	24	31	40	40	41	47
4) Construction	232	242	355	406	416	436
3. Services	2,577	2,446	2,708	3,158	3,315	3,805
1) Trade	952	869	973	1,078	1,183	1,259
2) Hotel & Restaurants	195	237	285	350	375	426
3) Transport & Communications	367	386	423	510	543	660
4) Public Administration	140	222	234	296	305	352
5) Others	922	732	794	923	908	1,108
4. GDP at Factor Cost	5,890	5,867	7,147	7,841	8,489	9,659
5. Adjustment Factors	195	334	395	483	537	585
1) Indirect Taxes on Products	197	339	407	499	543	594
2) Subsidies	2	4	12	15	7	9
6. GDP at Market Prices	6,084	6,201	7,543	8,325	9,025	10,244
7. GDP per Capita						
1) In 1000 Riels	623	616	726	778	816	897
2) In US\$	232	242	296	296	277	239

Source: National Accounts of Cambodia 1993-1998, May 1999, MOP

Remark: *1 Preliminary estimates

*2 Advance estimates

Table 2.2.3 Percentage Distribution of GDP at Factor Cost by Economic Sector: 1993-1998

Economic Sector						
	1993	1994	1995	1996	1997 ^{*1}	1998 ^{*2}
1. Agriculture	43.4	44.6	48.3	44.3	42.5	41.2
2. Industry	12.8	13.7	13.8	15.5	18.5	19.5
3. Services	43.8	41.7	37.9	40.3	39.0	39.4
4. Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: National Accounts of Cambodia 1993-1998, May 1999, MOP

Remark: *1 Preliminary estimates

*2 Advance estimates

Yet, per capita GDP grew at a rate of 0.8% per annum on average during the same six-year period. This rate was low as compared with the national economic growth rate of 4.0%. This is because the economic growth was wiped out by the population growth.

Table 2.2.4 GDP Real Growth for Latest Five Years

Item	GDP at 1993 Constant Prices (in Trillion Riels)		Average Growth Rate Between 1993 and 1998
	1993	1998	
Agriculture	2.56	2.84	2.1%
Industry	0.76	1.52	15.0%
Services	2.58	2.62	0.3%
GDP at Factor Cost	5.89	6.98	3.5%
GDP at Market Prices	6.08	7.40	4.0%
Per capita GDP (in 1000 Riels)	623	647	0.8%

Table 2.2.5 GDP by Economic Sector at 1993 Constant Prices: 1993-1998

Economic Sector	(Unit: Billion Riels)					
	1993	1994	1995	1996	1997* ¹	1998* ²
1. Agriculture	2,556	2,616	2,812	2,874	2,870	2,836
1) Crop Production	1,132	1,015	1,301	1,358	1,325	1,325
2) Livestock & Poultry	529	527	542	555	587	550
3) Fishery	610	574	582	630	655	695
4) Forestry	285	501	388	331	304	266
2. Industry	756	788	947	1,058	1,395	1,524
1) Mining	11	12	12	12	12	12
2) Manufacturing	490	513	569	675	1,033	1,187
3) Electricity, Gas & Water	24	26	35	36	36	38
4) Construction	232	237	331	335	314	287
3. Services	2,577	2,568	2,628	2,771	2,605	2,621
1) Trade	952	925	919	917	907	890
2) Hotel & Restaurants	195	243	287	305	283	289
3) Transport & Communications	367	404	405	440	383	387
4) Public Administration	140	210	215	252	238	236
5) Others	922	785	803	858	794	819
4. GDP at Factor Cost	5,890	5,972	6,388	6,703	6,869	6,980
5. Adjustment Factors	195	352	356	412	433	416
1) Indirect Taxes on Products	197	356	367	425	438	422
2) Subsidies	2	5	11	13	5	6
6. GDP at Market Prices	6,084	6,323	6,744	7,115	7,302	7,396
7. GDP per Capita						
In 1000 Riels	623	628	650	665	660	647
8. Implicit Deflator	1.00	0.98	1.12	1.17	1.24	1.39

Source: National Accounts of Cambodia 1993-1998, May 1999, MOP

Remark: *1 Preliminary estimates

*2 Advance estimates

Table 2.2.6 Real Growth of GDP by Economic Sector: 1993-1998

Economic Sector	1994	1995	1996	1997* ¹	1998* ²	1993/98
1. Agriculture	2.3	7.5	2.2	-0.1	-1.2	2.1
2. Industry	4.2	20.2	11.7	31.8	9.2	15.0
3. Services	-0.4	2.4	5.4	-6.0	0.6	0.3
4. GDP at Factor Cost	1.4	7.0	4.9	2.5	1.6	3.5
5. GDP at Market Prices	3.9	6.7	5.5	2.6	1.3	4.0
6. GDP per Capita	0.8	3.5	2.4	-0.7	-2.0	0.8

Source: National Accounts of Cambodia 1993-1998, May 1999, MOP

Remark: *1 Preliminary estimates

*2 Advance estimates

2.3 Financial Situation

2.3.1 Public Finance

The total budgetary expenditure of the national government has nominally increased from 1.28 billion Riels in 1996 to 2.11 billion Riels in 1999. In the total expenditure, the capital expenditure has relied generally on the foreign project aid. On the other hand, the total revenue has added up from 0.75 billion Riels in 1996 to 1.25 billion Riels in 1999. The revenues account for nearly 60% of the total expenditures. Thus, the national finance has reported a net loss for long time. The deficit was 0.53 billion Riels in 1996 and increased to 0.86 billion Riels in 1999. These deficits were covered mostly by foreign support in the form of budget support and project aid. The ratio of the expenditure to GDP has slightly decreased from 15.4% in 1996 to 13.1% in 1998 as shown in Table 2.3.1. The recent public finance was broken down in Table 2.3.2.

Table 2.3.1 Percentage Share of Public Expenditure to GDP

	(Unit: Billion Riels)		
Item	1996	1997	1998
GDP	8.33	9.03	10.24
Expenditure	1.28	1.32	1.34
Percentage (%)	15.4	14.6	13.1

2.3.2 Balance of Payment

Cambodia has traditionally run a deficit on its current account balance. In particular, it has consecutively recorded the deficit in merchandise trade. The deficit was mainly financed by borrowing from overseas, from official and private investment sources. This activity has accelerated the worsening current deficit. The deficit is said to be partly offset by tourism. The balance of payment for the recent six years is shown in Table 2.3.3.

In 1992, the current account recorded the deficit of US\$ 93 million. In 1993, the worsening in the merchandise trade and an increase in imports of services pushed up the current account deficit to US\$ 104 million. In 1994, the further worsening of the trade gap was offset by inflow of income as interest, profit and dividends, and the net result of current account was resulted in the deficit of \$ 157 million. This worsening trend has continued to 1997, and the current account reached at US\$ 210 million in 1997.

Cambodia has borrowed heavily in international capital markets. Being encouraged by the liberalization of investment regulations, foreign capital has accounted for a growing proportion of total new investment. Thus, the total investment inflows have risen strongly and steadily in the latter half of the 1990's.

Table 2.3.2 Statistics of State Financial Operation: 1996-1999

	(Unit: Billion Riels)			
	1996	1997	1998	1999
I. Revenue	746.4	881.0	918.0	1,245.0
1. Current Revenue	707.2	868.7	884.8	1,220.0
1) Tax Revenue	534.5	597.4	679.4	853.3
a. Customs Duties	344.1	347.3	376.3	440.7
Imports	-	337.4	373.6	436.0
Exports	-	9.9	2.7	4.7
b. Other Tax Revenues	190.4	250.1	303.1	412.6
Value Added Tax	-	75.2	90.1	230.7
Others	-	174.9	213.0	181.9
2) Non-tax Revenues	172.7	271.3	205.4	366.7
a. Forest Exploitation	-	37.4	22.8	75.7
b. Post and Telecommunication	-	83.0	87.2	161.0
c. Other Non-tax Revenues	-	150.9	95.4	130.0
2. Capital Revenue	39.2	12.3	33.2	25.0
1) Privatization	-	11.2	32.2	25.0
2) Other Revenues	-	1.1	1.0	0.0
II. Expenditure	1,280.0	1,319.7	1,338.7	2,106.2
1. Capital Expenditure	482.7	511.8	399.0	380.0
1) Domestic Financing	-	110.3	99.1	180.0
2) External Assistance	-	401.5	299.9	200.0
2. Current Expenditure	797.3	807.9	939.7	1,726.2
1) Defense/Security	410.5	440.3	436.4	1,100.0
a. Salaries	-	252.3	278.8	471.8
b. Others	-	188.0	157.6	628.2
2) Civil Administration	386.8	367.6	503.3	626.2
a. Salaries	-	133.6	152.2	166.8
b. Others	-	234.0	351.1	459.4
Subsidies to Social Sector	-	67.7	70.3	93.9
Other Subsidies *1	-	23.3	30.5	43.8
Others	-	143.0	250.3	321.7
Deficit	-533.6	-438.7	-420.7	-861.2
III. Financing	533.6	438.7	396.9	-
1. Foreign Financing	553.4	505.7	409.4	-
1) Budget Support	182.5	95.9	111.4	-
2) Project Aid	420.6	410.7	299.9	-
3) Amortization on External Debts	-49.7	-0.9	-1.9	-
2. Domestic Financing	-19.8	-67.0	-12.5	-

Source: Monthly Bulletin of Statistics, March 1999, MOEF

Remarks: Figures in 1996 and 1997 are based on outturn, respectively. Those in 1998 and 1999 are preliminary.

Table 2.3.3 Balance of Payment: 1992-1997

(Unit: US\$ Million)

Item	1992	1993	1994	1995	1996	1997
Current-account Balance						
- Merchandise Exports (FOB)	264.5	283.7	489.9	855.2	643.6	736.0
- Merchandise Imports (FOB)	443.4	471.1	744.4	1186.8	1071.8	1064.0
Trade Balance	-178.9	-187.4	-254.5	-331.6	-428.2	-328.0
- Export of Services	49.7	63.9	54.4	114.0	162.8	160.4
- Import of Services	63.6	120.5	139.6	187.9	214.8	188.0
Balance of Goods, and Services	-192.8	-244.0	-339.7	-405.5	-480.2	-355.6
- Inflow of IPD*1		0.5	2.1	9.7	12.6	16.0
- Outflow of IPD*1	20.6	16.6	49.1	66.9	98.3	58.5
Balance of Goods, Services and IPD	-213.4	-260.1	-386.7	-462.7	-565.9	-398.1
- Net Transfer	120.4	156.2	230.0	277.0	381.0	188.2
Current-account Balance	-93.0	-103.9	-156.7	-185.7	-184.9	-209.9
Capital-account Balance	126.3	123.4	73.2	78.0	75.8	65.2
Financial-account Balance						
- Direct Investment	33.0	54.1	68.9	150.8	293.6	203.7
- Other Investment Assets	-24.1	-51.1	-46.8	-103.4	-118.0	-23.6
- Other Investment Liability	5.0	-2.8	31.9	75.0	83.5	39.7
Financial-account Balance	13.9	0.2	54.0	122.4	259.1	219.8
Error & Omissions	-34.0	1.0	65.6	11.5	-78.0	-41.2
Overall Balance	13.2	20.7	36.1	26.2	72.0	33.9

Source: International Financial Statistics, May 1999, IMF

Note: Income as interest, profit and dividends

Inflows, surplus of capital-account balance and financial-account balance, were US\$ 126 million and US\$ 14 million in 1992, and remarkably changed in 1997 to US\$ 65 million and US\$ 220 million, respectively. Accordingly, an overall balance has recorded surplus since 1992, and reached US\$ 34 million in 1997.

2.3.3 Foreign Assistance and Debt

Gross receipts of official development assistance (ODA) from the bilateral and multilateral agencies aggregated to US\$ 1.88 billion in total between 1992 and 1996, and averaged US\$ 0.38 billion per year. The receipts increased year by year, although the total receipt in 1996 went down to US\$ 453 million because the assistance in 1995 jumped up sharply to US\$ 567 million. An average annual receipt of ODA accounted for approximately 40% of the annual expenditure of the national government's budget. The record of ODA to Cambodia is summarized in Table 2.3.4.

In 1996, the total external debt was US\$2.11 billion. It accounted for 67% of GDP (approximately US\$ 3.17 billion in 1996). The outstanding of long-term debt was US\$ 2.01 billion in the same year. The total debt-service was US\$ 10 million, comprising US\$ 4 million of principal repayment and US\$ 6 million of interest payment. Thus, the debt service ratio (DSR) was to 1.2% in 1996. It was recovered from 9.6% in 1993. The detailed figures are listed in Table 2.3.5.

2.4 Foreign Trade

Cambodia's external trade balance has recorded widening in the deficit as discussed in "balance of payment". The foreign trade is tabulated in detail by major commodities in Table 2.4.1. According to the table, the major traditional commodity exports like wooden products seems to contribute to the national trading performance for long time. For the recent three years, the leading positions were held by sawn wood, fishing products and handicrafts. The top three exports for the three years were recorded as follows: (1) sawn wood, accounting for 110.7 billion Riels or 50% of the total export, (2) handicrafts, 76.3 billion Riels or 35%, and (3) fishing products, 26.3 billion Riels or 12%. The total of these three articles accounted for 213.2 billion Riels or 97% of the total exports of 220.8 billion Riels for the three years.

The country's top five imports for the last three years comprised the following articles, which were shown in detail in Table 2.4.1: (1) cigarette, which accounted for 1,643 billion Riels or 26% of the total import; (2) diesel, 740 billion Riels or 12%; (3) gold, 521 billion Riels or 8%; (4) gasoline, 382 billion Riels or 6%; and (5) motorcycle, 264 billion Riels or 4%.

Table 2.3.4 Official Development Assistance ^{*1}: 1992-1996

(Unit: US\$ Million)

Item	1992	1993	1994	1995	1996
Bilateral	95.4	196.6	183.2	341.0	252.5
Australia	7.7	10.4	14.3	25.8	28.2
Belgium	3.6	2.7	2.6	5.0	5.6
Canada	3.3	3.5	3.2	4.2	2.1
France	8.7	16.8	28.4	5.3	52.1
Germany	10.2	5.5	12.2	19.6	14.2
Japan	4.7	61.3	64.5	152.0	71.3
Netherlands	13.6	12.6	11.0	11.8	8.4
Norway	5.3	4.7	5.0	4.5	5.8
Sweden	18.5	11.8	10.1	10.9	16.0
United Kingdom	1.7	6.6	7.0	10.7	12.3
United States	13.0	29.0	16.0	33.0	28.0
Others	5.1	31.7	8.9	58.2	8.5
Multilateral	111.4	120.2	155.6	225.8	200.3
ADB	6.0	6.0	16.4	45.4	32.1
CEC	15.7	17.0	11.4	33.0	52.6
IDA	0.0	0.0	38.2	24.6	45.6
IMF	0.0	0.0	20.0	42.5	0.0
UNDP	8.5	28.8	30.0	30.1	37.5
UNICEF	11.9	15.1	10.9	10.7	8.8
WFP	23.2	20.1	10.0	27.7	13.7
Others	46.1	33.2	18.7	11.8	10.0
Total	206.8	316.8	338.8	566.8	452.8

Source: Geographical Distribution of Financial Flows to Aid Recipients, Disbursements Commitments Country Indicators 1992-1996, OECD Development Assistance Committee

Note: *1 Official development assistance is defined as grants and loans, with at least a 25% grant element, administered with the aim of promoting economic and social development. Figures indicate net amounts.

Abbreviations

ADB: Asian Development Bank
 CEC: Commission of the European Communities
 IDA: International Development Association
 IMF: International Monetary Fund
 UNDP: United Nations Development Programme
 UNICEF: United Nations Children's Fund
 WFP: UN/FAO World Food Programme

Table 2.3.5 External Debt: 1991-1996

(Unit: US\$ Million)						
Item	1991	1992	1993	1994	1995	1996
Total External Debt	1,862	1,840	1,829	1,915	2,041	2,111
1. Long Term Debt	1,689	1,680	1,685	1,745	1,952	2,023
2. Use of IMF Credit	27	15	9	30	72	69
3. Short Term Debt	146	145	135	140	17	19
Debt Outstanding of Long Term Deb	1,688	1,680	1,685	1,745	1,940	2,014
1. Public and Publicly Guaranteed	1,688	1,680	1,685	1,745	1,940	2,014
a. Official Creditors	1,688	1,680	1,685	1,745	1,940	2,014
- Multilateral	1	-	5	58	118	193
- Bilateral	1,687	1,680	1,680	1,687	1,822	1,821
b. Private Creditors	0	0	0	0	0	0
- Bonds	0	0	0	0	0	0
- Commercial Banks	0	0	0	0	0	0
- Others	0	0	0	0	0	0
2. Private Non-guaranteed	0	0	0	0	0	0
Total Debt Service	16	13	34	2	7	10
1. Principal Repayment	0	11	15	0	4	4
a. Long Term Debt	0	0	0	0	4	4
b. IMF Repurchases	0	11	15	0	0	0
2. Interest Payments	16	2	19	2	3	6
a. Long Term Debt	15	1	0	0	1	4
b. IMF Charges	0	0	18	1	1	1
c. Short Term Debt	1	1	1	1	1	1
Ratios (%)						
1. Total External Debt/GNP	114.0	93.0	82.5	79.8	69.7	67.7
2. Debt Service Ratio *1	7.1	4.0	9.6	0.3	0.6	1.2

Source: Global Development Finance 1998, March 1998, World Bank

Note: Long term debt is defined as having original maturity of more than one year.

*1 Debt service as a percentage of earnings from exports of goods and service (including workers' remittances).

Table 2.4.1 Foreign Trade: 1996-1998

(Unit: Million Riels in Value)

Products	Quantity Unit	1996			1997			1998		
		Quantity	Value	Tax	Quantity	Value	Tax	Quantity	Value	Tax
Import (Value in CIF)										
1. Medicine	T	3,346	61,523	0	4,665	78,324	0	7,510	91,333	0
2. Cigarette	CTN	1,763,556	551,018	91,817	1,450,115	553,491	87,755	1,217,400	538,694	86,231
3. Beer	CTN	2,342,586	36,066	12,852	933,553	15,314	5,957	588,069	11,535	4,057
4. Alcohol	CTN	288,553	18,650	4,621	120,012	13,899	3,267	57,594	5,785	1,258
5. Softdrinks	CTN	956,698	13,709	5,185	989,462	15,822	4,865	591,748	8,466	2,653
6. Monosodium Glutamate	T	9,301	32,988	2,325	9,830	37,269	2,610	14,394	55,578	3,894
7. Sugar	T	26,829	35,348	2,475	37,374	44,953	3,147	44,484	51,239	3,584
8. Cooking Oil	CTN	199,308	11,033	1,067	290,771	12,424	871	285,770	10,846	760
9. Alimentary product	T	43,241	60,171	4,946	62,403	58,810	5,198	11,579	27,241	3,159
10. Equipment Construction	T	40,288	51,468	3,932	490,828	55,588	3,949	24,198	29,343	2,466
11. Cement	T	244,923	39,790	2,846	279,610	47,878	3,351	292,018	47,719	6,032
12. Steel	T	16,194	13,086	916	2,032	2,500	180	1,361	2,097	190
13. V.C.R.	UNIT	38,494	16,116	2,468	6,908	2,429	422	35,547	9,116	1,367
14. T.V.	UNIT	116,476	35,020	5,553	77,251	16,896	2,752	112,520	17,256	2,597
15. Radio Cassette Player	UNIT	174,612	6,645	1,653	42,555	4,433	1,020	61,858	7,035	1,055
16. Garment	T	265,156	56,092	3,977	189,654	51,979	3,771	30,373	81,733	5,955
17. Fabric	YD	9,904,319	26,453	1,861	6,554,191	11,704	857	4,235,753	13,864	1,029
18. Motorcycle	UNIT	99,948	48,455	14,784	59,322	50,990	10,770	151,309	165,257	32,809
19. Vehicle	UNIT	5,475	65,020	20,263	7,825	75,545	19,661	6,379	55,606	14,673
20. Spare Parts of Vehicle	T	6,219	17,128	4,421	533,926	23,227	4,797	10,260	21,729	4,461
21. Refrigerators	UNIT	15,086	5,614	1,958	18,032	6,705	1,507	26,916	9,923	1,500
22. Generator	UNIT	1,570	3,652	547	2,562	4,229	629	1,231	3,071	462
23. Gold	KG	3,648	107,656	322	12,741	400,609	1,224	327	12,918	39
24. Silver	T	5	2,360	7	2	710	2	0	0	0
25. Gasoline	T	139,037	117,585	56,425	145,849	136,502	67,993	105,736	128,686	64,343
26. Diesel	T	240,373	173,827	34,766	282,271	211,070	46,856	344,417	354,812	70,976
27. Jet Fuel	T	13,854	8,793	616	12,114	9,011	698	8,110	7,226	506
28. Oil Mixed	T	31,180	10,801	717	510	177	12	4,410	2,202	154
29. Lubricant	T	4,295	10,752	2,151	3,337	9,788	1,821	3,886	11,326	2,265
30. Kerosene	T	24,295	15,959	0	31,783	33,401	0	29,931	25,904	5
31. Gas	T	5,062	4,370	306	19,860	6,451	455	4,604	5,505	384
32. Other Petroleum Products	T	0	0	0	0	0	0	39,934	18,890	5,098
33. Others	T	0	247,639	39,569	0	259,198	39,528	0	355,932	39,903
Total			1,904,787	325,346		2,251,327	325,927		2,187,868	363,865
Export (Value in FOB)										
1. Lumber	M3	79	42	4	202,876	5,431	132	42,601	929	1,646
2. Sawn Wood	M3	56,684	54,905	5,490	147,693	32,829	3,163	10,845	22,941	43
3. Saw Dust	T	408	82	8	1,056	524	52	1,340	439	936
4. Fishing Products	T	1,656	8,055	805	1,845	8,849	885	1,303	9,370	0
5. Handicrafts	T	6,418	18,445	1,845	25,206	57,830	5,801	0	0	11
6. Rubber Wood	T	0	0	0	0	0	0	49	110	2,657
Total			81,529	8,153		105,464	10,034		33,788	5,293

Source: Statistics of Goods, Department of Customs & Excise (through National Institute of Statistics, MOP)

The total of these five articles accounted for 3,552 billion Riels or 56% of the total imports of 6,344 billion Riels for the three years. Imports of cigarette seem to keep the top raking for long time due to higher demand in domestic economy. On the other hand, diesel and motorcycle have increased rapidly among the import commodities for the three years.

2.5 Inflation and Prices

A consumer price is stabilized in 1999, but up to that point the price had increased at considerable rate of 10% to 20% per annum since the new political structure started in the middle of 1993. According to the consumer price index (CPI) during five years between 1994 and 1998, the inflation rate of all consumer items was calculated at 11.5% on average. The average rate of food was 12.2% for the same period, slightly higher than that of the all items. The rate of pure water in retail market was 9.0%. The CPIs of major consumer commodities are enumerated in Table 2.5.1. In this Study, thus, the inflation rate is assumed as 10% per annum hereinafter, unless specific explanation is set up.

The foreign exchange rates of Riels per US\$ Dollar from 1991 to 1999 are tabulated in the same table. Although the rate was around 2,600 Riels per US Dollar in 1994, it went up to 3,800 Riels per US Dollar at the end of 1998. An average rate of the foreign exchange for this period was calculated at 9.4%.

2.6 Employment and Wages

In 1998, the labor force in Cambodia registered 4.56 million. This accounted for 65.8% of the total working age population (6.93 million), i.e., 10 years old and over. Of this number, 4.53 million or 99.3% were employed. Then, an unemployment rate was only 0.7% in nationwide labor market. In the urban areas excluding Phnom Penh, the unemployment rate was 1.6%, which was somewhat higher than that of the national average. These figures are enumerated in Table 2.6.1.

According to “Siem Reap 1998, Provincial Development Plan by Department of Planning and Secretariat of PRDC”, the total labor force was estimated at 457,324 in Siem Reap Province. Of this number, 356,713 or 78% were reported as employed population. Then, an unemployed population was estimated at 100,611, accounting for 22% of the labor force. This figure is far from the unemployment rate of the urban areas above, i.e., 1.6%. The reason of this big difference may be caused by data treatment of employment status like unpaid family worker and underemployment.

Table 2.5.1 Consumer Price Indices and Foreign Exchange: 1991-1999

Year	Month	Consumer Price Index (Base: July 1993 = 100)						Retail Price of Pure Water (Riels/Bottle*1)	Foreign Exchange Rate (Riels/US\$)
		All Items	Food	Beverages & Cigarettes	Energy	Clothing	Services		
1991	Dec.	19.5	19.6	17.4	28.8	16.8	8.7	60	540
1992	Dec.	63.9	63.3	65.7	76.7	72.5	40.0	245	2,280
1993	Dec.	90.6	94.9	86.0	96.4	69.8	86.3	400	2,470
1994	Dec.	108.4	116.9	88.3	107.4	80.9	92.5	400	2,593
1995	Dec.	102.4	104.1	91.1	135.3	85.1	90.0	400	2,568
1996	Dec.	113.9	117.8	94.5	153.2	90.5	90.0	400	2,728
1997	Dec.	126.8	127.5	108.5	194.3	92.8	120.0	500	3,518
1998	Dec.	153.1	162.5	120.6	195.5	96.3	131.3	600	3,798
1998	Feb.	125.7	125.5	108.5	194.3	92.8	125.0	500	3,595
	Mar.	125.5	125.6	108.5	192.2	92.8	125.0	500	3,608
	Apr.	133.9	137.3	111.8	192.2	93.9	125.0	500	3,715
	May	150.9	156.7	114.1	215.2	98.4	125.0	500	4,125
	Jun.	152.3	157.3	127.9	217.7	98.4	131.3	600	4,065
	Jul.	162.2	174.6	127.5	197.1	98.4	131.3	600	3,915
	Aug.	157.0	168.6	121.6	188.1	97.9	131.3	600	3,882
	Sep.	157.8	169.8	121.4	188.1	97.9	131.3	600	3,882
	Oct.	158.4	169.0	121.4	195.5	97.9	131.3	600	3,882
	Nov.	157.5	168.1	121.4	197.1	96.3	131.3	600	3,778
	Dec.	153.1	162.5	120.6	195.5	96.3	131.3	600	3,798
1999	Jan.	155.3	165.3	121.0	196.3	96.3	131.3	600	3,788
	Feb.	139.8	143.4	122.4	192.7	94.0	131.3	600	3,813
		Annual Inflation Rate (%)						Retail Price of Pure Water (%)	Foreign Exchange Rate (%)
		All Items	Food	Beverages & Cigarettes	Energy	Clothing	Services		
1991	Dec.	-	-	-	-	-	-	-	-
1992	Dec.	227.7	223.0	277.6	166.3	331.5	359.8	308.3	322.2
1993	Dec.	41.8	49.9	30.9	25.7	-3.7	115.8	63.3	8.3
1994	Dec.	19.6	23.2	2.7	11.4	15.9	7.2	0.0	5.0
1995	Dec.	-5.5	-10.9	3.2	26.0	5.2	-2.7	0.0	-1.0
1996	Dec.	11.2	13.2	3.7	13.2	6.3	0.0	0.0	6.2
1997	Dec.	11.3	8.2	14.8	26.8	2.5	33.3	25.0	29.0
1998	Dec.	20.7	27.5	11.2	0.6	3.8	9.4	20.0	8.0
1999	Jan.*2	1.4	1.7	0.3	0.4	0.0	0.0	0.0	-0.3
	Feb.*2	-10.0	-13.2	1.2	-1.8	-2.4	0.0	0.0	0.7
Average(94-98)		11.5	12.2	7.1	15.6	6.8	9.4	9.0	9.4

Source: Monthly Bulletin of Statistics, March 1999, MOEF

Notes: *1 The volume of a bottle is 1 liter.

*2 Monthly inflation rate

Table 2.6.1 Labor Force Distribution and Employment Conditions in Cambodia, Phnom Penh, Urban and Rural Areas : 1997

Item	Cambodia	Phnom Penh	Other Urban Areas	Rural Areas
I. Labor Force Participation , Employment and Unemployment Rates				
1. Population Extrapolated *1	10,368,000	925,000	1,051,000	8,391,000
2. Working Age Population *2	6,929,270	737,639	737,203	5,454,428
3. Labor Force *3	4,560,365	362,748	448,265	3,749,352
4. Economically Inactive Population	2,368,905	374,891	288,938	1,705,076
II. Labor Force Participation , Employment and Unemployment Rates (%)				
1. Labor Participation Rates *4	65.8	49.2	60.8	68.7
2. Employment Rates	99.3	96.7	98.4	99.6
3. Unemployment Rates	0.7	3.3	1.6	0.4
III. Status of Employment (%)				
1. Employer	0.4	1.0	0.6	0.3
2. Own Account Worker	44.7	40.2	43.1	45.4
3. Employee	9.9	36.5	17.7	6.5
4. Unpaid Family Worker	30.3	5.0	23.8	33.4
5. Others	0.3	0.2	0.3	0.3
6. Not Stated	14.4	17.1	14.5	14.1
Total	100.0	100.0	100.0	100.0
IV. Distribution of Employed Population by Industry (%)				
1. Agriculture	77.1	7.9	49.2	86.9
1) Agriculture, Livestock & Forestry	75.4	6.1	44.1	85.6
2) Fishery	1.7	1.8	5.1	1.3
2. Industry	4.7	15.4	7.7	3.3
1) Mining	0.2	0.0	0.1	0.2
2) Manufacturing	3.2	9.4	5.2	2.4
3) Electricity, Gas & Water	0.1	0.9	0.2	0.0
4) Construction	1.2	5.1	2.2	0.7
3. Services	18.2	76.7	43.1	9.8
1) Trade	7.7	35.1	20.7	3.6
2) Hotel & Restaurants	0.1	0.8	0.2	0.0
3) Transport & Communications	1.8	7.6	6.0	0.7
4) Public Administration	3.1	18.4	6.9	1.2
5) Others	5.5	14.8	9.3	4.3
Total	100.0	100.0	100.0	100.0

Source: Report on the Cambodia Socio-Economic Survey 1997, June 1998, MOP, UNDP

Notes: *1 The estimate was extrapolated on the basis of the survey.

*2 Working age population is defined as a population aged 10 years and older.

*3 Labor force is an economically active population, which consists of employed and unemployed population.

*4 Labor force participation rate is based on the economically active population to the total working age population.

Among major economic sectors, the agricultural sector absorbs the greatest portion of manpower resources in the country. Even in urban areas excluding Phnom Penh, the agricultural sector accounted for 49% of the total labor, as summarized in Table 2.6.2. On the other hand, Siem Reap Province has the great agricultural labor portions of more than 93% of the total manpower. Thus, the Province is said to be specialized as agricultural area in the country.

Table 2.6.2 Distribution of Labor Force: 1998

Sector	Cambodia	Urban Areas	Siem Reap
Agriculture	77.1	49.2	93.3
Industry	4.7	7.7	1.4
Services	18.2	43.1	5.3
Total	100.0	100.0	100.0

Siem Reap District in the Province has a lot of tourism resources and receives increasing tourists from both domestic areas and foreign countries in recent years after the new political structure was established. The services' sector share in the labor market, however, was only 5.3% in Siem Reap, as shown in the table above. The labor force in tourism was included in this sector. Then, this rate seems to be too small, as compared with the national average and other urban areas' average rates. It might increase gradually in proportion to tourism growth under the national development policy.

The industrial sector employed the smallest share of the labor force among the three major economic sectors. Though its share was 4.7% in the country, Siem Reap Province recorded only 1.4%. Most of the industrial establishments in the province belong to cottage industry, and produce handicraft mostly. The province seems to have considerably lower share than the other provinces at present, because even in rural areas the industrial share recorded 3.3%, as shown in Table 2.6.1.

Average wages were estimated at around 163,000 Riels (equivalent to US\$ 43) per month in the capital city of Phnom Penh in June 1998, according to "Labor Force Survey of Phnom Penh in Second Quarter 1998, March 1999, National Institute of Statistics". As known well, the income survey is always under difficulties of eliciting complete and reliable data even for national survey. This income source is said to come from main income source, so the actual income for a person is more than the said average because most of people have side jobs. In fact, the report says that some of answerers have additional jobs beside their main source work. Anyhow, supposing that a household had 2.5 income earners on average, the household income might be around 407,500 (equivalent to US\$ 107) per month.

Figure 2.6.1 shows the distribution of average monthly wages in Phnom Penh in July 1999. The majority range of income was 50,000 to 100,000 Riels per month, although the average was 160,000 Riels. The detailed distribution is tabulated in Table 2.6.3. The incomes in Siem Reap have not been surveyed so far, so they are not clear at present. However, the average income and distribution of wages might be much worse than those in the figure below. These issues will be described in the next section of household income and expenditure.

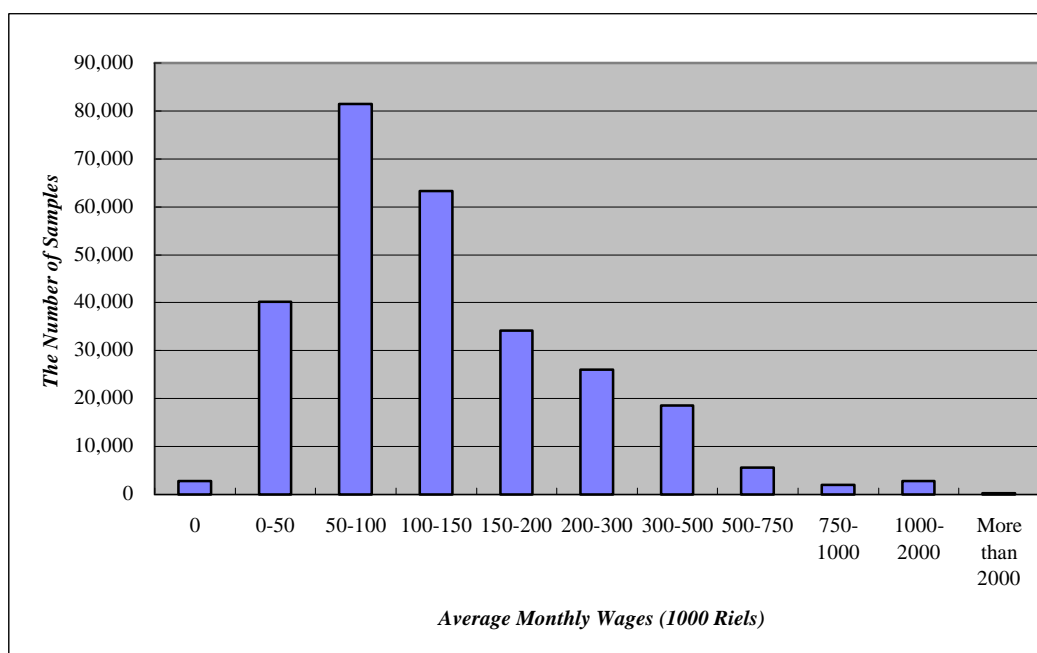


Figure 2.6.1 Income Distribution in Phnom Penh: 1998

2.7 Household Income and Expenditure

Living conditions can be derived sketchily from family income and expenditure. As regards average household expenditure, the urban areas' averages except Phnom Penh was reported as 403,000 Riels (equivalent to US\$ 115) per month in 1997, lower than the Phnom Penh's average of 727,000 Riels, according to "Report on the Cambodia Socioeconomic Survey 1997, June 1998, Ministry of Planning". The former value accounted for 55% of the latter one. In local urban areas, thus, people support themselves on 55% of living expenses in the capital city of Phnom Penh. The detailed information is enumerated in Tables 2.7.1 and 2.7.2. A household income was not surveyed in the report because of its difficulties, but its tendency might be almost the same as expenditure distribution.

Engel coefficient, which is a rate of food expenditure to total income, is said to characterize destitute living condition. The lower income family shows the higher coefficient.

Table 2.6.3 Labor Force Distribution and Employment Conditions in Phnom Penh: 1997-1998

Item	1997 May	1997 September	1997 October	1998 June
I. Labor Force by Industry	320,200	324,564	329,613	318,300
1. Agriculture	32,891	43,836	42,350	40,043
2. Industry	50,065	46,134	49,904	57,378
3. Services	237,244	234,594	237,359	220,879
II. Status of Employment	320,200	324,564	329,613	318,300
1. Employer	3,231	2,980	2,232	1,841
2. Own Account Worker	130,988	136,289	138,378	142,872
3. Employee	140,683	132,581	137,298	132,306
4. Unpaid Family Worker	45,298	52,374	50,865	41,281
5. Others	0	340	840	0
III. Distribution of Average Monthly Wages in Cash				
1. 0	10,548	6,252	3,233	2,839
2. 100 - 49,900	63,570	62,867	70,264	40,206
3. 50,000 - 99,900	102,761	94,340	81,433	81,434
4. 100,000 - 149,900	47,479	38,639	48,404	63,239
5. 150,000 - 199,900	24,900	25,330	34,665	34,201
6. 200,000 - 299,900	18,292	19,262	16,895	26,025
7. 300,000 - 499,900	13,893	12,338	13,569	18,550
8. 500,000 - 749,900	8,711	7,324	5,929	5,619
9. 750,000 - 999,900	2,778	2,908	1,954	1,959
10. 1,000,000 - 1,999,900	1,474	2,252	894	2,831
11. 2,000,000 & Over	498	339	668	314
Total	294,904	271,851	277,908	277,217
IV. Employment Conditions				
1. In Labor Force	330,610	340,931	343,583	325,221
- Employed	320,200	324,564	329,613	318,300
- Unemployed	10,410	16,367	13,970	6,921
2. Not in Labor Force	305,912	314,404	317,758	344,340
3. Total Population 10 Years and Over	636,522	655,335	661,341	669,561

Source: Labor Force Survey of Phnom Penh May 1997, Sept. 1997, MOP, NIS
Labor Force Survey of Phnom Penh September 1997, Dec. 1997, MOP, NIS
Labor Force Survey of Phnom Penh October 1997, Dec. 1998, MOP, NIS
Labor Force Survey of Phnom Penh Second Quarter 1998, March 1999, MOP, NIS

Table 2.7.1 Average Monthly Household Expenditure by Major Group: 1997

(Unit: Riels)

Item	Cambodia	Phnom Penh	Other Urban Areas	Rural Areas
I. Total Expenditure	286,584	727,082	403,253	220,036
II. Expenditure by Major Group				
1. Food, Beverage & Tobacco	183,979	319,368	272,882	156,803
2. Non-food Items	102,605	407,714	130,371	63,233
1) Clothing & Footware	9,899	17,204	13,802	8,547
2) Housing and Utilities	44,065	234,187	52,265	20,682
a. House Rent	29,347	193,315	31,873	9,755
b. Water Charge	3,777	11,941	5,631	2,583
c. Fuel & Power	4,383	16,698	6,681	2,645
d. Wood Fuel	6,558	12,233	8,080	5,699
3) Furnishing & Operation	2,035	4,286	3,395	1,599
4) Medical Care	11,745	12,123	16,821	11,059
5) Transport & Communication	12,608	69,411	14,814	5,652
6) Recreation	841	2,092	2,010	546
7) Education	4,565	26,429	5,966	1,818
8) Personal Care & Effects	5,841	11,214	10,693	4,596
9) Miscellaneous Expenditure	11,006	30,768	10,605	8,734
III. Percentage Distribution				
1. Food, Beverage & Tobacco	64.2	43.9	67.7	71.3
2. Non-food Items	35.8	56.1	32.3	28.7
1) Clothing & Footware	3.5	2.4	3.4	3.9
2) Housing and Utilities	15.4	32.2	13.0	9.4
a. House Rent	10.2	26.6	7.9	4.4
b. Water Charge	1.3	1.6	1.4	1.2
c. Fuel & Power	1.5	2.3	1.7	1.2
d. Wood Fuel	2.3	1.7	2.0	2.6
3) Furnishing & Operation	0.7	0.6	0.8	0.7
4) Medical Care	4.1	1.7	4.2	5.0
5) Transport & Communication	4.4	9.5	3.7	2.6
6) Recreation	0.3	0.3	0.5	0.2
7) Education	1.6	3.6	1.5	0.8
8) Personal Care & Effects	2.0	1.5	2.7	2.1
9) Miscellaneous Expenditure	3.8	4.2	2.6	4.0
3. Total	100.0	100.0	100.0	100.0

Source: Report on the Cambodia Socio-Economic Survey 1997, June 1998, MOP, UNDP

Table 2.7.2 Average Monthly Household Expenditure by Item and by Per Capita Expenditure Decile in Urban Areas Excluding Phnom Penh: 1997

(Unit: Riels)

Item	Total	1st Decile	2nd Decile	3rd Decile	4th Decile	5th Decile	6th Decile	7th Decile	8th Decile	9th Decile	10th Decile
I. All Items	403,253	129,019	165,741	204,654	232,281	254,942	291,617	327,175	397,488	596,593	1,443,061
II. Expenditure by Major Group											
1. Food Items	272,882	100,214	125,834	153,271	168,218	182,880	212,921	222,268	268,209	388,945	912,308
2. Non-food Items	130,371	28,805	39,907	51,383	64,063	72,062	78,696	104,907	129,279	207,648	530,753
1) Clothing & Footware	13,802	3,888	5,928	7,189	8,721	8,602	13,166	11,973	12,079	18,259	48,608
2) Housing and Utilities	52,265	12,253	17,572	23,365	22,124	30,688	29,976	44,088	55,607	91,915	196,202
a. House Rent	31,873	5,502	7,761	10,455	9,993	13,687	13,085	24,095	31,140	57,966	146,028
b. Water Charge	5,631	1,321	2,162	2,398	2,908	5,302	3,367	6,270	6,933	10,138	15,558
c. Fuel & Power	6,681	1,997	2,885	4,427	3,326	4,056	7,114	5,981	6,806	13,731	16,507
d. Wood Fuel	8,080	3,433	4,764	6,085	5,897	7,643	6,410	7,742	10,728	10,080	18,109
3) Furnishing & Operation	3,395	442	613	1,019	1,460	1,331	1,689	3,058	2,618	4,221	17,678
4) Medical Care	16,821	3,725	4,312	7,061	10,732	11,331	9,802	17,800	19,344	30,817	53,533
5) Transport & Communication	14,814	713	1,360	1,857	4,103	2,765	3,197	6,503	7,886	13,926	107,010
6) Recreation	2,010	25	170	151	94	437	556	1,127	686	4,320	12,631
7) Education	5,966	1,017	2,052	2,219	3,992	4,405	5,120	4,864	7,483	10,688	17,888
8) Personal Care & Effects	10,693	3,374	3,881	3,379	5,677	5,576	6,445	7,791	10,900	18,489	41,663
9) Miscellaneous Expenditure	10,605	3,368	4,019	5,143	7,160	6,927	8,745	7,703	12,676	15,013	35,540
III. Percentage Distribution											
1. Food, Beverage & Tobacco	67.7	77.7	75.9	74.9	72.4	71.7	73.0	67.9	67.5	65.2	63.2
2. Non-food Items	32.3	22.3	24.1	25.1	27.6	28.3	27.0	32.1	32.5	34.8	36.8
1) Clothing & Footware	3.4	3.0	3.6	3.5	3.8	3.4	4.5	3.7	3.0	3.1	3.4
2) Housing and Utilities	13.0	9.5	10.6	11.4	9.5	12.0	10.3	13.5	14.0	15.4	13.6
a. House Rent	7.9	4.3	4.7	5.1	4.3	5.4	4.5	7.4	7.8	9.7	10.1
b. Water Charge	1.4	1.0	1.3	1.2	1.3	2.1	1.2	1.9	1.7	1.7	1.1
c. Fuel & Power	1.7	1.5	1.7	2.2	1.4	1.6	2.4	1.8	1.7	2.3	1.1
d. Wood Fuel	2.0	2.7	2.9	3.0	2.5	3.0	2.2	2.4	2.7	1.7	1.3
3) Furnishing & Operation	0.8	0.3	0.4	0.5	0.6	0.5	0.6	0.9	0.7	0.7	1.2
4) Medical Care	4.2	2.9	2.6	3.5	4.6	4.4	3.4	5.4	4.9	5.2	3.7
5) Transport & Communication	3.7	0.6	0.8	0.9	1.8	1.1	1.1	2.0	2.0	2.3	7.4
6) Recreation	0.5	0.0	0.1	0.1	0.0	0.2	0.2	0.3	0.2	0.7	0.9
7) Education	1.5	0.8	1.2	1.1	1.7	1.7	1.8	1.5	1.9	1.8	1.2
8) Personal Care & Effects	2.7	2.6	2.3	1.7	2.4	2.2	2.2	2.4	2.7	3.1	2.9
9) Miscellaneous Expenditure	2.6	2.6	2.4	2.5	3.1	2.7	3.0	2.4	3.2	2.5	2.5
3. Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Report on the Cambodia Socio-Economic Survey 1997, June 1998, MOP, UNDP

The coefficient in local urban areas except Phnom Penh was calculated at 68%, according to the same report. It was somewhat larger than that of the nation, 64%. Thus, the living condition in local urban areas may be more serious than the national average.

Housing expense of the local urban areas' average accounted for 13% of the total family expenditure, which is lower than those of the nation (15%) and Phnom Penh (32%). The expense includes housing cost and its utility costs. Of the total percentage of 13%, water charge accounted for 1.4% of the total expenditure. This amounted to 5,600 Riels (equivalent US\$ 1.60) per month in 1997.

The housing expense also includes energy costs. Of the total percentage of 13%, the energy cost accounted for 3.7%, which was composed of fuel and power cost of 1.7% and wood fuel costs of 2.0%. For cooking purposes, the following fuel sources are used in urban areas: firewood accounting for 87.9%; charcoal, 9.1%; LPG, 1.2%; and others, 1.8%. The percentage was calculated on the basis of the number of households of the said fuel against the total household answerer.

In the "Cambodia Socioeconomic Survey", the survey collected self-data relating to any major illness or other health problems of household for the reference period of a month from 15 May to 14 June 1997. According to this survey, a household expended around 46,000 Riels on outpatient and inpatient treatment for their health on average in urban areas. The expenditure was divided into 36,000 Riels on outpatient and 10,000 Riels on inpatient treatment. For the period, the number of persons with health problems was 165,000 among 1,051,000 people in urban areas, of whom 75% belonged to working age population, i.e., more than 10 years old. Of the total number of 165,000 persons, 20,780 people stopped doing their usual activities for 5.9 days on average. These figures are broken down in Table 2.7.3.

2.8 Health Situation

In Siem Reap Province, there are one provincial hospital, four district hospitals and 40 health centers as of 1999. Nine more health centers are under preparation to open to the public in 1999. According to "Provincial Development Plan of Siem Reap for 1999-2000, November 1998, Provincial Rural Development Committee", the health coverage plan has started to provide health coverage service to around 74% of the total provincial population in these hospitals and health centers. In addition to these public health facilities, private hospitals and clinics exist in urban areas. Their activities and inventory, however, are not informed in statistical forms.

Table 2.7.3 Health Statistics during Reference Period of Four Weeks*1 : 1997

Item	Cambodia	Phnom Penh	Other Urban Areas	Rural Areas
I. Health Information during Reference Period of Four Weeks*1				
1. Age Distribution of Persons Suffering from any Illness or Injury (%)				
Less Than 9 Years Old	28.4	20.7	25.1	29.4
More Than 10 Years Old	71.6	79.3	74.9	70.6
Persons with Health Problems	1,595,000	108,000	165,000	1,324,000
2. Age Specific Morbidity Rates (%)				
Less Than 9 Years Old	16.0	10.9	14.1	16.8
More Than 10 Years Old	15.2	11.8	16.3	15.5
All Ages	15.4	11.6	15.7	15.8
3. Age Distribution of Persons Suffering from Diarrhea (%)				
Less Than 9 Years Old	56.1	60.5	50.5	56.4
More Than 10 Years Old	43.9	39.5	49.5	43.6
4. Percentage of Diarrhea among Total Initial Symptoms (%)				
	11.1	8.3	9.1	11.6
II. Average Health Expenditure on Outpatient and Inpatient Treatment during Reference Period of Four Weeks*1 (Riels/Household)				
1. Outpatient Treatment				
1) Outpatient Health Care	14,652	17,134	23,726	13,213
2) Medicines	6,776	6,069	11,187	6,302
3) Travel Cost	846	697	829	866
Sub-Total	22,274	23,900	35,742	20,381
2. Inpatient Treatment				
1) Inpatient Health Care	4,925	6,563	5,627	4,643
2) Medicines	3,023	3,429	4,082	2,841
3) Travel Cost	669	534	395	720
Sub-Total	8,617	10,526	10,104	8,204
Total Expenditure	30,891	34,426	45,846	28,585
III. Number of Persons and Mean Number of Days of Impairment due to Ill Health based on Reference Period of Four Weeks*1				
1. Number of Persons who Stopped Doing Usual Activities				
	232,492	13,994	20,780	197,717
2. Mean Number of Days for Which They Stopped Doing Their Usual Activities				
	6.5	6.5	5.9	6.5
IV. General Information				
1. Extrapolated Population				
Less Than 9 Years Old	10,368,000	925,000	1,051,000	8,391,000
More Than 10 Years Old	2,682,000	188,000	280,000	2,220,000
Total	7,686,000	737,000	771,000	6,171,000
2. Estimated Number of Households				
	2,098,000	178,000	202,000	1,718,000
3. Average Household Size				
	4.9	5.2	5.2	4.9

Source: Report on the Cambodia Socio-Economic Survey 1997, June 1998, MOP, UNDP

Remark: *1 Between May 15 and June 15, 1997

Among a population of 695,000 in Siem Reap in 1998, around 278,000 patients were cared by the district hospitals. They are broken down to 266,000 outpatients and 12,000 inpatients. Of these patients, three major diseases caused by poor water supply conditions are reported as shown Table 2.8.1. The detailed information is tabulated in Table 2.8.2.

Table 2.8.1 Number of Patients Suffering from Water Borne Diseases: 1998

Disease	Outpatient	Inpatient
Diarrhea	24,598	214
Dysentery	26,071	139
Typhoid	-	157
Other Diseases	215,508	11,671
Total Patients	266,177	12,181

The central government appropriated 62.4 billion Riels for health expenditure such as salary for medical staff, operating costs, drugs and medical supplies in 1998, according to “National Health Statistics Report 1998, Ministry of Health”. In Siem Reap Province, the government also appropriated 2.9 billion Riels for health expenditure, accounting for 4.5% of the national total. Besides this running cost, the central government appropriated an investment cost of 2.1 billion Riels for construction and equipment to medical facilities.

2.9 Regional Economy

2.9.1 Agriculture

In Siem Reap Province, agriculture is the leading industry, as described in Section 2.6. It absorbed more than 90% of the total labor force in the province. In particular, rice production is the main source for income of these farmers. At present, rice production can cover only their self-sufficiency, but provides no extra rice to spare for exporting to other Provinces. The reason for this is lack of irrigation systems. Most of rice farming is based on rain fed, and sometimes suffers from damage by natural disaster such as flood and drought. The rice yield is only 1.20 to 1.25 tons per hectare at present. On the other hand, there is a limitation for expanding farmlands because of reservation for underground mines development and livestock breeding grounds. In order to increase rice production, thus, intensive farming in existing farmlands is expected as effective means. The Provincial Department of Agriculture, Forestry and Fishery strengthens extension services to farmers, including traditional farming practice improvement, new technology promotion, existing irrigation system rehabilitation, new irrigation system development and farmer organization promotion.

Table 2.8.2 Public Health Conditions in Siem Reap Province: 1996-1998

Item	1996			1997			1998		
	Less Than 14 Years	More Than 15 Years	Total	Less Than 14 Years	More Than 15 Years	Total	Less Than 14 Years	More Than 15 Years	Total
I. Estimated Population in Siem Reap Provin	659,761			669,875			695,485		
II. Number of Patients at Operational District Hospitals									
1. Out-patients	-	-	-	131,046	126,679	257,725	110,091	156,086	266,177
1) Diarrhea	-	-	-	17,323	10,569	27,892	14,627	9,971	24,598
2) Dysentery	-	-	-	12,724	11,729	24,453	12,580	13,491	26,071
3) Other Diseases	-	-	-	100,999	104,381	205,380	82,884	132,624	215,508
2. In-patients	-	-	-	2,903	11,308	14,211	3,346	8,835	12,181
1) Diarrhea	-	-	-	110	63	173	106	108	214
2) Dysentery	-	-	-	41	70	111	69	70	139
3) Typhoid	-	-	-	26	136	162	36	121	157
4) Other Diseases	-	-	-	2,726	11,039	13,765	3,135	8,536	11,671
III. Percentage Distribution of Diseases (%)									
1. Out-patients	-	-	-	100.0	100.0	100.0	100.0	100.0	100.0
1) Diarrhea	-	-	-	13.2	8.3	10.8	13.3	6.4	9.2
2) Dysentery	-	-	-	9.7	9.3	9.5	11.4	8.6	9.8
3) Other Diseases	-	-	-	77.1	82.4	79.7	75.3	85.0	81.0
2. In-patients	-	-	-	100.0	100.0	100.0	100.0	100.0	100.0
1) Diarrhea	-	-	-	3.8	0.6	1.2	3.2	1.2	1.8
2) Dysentery	-	-	-	1.4	0.6	0.8	2.1	0.8	1.1
3) Typhoid	-	-	-	0.9	1.2	1.1	1.1	1.4	1.3
4) Other Diseases	-	-	-	93.9	97.6	96.9	93.7	96.6	95.8
IV. Health Expenditure in Siem Reap Province (Unit: Million Riels in Budgetary Base)									
1. Administrative Expenditure			1,468.8			1,500.0			1,499.9
Salary			487.5			513.3			563.2
Administrative			899.7			961.7			911.7
Development			60.0			0.0			0.0
Social Payment			21.6			25.0			25.0
2. Medical Expenses			846.2			1,167.7			1,357.6
Total Expenditure			2,315.0			2,667.7			2,857.5

Source: Provincial Health Department in Siem Reap, Ministry of Health

Remark: *1 In-patient figures are included in those of out-patients.

In addition to rice production, farmers produce cash crops such as peanuts, corns, mung beans, etc. and long-term crops such as fruit trees. Besides, inland fishery is conducted in Tonle Sap Lake. It has covered not only domestic consumption in the province but also other outside areas through exportation. However, its production decreases year-by-year because of water pollution, illegal and destructive fishing, and siltation in the lake.

Livestock production is another important agricultural activities in rural areas in the province. Livestock raising such as cattle, hog and poultry provides additional incomes for farmers. For the production, however, inadequate veterinary services are serious bottleneck for expansion.

2.9.2 Tourism

Besides agriculture, tourism is the next important industry for Siem Reap Province. Archeological monuments have attracted tourists to visit Siem Reap not only for domestic tourists but also for foreign tourists. Table 2.9.1 indicates the tourist arrivals to Siem Reap between 1994 and 1998. In 1997 and 1998, the number of tourists who visited Siem Reap dropped down because of social disorder in 1997 and general election in 1998. After 1999, it is expected to recover to the level of 1996 and to increase owing to keeping safe public security in Siem Reap.

Table 2.9.1 Number of Tourists Visiting Siem Reap: 1994 - 1998

Tourist	1994	1995	1996	1997	1998
Domestic	-	11,336	11,703	0	1,503
Foreign	25,293	44,833	55,560	31,472	30,255

Source: Report on Tourism Statistics Tourist Arrivals to Siem Reap (Passed check Point) in 1998, Ministry of Tourism, Tourism Office Siem Reap

In terms of accommodation for tourists, there were 25 hotels and 28 guesthouses in Siem Reap as of 1998. The hotels installed 147 single rooms and 898 double rooms. The guesthouses installed 117 single rooms and 157 double rooms. In the near future, the accommodations is planned to increase in proportion to the growth of tourist arrivals. In addition, tourism growth will absorb a number of new employment in the region. This will contribute to the regional economy.

2.9.3 Infrastructure

(1) Transportation

A main trunk road for Siem Reap Province is National Road No.6, which links Banteay Meanchey and Kampong Thom Provinces. The total length of the Road No.6 is 132 kilometers. Besides the Road No.6, there are various lateral lines such as National Roads 63, 66, 67,68,105 and 231. These and other branch roads

link various areas among districts, communes and villages in the province. In addition to this road network, the province installs an international airport. It links Siem Reap to the capital city of Phnom Penh domestically and to Bangkok internationally.

(2) Water Supply

According to “Provincial Development Plan of Siem Reap for 1999-2000, Provincial Rural Development Committee”, 91% of Siem Reap population uses wells as drinking water source and 8% gets drinking water from rivers, ponds, and lakes. 83% of the total population relies on unprotected dug wells.

The JICA Study Team conducted the “Public Awareness and Water Use Survey” in Siem Reap Town in 1997. According to the results of the survey, 98.4% of the households surveyed have wells. Out of these households, 78.5% is tube-well and 19.9% is open well. Only 1.5% uses surface water as their water source. The water in the wells is available throughout the year, but 10.3% mentioned that they could not get water in dry season. The water quality appeared as good or acceptable, but 89.7% of the respondents use boiling as the method of disinfection. In hotels and restaurants, however, bottled potable water is popular for drinking purposes in Siem Reap. There are three water bottlers, which are registered to Provincial Department of Industry, Mines and Energy (PDIME). The PDIME is a provincial branch office of MIME. These three bottlers are listed in Table 2.9.2. These bottlers cannot cover all demand of potable water in Siem Reap. Most of bottled water is imported from other towns, especially from Phnom Penh.

Table 2.9.2 Water Bottlers Registered to MIME in Siem Reap Province: 1999

Item	Bottler 1	Bottler 2	Bottler 3
1. Name of Owner	Kim Phon	Nong Nrin	Kouv Lokam
2. Year Registered	1998	1993	1993
3. Address	Road 6, Slor Kram, Siem Reap District	Vat Bo Village, Salkomreuk Commune, Siem Reap District	Salakonceng Village, Svay Dongkoum Commune, Siem Reap District
4. Labor (persons)	3	4	4
1) Manager	1	2	1
- Male	1	1	0
- Female	0	1	1
2) Worker	2	2	3
- Male	0	2	2
- Female	2	0	1
5. Assets (1000 Riels)	7,000	1,950	60,000
- Immovables	6,000	1,600	35,000
- Movables	1,000	350	25,000
6. Production (1000 lit/yr)	1,000	1,800	910

Source: Ministry of Industry, Mines and Energy, Siem Reap Provincial Office

A piped water supply system was managed by the PDIME till 1995. In 1995, the PDIME started to construct a new water supply system using groundwater, financed by French Aid. The new system was completed in 1998, but the PDIME did not approve its commencement of water supply because of high electricity costs. After negotiation of electricity price and approval of the new water supply tariff from the MIME head office, the PDIME started the new water supply for around 110 connections in July 1999.

2.10 Development Programs

2.10.1 National Development Plan

The “First Socioeconomic Development Plan, 1996-2000” was published in the context of a market-oriented economy in Cambodia. The major thrust of this plan is social development in the country. It insists on the following development points: (1) development of rural areas where 90% of the poor in the country reside; (2) poverty alleviation through health programs, rural water supply and sanitation programs, primary education programs and specific targeting program for vulnerable groups.

The plan presents macroeconomic projections for the planning period, 1996-2000. A rate of real growth is projected at 7.5% per annum on average. The major economic sectors are also projected at the following rates on average for the planning period: agricultural sector of 4.9%; industrial sector of 9.9%; and services’ sector of 9.0%. GDP per capital is projected to grow at an average rate of 4.0% per annum. The detailed projection is tabulated in Table 2.10.1.

As the plan emphasizes social development, it proposes to improve access to safe water with targeting vulnerable groups through formal and informal methods. In 1996, people who can access to safe water were estimated at 65% of urban population (mostly in Phnom Penh) and 26% of rural population. It was estimated at some 3.2 million people or 32% of the total population. By the year 2000, the plan proposed that 90% of urban population and 65% of rural population could access to safe water.

Table 2.10.1 GDP Projection by Industrial Origin: 1996-2000

Economic Sector	1996	1997	1998	1999	2000
I. Gross Domestic Product (Unit: Billion Riels at 1989 Constant Prices)					
1. Agriculture	152.2	160.1	168.0	176.1	184.7
1) Crop Production	87.4	92.6	97.7	102.9	108.4
2) Livestock & Poultry	42.7	44.4	46.2	48.1	50.0
3) Fishery	12.7	13.2	13.7	14.3	14.9
4) Forestry	9.4	9.9	10.4	10.9	11.4
2. Industry	68.1	74.8	82.2	90.3	99.2
1) Mining	4.3	4.7	5.0	5.4	5.9
2) Manufacturing	27.7	30.5	33.5	36.9	40.6
3) Electricity, Gas & Water	0.9	0.9	1.0	1.1	1.2
4) Construction	35.2	38.7	42.6	46.9	51.6
3. Services	129.0	140.6	153.3	167.2	182.3
1) Trade	52.2	57.5	63.2	69.5	76.5
2) Hotels & Restaurants	2.0	2.2	2.5	2.7	3.0
3) Transport & Communications	11.8	13.0	14.3	15.7	17.3
4) Public Administration	13.9	15.0	16.2	17.5	18.9
5) Other Services	49.0	52.9	57.2	61.7	66.7
4. GDP	349.3	375.5	403.5	433.6	466.1
5. GDP per Capita (in 1000 Riels)	32.6	34.0	35.3	36.7	38.2
II. Real Growth Rate (Unit: % per Annum)					
1. Agriculture	5.2	5.2	5.0	4.8	4.8
1) Crop Production	5.9	5.9	5.5	5.3	5.3
2) Livestock & Poultry	4.0	4.0	4.0	4.0	4.0
3) Fishery	4.0	4.0	4.0	4.0	4.0
4) Forestry	5.0	5.0	5.0	5.0	5.0
2. Industry	11.8	9.8	9.9	9.9	9.9
1) Mining	8.0	8.0	8.0	8.0	8.0
2) Manufacturing	15.0	10.0	10.0	10.0	10.0
3) Electricity, Gas & Water	8.0	8.0	8.0	8.0	8.0
4) Construction	10.0	10.0	10.0	10.0	10.0
3. Services	8.2	9.0	9.0	9.0	9.1
1) Trade	8.0	10.0	10.0	10.0	10.0
2) Hotels & Restaurants	10.0	10.0	10.0	10.0	10.0
3) Transport & Communications	10.0	10.0	10.0	10.0	10.0
4) Public Administration	8.0	8.0	8.0	8.0	8.0
5) Other Services	8.0	8.0	8.0	8.0	8.0
4. GDP	7.5	7.5	7.5	7.5	7.5
5. GDP per Capita (in 1000 Riels)	-	4.0	4.0	4.0	4.0

Source: First Five Year Socioeconomic Development Plan, 1996-2000, January 1997, The Royal Government of Cambodia

2.10.2 Provincial Development Plan

Corresponding to the national “First Socioeconomic Development Plan, 1996-2000”, the “Provincial Development Plan, 1996-2000” was prepared in 1997. The plan proposed goal setting, implementation schedule, monitoring and evaluation of development activities. In the plan, water supply scheme in Siem Reap Town is projected to expand as shown Table 2.10.2. The quantity of potable water supplied through the piped water system increases from 730,000 m³ in 1996 to 1,460,000 m³ in the year 2000 or two times for five years. The total length of distribution pipes extends from 16 km in 1996 to 30 km in 2000 or also about two times.

Table 2.10.2 Development Plan of Water Supply System in Siem Reap

Item	1996	1997	1998	1999	2000
Quantity of Water Supplied (1000 m ³ per Year)	730	730	730	1,460	1,460
Length of Distribution Piping Network (km in total)	16	16	16	30	30

In the “Provincial Development Plan of Siem Reap for 1999-2000”, the PDIME understood the situation of water supply as clean and potable water is still inadequate for people’s consumption in the region. Thus, the PDIME confirmed the two works: (a) water works has been repaired under financial support from French assistance and is not yet operational since the system was not completely set up yet; and (b) JICA restarted the Master Plan Study on water supply system in Siem Reap after the general election in 1998. In the planning period, the PDIME expected that the water supply system in the provincial capital town be completely repaired and improve its water capacity to meet the water demand by the people in the service areas. It provided free water meters and ensured around 400 consumers of water delivery system.

3 Financial Status of Waterworks

3.1 Present Situation of Water Supply

As mentioned in the “Provincial Development Plan of Siem Reap for 1999-2000”, the new water supply system in the core part in Siem Reap Town was completed in 1998, although some parts of distribution piping network are still being fixed because of long interval since 1995. In July 1999, the PDIME got approval of a new water tariff from the MIME head office, and started operation of water supply facilities to consumers in the town. As of July, the number of water connections was expected to around 110.

In outside areas from water supply services, the people still get drinking water from wells or surface waters such as rivers, ponds and lakes. Even in the town

proper, most of them rely on unprotected dug wells. As mentioned in Section 2.9.3-(2), the present situation of water sources for drinking water in the project area is analyzed as follows: (1) 98% of the total households get water through wells; (2) out of these households, 78% have installed protected tube-wells and 20% have unprotected open wells; (3) 2% get from surface water sources. After introducing the new water supply system, around 400 households switched their potable water sources from present systems to the new piped system. Most hotels, guesthouses, and restaurants in the service areas of the new water system would switch their individual water source procurement systems to the new piped system as well.

3.2 Water Tariffs

Until 1995, the piped water supply system was operated by the PDIME, applying the Old American System. At that time, the system did not install any water meters for every connection. Then, water charges were imposed on the basis of flat rate. For example, the water rate for domestic use was 3,700 Riels per month in high-pressure area, 2,500 Riels per month in medium-pressure area and 1,500 Riels per month in low-pressure area. On the other hand, the tariff for the grand hotel, Villa Apsara and hospitals was set as 18,000 Riels/month, 8,000 Riels/month and 5,500 Riels/month, respectively. It was imposed without regard to water pressure. These rates are tabulated in Table 3.2.1.

Table 3.2.1 Water Tariff in 1995

Category	Pressure Range		
	High	Medium	Low
1. Domestic	3,700	2,500	1,500
2. Government Office	3,700	2,500	1,500
3. School	3,700	2,500	1,500
4. Grand Hotel ^{*1}		18,000	
5. Villa Apsara (Palace) ^{*1}		8,000	
6. Hospital ^{*1}		5,500	

Source: Water Supply Station in Siem Reap

Remark: ^{*1} The water rates are set without regard to water pressure.

In July 1999, the PDIME launched the new water supply system. It provided a new tariff shown in Table 3.2.2. The water tariff was simplified into two categories only: (1) normal consumers and (2) big consumers. The former mainly includes domestic consumers, expected to account for about 85% of the total demand. The latter includes hotels and large restaurants, expected to account for about 15%. This time, the PDIME provided water meters for the respective

connections. Therefore, the tariff is based on measured service system. Incidentally, it does not impose any standing charges.

Table 3.2.2 Water Tariff^{*1} in 1999

Category	Rate
Water Charge (Unit: Riels/m ³)	
Normal Consumers (Domestic use, 85% of total water supply volume)	1,200
Big Consumers (Non-domestic use, 15% of total water supply volume)	1,400
Connection Charge (Unit: US\$)	
Including water meter ^{*2} , connection pipes and installation costs (Charged at the first connection to a new consumer)	137.75

Source: Water Supply Station in Siem Reap

Remark: *1 The tariff was approved in July 1999

*2 The water supply station provides a half-inch diameter's meter only. In case that a big consumer needs a bigger size water meter, he has to provide it by himself.

In addition to water charge, the PDIME imposes "connection charge" for a new connection. Its rate is US\$ 137.75 per connection. A new consumer has to pay for this charge, when he applies for the water supply services. The charge includes water meter, connection pipes, and installation costs. At present, the PDIME provides a half-inch diameter's water meter only. In case that a big consumer needs a bigger water meter than a half-inch, he has to procure the big meter by himself.

The water supply system has a capacity of 262,800 m³ per year. Of this total volume, 30% or 78,840 m³ per year might be lost due to technical losses, so 70% or 183,900 m³ per year could be sold to the water consumers. The total production cost was estimated at US\$ 62,772 per annum. So the unit production cost of water was calculated at 1,292 Riels per m³. Accordingly, the selling price of water was calculated at 1,372 Riels per m³, added up 5% for profit and 1.25% for business tax on the total production cost. Finally, the water rates were set up as shown in the table above. The details of water costs and water tariff background are described in Table 3.2.3.

Table 3.2.3 Water Cost and Tariff for Siem Reap Water Supply Scheme

I. Scheme Outline

1. Production Capacity: $60 \text{ m}^3 \times 24 \text{ hr} \times 365 \text{ days/year} = 525,600 \text{ m}^3/\text{year}$
2. Planning of Production in 1999
 The year 1999 is the first year when the Water Work of Siem Reap put on activity test. The Work is planned to produce 50% of the production capacity.
 $525,600 \text{ m}^3/\text{year} \times 50\% = 262,800 \text{ m}^3/\text{year}$
3. Technical Losses
 Water losses of distribution network and treatment plant is assumed to be 30%.
 $262,800 \text{ m}^3/\text{year} \times 30\% = 78,840 \text{ m}^3/\text{year}$
4. Water to be Charged to Consumers
 The volume of water to be charged to consumers is estimated as a difference between the production and the technical losses.
 $262,800 \text{ m}^3/\text{year} - 78,840 \text{ m}^3/\text{year} = 183,900 \text{ m}^3/\text{year}$

II. Production Cost

		(in US\$)
1. Electric Power	$0.6 \text{ kWh/m}^3 \times 262,800 \text{ m}^3 \times \$0.20/\text{kWh}$	= 31,536
2. Chloride	$0.001 \text{ kg/m}^3 \times 262,800 \text{ m}^3 \times \$2.50/\text{kg}$	= 657
3. Limes	$0.045 \text{ kg/m}^3 \times 262,800 \text{ m}^3 \times \$0.30/\text{kg}$	= 3,603
4. Chemical Analysis	$2 \text{ times/month} \times 12 \text{ months} \times \$25/\text{time}$	= 600
5. Electricity Use for Office	$40 \text{ kWh/month} \times 12 \text{ months} \times \$0.20/\text{kWh}$	= 96
6. Salary	$13 \text{ persons} \times 12 \text{ months} \times \$40/\text{month}$	= 6,240
7. Office Furniture	$12 \text{ months} \times \$50/\text{month}$	= 600
8. Maintenance	$12 \text{ months} \times \$100/\text{month}$	= 1,200
9. Mission	$2 \text{ persons} \times 6 \text{ times} \times 5 \text{ days} \times \$30/\text{person/day}$	= 1,800
10. Communication	$12 \text{ months} \times \$50/\text{month}$	= 600
Total of 1. to 10.		46,932
11. Miscellaneous Expenses (3% of the Total above)		= 1,408
12. Depreciation of Plant System*1 (20 Years)		= 9,532
13. Depreciation of Distribution Network*2 (50 Years)		= 4,900
Grand Total (Total of 1. to 13.)		62,772

		(in Riels/m ³)
Production Cost	$\$62,772 / 183,900 \text{ m}^3 \times 3,800 \text{ Riels/US\$}$	= 1,292.00
Profit Expected (5% of Production Cost)	$1,292 \text{ Riels/m}^3 \times 5\%$	= 64.60
Business Tax (1.25% of Production Cost)	$1,292 \text{ Riels/m}^3 \times 1.25\%$	= 16.15
Selling Price (Total of the Three Items above)		= 1,372.75

		(in Riels)
Total Profit Expected	$64.60 \text{ Riels/m}^3 \times 183,900 \text{ m}^3/\text{year}$	= 11,879,940
Tax on Profit (20% of Profit)	$11,879,940 \text{ Riels} \times 20\%$	= 2,375,988

III. Tariff of Water

1. Normal Consumers (85% of Total Volume Supplied): 1,200 Riels/m³
2. Big Consumers (15% of Total Volume Supplied): 1,400 Riels/m³

Source: MIME, Siem Reap, July 1999

Remarks: *1 5% of the construction cost (US\$190,650) is allotted as depreciation charge.

*2 2% of the evaluated cost (US\$245,000 for 10km) is allotted.

3.3 Financial Performance of Old Waterworks

The water supply ran a deficit on its financial account continuously until the supply was stopped in 1995. Table 3.3.1 shows the last four years' financial performance of the water supply management. The sales revenue accounted for around 40% of the total expenditure except 1994. The deficit was filled by the government subsidy.

Table 3.3.1 Management Performance of Water Supply Services: 1991 - 1994

(Unit: million Riels)				
Item	1991	1992	1993	1994
Income	6.61	13.78	22.36	22.80
Sales Revenue	2.80	5.21	9.38	4.86
Subsidy	3.81	8.57	12.98	17.94
Expenditure	6.61	13.78	22.36	22.80

In 1993, the sales revenue was reported at 9.38 million Riels or 42% of the total revenue. Of the sales revenue, 8.62 million Riels or 92% was earned from the water charges. On the other hand, the water production cost was reported as 15.60 million Riels in the same year, consisting of 12.95 million Riels of electricity cost and 2.66 million Riels of chemicals cost. The water charge accounted for only 55% of the production cost. The water charge cannot cover even direct material cost for water production. The details of these records are shown in Table 3.3.2.

In 1993, uncollected bill was only 2.7%, according to "Plan D'Urbanisme de Reference et projets Prioritaires, Novembre 1995, APSARA". In other words, 97.3% of billed amount was collected by the PDIME. These records are tabulated in Table 3.3.3. Thus, even if the whole consumers paid for the bill completely, the water charges could not cover their water production costs. The water rates did not reflect the production cost. In general, water rates are set up in consideration for political view. Accordingly, the rates are not always based on the production costs, so the financial performance of the water management ran a deficit in general.

3.4 Financial Performance of New Waterworks

3.4.1 Present Situation of New Waterworks

In July 1999, the PDIME got approval of a new water tariff for the renewed water supply system. At the end of July 1999 the water station started operation of the water supply system to consumers in the central part of Siem Reap Town. As of July, the water station expected that around 400 water connections in the service area would be registered after the inauguration. The performance of the operation for the first three months was reported in Table 3.4.1.

Table 3.3.2 Financial Performance of Water Supply in Siem Reap: 1991-1994

(Unit: 1000 Riels)				
Item	1991	1992	1993	1994
I. Income				
1. Sales Revenue	2,800	5,211	9,378	4,861
(1) Water Sales	2,597	4,268	8,622	-
a. Domestic	-	2,808	5,228	-
b. Non-domestic	-	1,460	3,394	-
(2) Connection Charge	204	943	756	-
2. Government Subsidy	3,814	8,568	12,985	17,939
Total	6,614	13,779	22,363	22,800
II. Expenditure				
1. Salary of Staff	1,410	3,625	4,820	4,280
2. Water Production	5,055	9,935	15,611	18,520
(1) Electricity	4,360	9,373	12,952	16,722
(2) Chemicals	695	562	2,659	1,798
3. Others	149	219	1,932	0
Total	6,614	13,779	22,363	22,800

Source: (1) Data from Accountant of MIME, Siem Reap

(2) Plan D'Urbanisme de Reference et Projets Prioritaires, Rapport Definitif, Novembre 1995, APSARA

Remark: This table is compiled on the basis of the sources above.

Table 3.3.3 Records of Water Charge Collection: 1992 and 1993

Year	Category	Number of Connection (Average)	Billed (1000 Riels)	Collected (1000 Riels)	Uncollected (1000 Riels)
1992	(1) Domestic	178	2,822.5	2,807.5	15.0
	(2) Non-domestic	42	1,506.9	1,460.0	46.9
	Total	220	4,329.4	4,267.5	61.9
	Ratio (%)		100.0	98.6	1.4
1993	(1) Domestic	175	5,255.3	5,227.7	27.6
	(2) Non-domestic	34	3,587.3	3,376.3	211.0
	Total	209	8,842.6	8,604.0	238.6
	Ratio (%)		100.0	97.3	2.7

Source: Plan D'Urbanisme de Reference et Projets Prioritaires, Rapport Definitif, Novembre 1995, APSARA

Table 3.4.1 Operational Performance of New Waterworks

Month	Category 1* ¹		Category 2* ²		Total	
	Number of Connection (Nos)	Volume of Water Sold (m ³ /month)	Number of Connection (Nos)	Volume of Water Sold (m ³ /month)	Number of Connection (Nos)	Volume of Water Sold (m ³ /month)
August	100	1,021	13	308	113	1,329
September	167	2,429	22	1,843	189	4,272
October	189	3,311	22	2,749	211	6,060

Note: *1 Normal consumers such as domestic water users

*2 Big consumers such as hotels, guesthouses, etc.

The number of 211 connections in October is still around a half of the number expected at the beginning. This is because the distribution piping-network has been considerably deteriorated than the water station had expected. In particular, a lot of pipes connecting into private yards suffered severe deterioration. Thus, the water station must repair these connection pipes. It takes long time and needs unexpected repairing costs. In addition, the water leakage losses through the piping-network were more serious than the water station had considered. Although they have repaired the spoiled pipes, the leakage is still considerable as compared with the other existing water supply systems in Cambodia. The losses for the three months are shown in Table 3.4.2.

Table 3.4.2 Operation Losses of New Waterworks

Month	Intake (m ³)	Production (m ³)	Sold (m ³)	Losses (m ³)	Loss Rate (%)
August	9,054	8,604	1,329	7,725	85.5
September	14,639	14,190	4,272	10,367	70.8
October	15,620	15,170	6,060	9,560	61.2

3.4.2 Financial Performance of New Waterworks

Before the inauguration of the water supply system in July 1999, the water station laid two kinds of obligations to the consumers: they are (1) deposit of water consumption, i.e., 10 m³ or 12,000 Riels in the case of category 1 or domestic use, and (2) maintenance charge (US\$ 20.00) of connection pipes and water meter which were already installed between the water service pipe and inside consumer's site. The deposit will be repaid to the water consumer, if he has no obligations when he closes the agreement between the water station and him. The maintenance charge is paid only one time when the water consumer signs on the agreement with the water station. Before receiving water from the water supply system, every consumer in the service areas is obliged to pay the deposit and the maintenance charge to the water station.

Every month a meter reader visits all water consumers and measures their monthly

consumption volume. The water station invoices to the consumers through the meter reader. After receiving the invoice, the consumer has to pay the water charge in a week in principle. After some negotiations regarding payment of water charge, the water station stops supplying potable water to the consumer in the case that he does not pay for the charge. However, there have been no unpaid consumers so far since the water station started the supply services in July.

Since the water station in Siem Reap does not have a specific accounting system as an autonomous entity, it is difficult to figure out the financial situation of present water supply management. At present, the PDIME manages the water supply services and carries out accounting treatment under public accounting system. On the basis of their financial information, the profile of income statement is drafted out as shown in Table 3.4.3.

Table 3.4.3 Performance of Water Supply in Siem Reap

(Unit: US Dollars)

Item	August	September	October
I. Revenue			
1. Water Sales	436	1,446	2,058
2. Installation Charges	1,014	899	513
Total	1,450	2,345	2,572
II. Expenditures			
1. Chemical Product *1	147	238	255
2. Power Cost *2	937	1,498	1,935
3. Maintenance *3	914	396	364
4. Labor Costs *4	435	241	271
5. Office Supplies	77	46	134
6. Communication	92	59	59
Sub-total	2,601	2,478	2,825
7. Depreciation *5	1,203	1,203	1,203
Total	3,804	3,680	4,028
III. Balance	-2,354	-1,336	-1,649

Source: Water Station, PDIME

Notes: *1 Raw materials are consumed as follows.

(a) Lime (0.0457 kg/m ³)	414 kg	669 kg
(b) Reactive (1 bottle per month)	1 bottle	1 bottle
(c) Chloride (0.001 kg/m ³)	9 kg	15 kg

*2 Unit price of power is US\$0.195 per kWh.

*3 Repairing costs of distribution piping network.

*4 Permanent staff (512,840 Riels per month for 10 members) plus temporary workers

*5 Capital investment was evaluated as follows.

- (a) Plant system was US\$190,650, which was depreciated straight-line in 20 years. The system was mostly rehabilitated by French on the basis of ODA.
- (b) Distribution piping network was US\$245,000, which was depreciated straight-line in 50 years.

As shown in the table, the balance of income statement in each month resulted in considerable deficit as follows: US\$ 2,354 in August, US\$ 1,336 in September, and US\$ 1,649 in October. The depreciation of plant system and piping network mainly caused the deficit. On the other hand, the installation charges are not

regular income but one-off payment at the time when the consumers enter into the agreement. Then, to simplify the financial situation of the water supply service, a net profit (or loss) from operations is calculated by means of eliminating both depreciation and installation charges from the income statement. The net operation loss of the new waterworks was summarized in Table 3.4.4.

Table 3.4.4 Net Operation Loss of New Waterworks

(Unit: US Dollars)

Item	August	September	October
Income from Water Sales	436	1,446	2,058
Expenditures for Water Production	2,601	2,478	3,018
Balance (Net Profit/Loss)	-2,165	-1,032	-960

Note: * The amount did not include expenses of office supplies and communication.

As far as this balance shows, the management of the water supply services seems to be improved month by month, although the balance recorded a deficit for the three months. If this tendency keeps on hereafter and when the water station attains the target connections in the service areas, the nominal cash balance may turn into profit in single year. In the future, the management of the water station may get rid of the cumulative deficit and turn to the black, if the depreciation of plants and other facilities are left out of consideration.

4 Financial Analysis

4.1 Overview of Financial Analysis

Financial analysis is carried out on the basis of market values of project costs and incomes from the proposed projects. The project costs are estimated in Section 4.5.4 in the Main Report (Vol. II of the Final Report). These costs reflect the actual present market conditions. The revenue of water sales is calculated as a product of a volume of water sold and water rates lay down by the PDIME, Siem Reap. Finally, the projects are examined in financial efficiency and evaluated taking into account of financial situation.

In the master plan stage, financial viability of the proposed project is examined by means of an evaluation indicator of “financial internal rate of return (FIRR)”. If the FIRR were not good to implement from the point of financial view, financial difficulties would be analyzed and identified, and some countermeasures would be proposed in this stage.

The analysis above is done mainly on the supply side. The project management is also evaluated from the viewpoint of demand side. Affordability of the proposed project from water consumers is important constraint for the project to be accepted by the consumers. It will be discussed in Chapter 5 in this Annex. Through these

analyses, this financial study proposes financial solutions and recommendations in the sectoral conclusion of the master plan study.

4.2 Revenue from Water Supply Services

The revenue of the proposed project accrues from expenses of the water consumers. The consumers pay for water charges in accordance with their water volume consumed. The PDIME lay down the new water tariff on water consumption in their service areas in July 1999. Its details are shown in Table 3.2.2.

The revenue from water supply services is calculated as a product of water volume consumed and unit rates settled in the water tariff. As discussed in the previous section, the average unit volume of water consumption in the year 2002 was set up and the consumption volumes were already calculated in forms of monthly and annual figures. The details of water demand are explained in Section 4.1.3 in the Main Report. The unit revenue is calculated as a product of unit rate (Riels/m³) and an average volume of water consumption by consumer types. Table 4.2.1 shows the annual average unit revenue of the respective consumers.

Table 4.2.1 Average Water Consumption and Water Charge

Type of Consumer	Unit	Domestic User (per Household)	Hotel User (per Hotel)
I. Monthly Consumption			
Consumption Volume	m ³	17.1	480.0
Monthly Charge	1000 Riels	20.5	672.0
II. Annual Consumption			
Consumption Volume	m ³	208.1	5,840.0
Annual Charge	1000 Riels	246.2	8,176.0

Note: *1 A family size is set up as 5.7 persons, the average number of household member.
*2 A hotel has 40 guestrooms, the average number of hotels in Siem Reap.

As mentioned before, the total revenue of the proposed project is estimated as a product of unit rate of the water tariff and total volume of the water supply scheme. The unit rate is assumed to be constant during the evaluation period, which was set up in July 1999. The total water consumption volume for the respective years during the project life is estimated in Section 4.1.3 in the Main Report. The total annual revenue from water supply services is summarized in Table 4.2.2.

In addition to water sales, the PDIME can receive the connection charges from new consumers. The number of the new consumers is estimated at 7,050 between 2002 and 2010. The PDIME, therefore, will collect the connection charge of US\$ 971,000 in total at 1999 constant prices. The annual distribution of this revenue is enumerated in Table 4.4.1.

Table 4.2.2 Annual Revenue of Water Supply Services: 2002 and 2010

Item	2002	2010
I. Water Demand (1000 m ³ /Year)		
Normal Consumers	364	1,821
Big Consumers	269	992
Total	633	2,814
II. Revenue (Million Riels/Year)		
Normal Consumers	437	2,185
Big Consumers	377	1,389
Total	814	3,574
Total in US\$1000	214	941

4.3 Cost for Water Production

The financial construction cost of the proposed project consists of the following major items:

- (a) Main construction cost
- (b) Compensation cost
- (c) Government administration cost
- (d) Engineering service cost
- (e) Physical contingency cost
- (f) Price contingency cost

The work types of the main construction cost comprise (i) well facilities, (ii) supplementary facilities, and (iii) distribution circulation pumps. The supplementary facilities include receiving well, chlorinator house, clear water reservoirs, generator, pumps and other machinery. The compensation cost is paid for landowners who have land expropriated for distribution pump station. Other costs are estimated as some proportions to the main construction cost. The details of cost estimate were described in Section 4.5 in the main report. The financial costs of the proposed project were summarized as follows.

Table 4.3.1 Investment Costs of Proposed Project

Description	(Unit: US\$ 1000)		
	First Stage	Second Stage	Total
1. Construction Cost	11,242	1,963	13,205
2. Land Acquisition Cost	250	0	250
3. Administration Cost	225	40	265
4. Engineering Services	1,687	295	1,982
5. Physical Contingency	1,316	230	1,546
6. Price Contingency	1,472	253	1,725
Total	16,192	2,781	18,973

The construction costs are disbursed in compliance with the construction schedule of two years in the first stage and one year in the second stage. Then, the disbursement of construction costs is tabulated in Table 4.4.1.

In addition to the investment costs above, a connection system such as connection service pipes and a water meter is installed for each consumer. The installation costs of these connection systems are fully collected from the individual consumers as connection charges. Thus, the waterworks does not procure for these installation costs. Anyhow, these costs are invested in accordance with the increase of new consumers year by year.

The cost of operation and maintenance (O&M) must be paid annually during the economic life of the proposed project. The O&M cost was estimated at US\$ 0.135 per m³ during the first stage and US\$ 0.115 per m³ at 1999 price level. The details of the O&M cost are described in Section 4.5.4 in the Main Report.

4.4 Financial Efficiency

Financial expenditure and revenue during the evaluation period are shown as an annual stream in Table 4.4.1. The table also shows evaluation indices. The indices were -2.2% of FIRR, 0.34 of B/C and minus US\$ 12.0 million of NPV. The latter two indices were the results applying 10% discount rate. From the financial point of view, accordingly, the proposed project is not viable, because the FIRR is much lower than the opportunity cost of capital of 10%.

The proposed project is not financially viable because the revenue is too small as compared with the investment and O&M costs. If it is wished by means of only revenue increase that the proposed project was made to have the FIRR of more than 10%, the water rates for all consumers would have to be increased 3.2 times more than the present rate. The results of this countermeasure case (named as Case 1) are tabulated in Table 4.4.2. On the other hand, it would be possible to make the project viable by subsidizing the investment costs. The analysis says that would be made by covering almost 81% of the capital investment. A FIRR of more than 10% could be obtained by subsidizing almost 81% of the capital investment.

These two countermeasures could be combined to make the proposed project financially viable. If 62% of investment costs were subsidized and 50% higher water rates than the present ones were introduced in the water supply management, the proposed project could be viable financially. This case (named as Case 3) is enumerated in Table 4.4.4.

The combination of these countermeasures has many variations. For example, the combination case of 70% of the subsidy and 30% of rate hike also makes the proposed project viable financially. These variations are proposed on the basis of the water policy and financial conditions.

Table 4.4.1 Financial Expenditure and Revenue Stream of Proposed Project

(Unit: US\$1000 in Financial Terms)

Year	Expenditure				Revenue			Balance		
	Capital Investment	O&M	Replacement	Total	Water Sales		Connection Charge			
					Domestic	Non-Domestic				
1	2000	1,962						0	-1,962	
2	2001	14,229						0	-14,229	
3	2002	187	61		115	99	187	401	153	
4	2003	103	113		170	155	103	428	212	
5	2004	114	174		235	220	114	569	281	
6	2005	121	227		310	255	121	686	339	
7	2006	2,865	266		371	277	84	731	-2,400	
8	2007	146	304		454	299	146	900	449	
9	2008	111	340		517	321	111	949	499	
10	2009	56	361		547	343	56	947	530	
11	2010	52	381		575	366	52	992	560	
12	2011		381		575	366	0	941	560	
13	2012		381		575	366	0	941	560	
14	2013		381		575	366	0	941	560	
15	2014		381		575	366	0	941	560	
16	2015		381		575	366	0	941	560	
17	2016		381	1,777	2,158	575	366	0	941	-1,217
18	2017		381		381	575	366	0	941	560
19	2018		381		381	575	366	0	941	560
20	2019		381		381	575	366	0	941	560
21	2020		381		381	575	366	0	941	560
22	2021		381	417	798	575	366	0	941	143
23	2022		381		381	575	366	0	941	560
24	2023		381		381	575	366	0	941	560
25	2024		381		381	575	366	0	941	560
26	2025		381		381	575	366	0	941	560
27	2026		381		381	575	366	0	941	560
28	2027		381		381	575	366	0	941	560
29	2028		381		381	575	366	0	941	560
30	2029		381		381	575	366	0	941	560
31	2030		381		381	575	366	0	941	560
32	2031		381		381	575	366	0	941	560

Evaluation Indices NPV: -12,032 thousand US\$ *1
 B/C: 0.34 *1
 FIRR: -2.2%

Note: *1 Discounted at 10%

Table 4.4.2 Financial Expenditure and Revenue Stream of Proposed Project: Case 1

(Unit: US\$1000 in Financial Terms)

Year	Expenditure				Revenue			Balance		
	Capital Investment	O&M	Replacement	Total	Water Sales		Connection Charge			
					Domestic	Non-Domestic			Total	
1	2000	1,962						0	-1,962	
2	2001	14,229						0	-14,229	
3	2002	187	61		368	317	187	872	624	
4	2003	103	113		544	497	103	1,143	928	
5	2004	114	174		750	705	114	1,570	1,282	
6	2005	121	227		993	815	121	1,929	1,582	
7	2006	2,865	266		1,187	886	84	2,157	-975	
8	2007	146	304		1,453	957	146	2,557	2,106	
9	2008	111	340		1,655	1,028	111	2,794	2,344	
10	2009	56	361		1,752	1,099	56	2,906	2,490	
11	2010	52	381		1,841	1,170	52	3,062	2,630	
12	2011		381		1,841	1,170	0	3,010	2,630	
13	2012		381		1,841	1,170	0	3,010	2,630	
14	2013		381		1,841	1,170	0	3,010	2,630	
15	2014		381		1,841	1,170	0	3,010	2,630	
16	2015		381		1,841	1,170	0	3,010	2,630	
17	2016		381	1,777	2,158	1,841	1,170	0	3,010	853
18	2017		381		381	1,841	1,170	0	3,010	2,630
19	2018		381		381	1,841	1,170	0	3,010	2,630
20	2019		381		381	1,841	1,170	0	3,010	2,630
21	2020		381		381	1,841	1,170	0	3,010	2,630
22	2021		381	417	798	1,841	1,170	0	3,010	2,212
23	2022		381		381	1,841	1,170	0	3,010	2,630
24	2023		381		381	1,841	1,170	0	3,010	2,630
25	2024		381		381	1,841	1,170	0	3,010	2,630
26	2025		381		381	1,841	1,170	0	3,010	2,630
27	2026		381		381	1,841	1,170	0	3,010	2,630
28	2027		381		381	1,841	1,170	0	3,010	2,630
29	2028		381		381	1,841	1,170	0	3,010	2,630
30	2029		381		381	1,841	1,170	0	3,010	2,630
31	2030		381		381	1,841	1,170	0	3,010	2,630
32	2031		381		381	1,841	1,170	0	3,010	2,630

Evaluation Indices NPV: 175 thousand US\$

B/C: 1.01

FIRR: 10.1%

Note: *1 Discounted at 10%

Management Condition:

The rates of water charge are raised to 3.1 times of the present ones.

Table 4.4.3 Financial Expenditure and Revenue Stream of Proposed Project: Case 2

(Unit: US\$1000 in Financial Terms)

Year	Expenditure				Revenue			Balance	
	Capital Investment	O&M	Replacement	Total	Water Sales		Connection Charge		
					Domestic	Non-Domestic			
1	2000	373						0	-373
2	2001	2,703						0	-2,703
3	2002	187	61		115	99	187	401	153
4	2003	103	113		170	155	103	428	212
5	2004	114	174		235	220	114	569	281
6	2005	121	227		310	255	121	686	339
7	2006	612	266		371	277	84	731	-147
8	2007	146	304		454	299	146	900	449
9	2008	111	340		517	321	111	949	499
10	2009	56	361		547	343	56	947	530
11	2010	52	381		575	366	52	992	560
12	2011		381		575	366	0	941	560
13	2012		381		575	366	0	941	560
14	2013		381		575	366	0	941	560
15	2014		381		575	366	0	941	560
16	2015		381	2,158	575	366	0	941	-1,217
17	2016		381	1,777	575	366	0	941	560
18	2017		381		575	366	0	941	560
19	2018		381		575	366	0	941	560
20	2019		381		575	366	0	941	560
21	2020		381		575	366	0	941	143
22	2021		381	417	575	366	0	941	560
23	2022		381		575	366	0	941	560
24	2023		381		575	366	0	941	560
25	2024		381		575	366	0	941	560
26	2025		381		575	366	0	941	560
27	2026		381		575	366	0	941	560
28	2027		381		575	366	0	941	560
29	2028		381		575	366	0	941	560
30	2029		381		575	366	0	941	560
31	2030		381		575	366	0	941	560
32	2031		381		575	366	0	941	560

Evaluation Indices NPV: 53 thousand US\$

B/C: 1.01

FIRR: 10.2%

Note: *1 Discounted at 10%

Management Condition:

77% of capital investment cost is subsidized.

Table 4.4.4 Financial Expenditure and Revenue Stream of Proposed Project: Case 3

(Unit: US\$1000 in Financial Terms)

Year	Expenditure				Revenue			Balance		
	Capital Investment	O&M	Replacement	Total	Water Sales		Connection Charge			
					Domestic	Non-Domestic			Total	
1	2000	746						0	-746	
2	2001	5,407						0	-5,407	
3	2002	187	61		173	149	187	508	260	
4	2003	103	113		255	233	103	590	375	
5	2004	114	174		352	331	114	796	509	
6	2005	121	227		466	382	121	968	621	
7	2006	1,140	266		556	415	84	1,055	-352	
8	2007	146	304		681	449	146	1,276	826	
9	2008	111	340		776	482	111	1,368	918	
10	2009	56	361		821	515	56	1,392	976	
11	2010	52	381		863	548	52	1,463	1,030	
12	2011		381		863	548	0	1,411	1,030	
13	2012		381		863	548	0	1,411	1,030	
14	2013		381		863	548	0	1,411	1,030	
15	2014		381		863	548	0	1,411	1,030	
16	2015		381		863	548	0	1,411	1,030	
17	2016		381	1,777	2,158	863	548	0	1,411	-746
18	2017		381		381	863	548	0	1,411	1,030
19	2018		381		381	863	548	0	1,411	1,030
20	2019		381		381	863	548	0	1,411	1,030
21	2020		381		381	863	548	0	1,411	1,030
22	2021		381	417	798	863	548	0	1,411	613
23	2022		381		381	863	548	0	1,411	1,030
24	2023		381		381	863	548	0	1,411	1,030
25	2024		381		381	863	548	0	1,411	1,030
26	2025		381		381	863	548	0	1,411	1,030
27	2026		381		381	863	548	0	1,411	1,030
28	2027		381		381	863	548	0	1,411	1,030
29	2028		381		381	863	548	0	1,411	1,030
30	2029		381		381	863	548	0	1,411	1,030
31	2030		381		381	863	548	0	1,411	1,030
32	2031		381		381	863	548	0	1,411	1,030

Evaluation Indices NPV: 24 thousand US\$

B/C: 1.00

FIRR: 10.0%

Note: *1 Discounted at 10%

Management Condition:

- (1) 60% of capital investment cost is subsidized.
- (2) The rates of water charge are raised to 50% higher than the present rates.

Furthermore, the following combination makes the project viable from the financial viewpoint: (a) 100% of construction costs of the stage 1 are procured through subsidy; (b) 100% of construction costs of the stage 2 are procured through the international finance; and (c) 25% of water rate is reduced. Among these countermeasures, what kind of combination is the most realistic is a policy matter. The available financial sources for the proposed project have to be found in the foreign and local financial markets. On the other hand, the water rates should be considered referring to household economy and affordability of the project from water consumers.

5 Economic Analysis

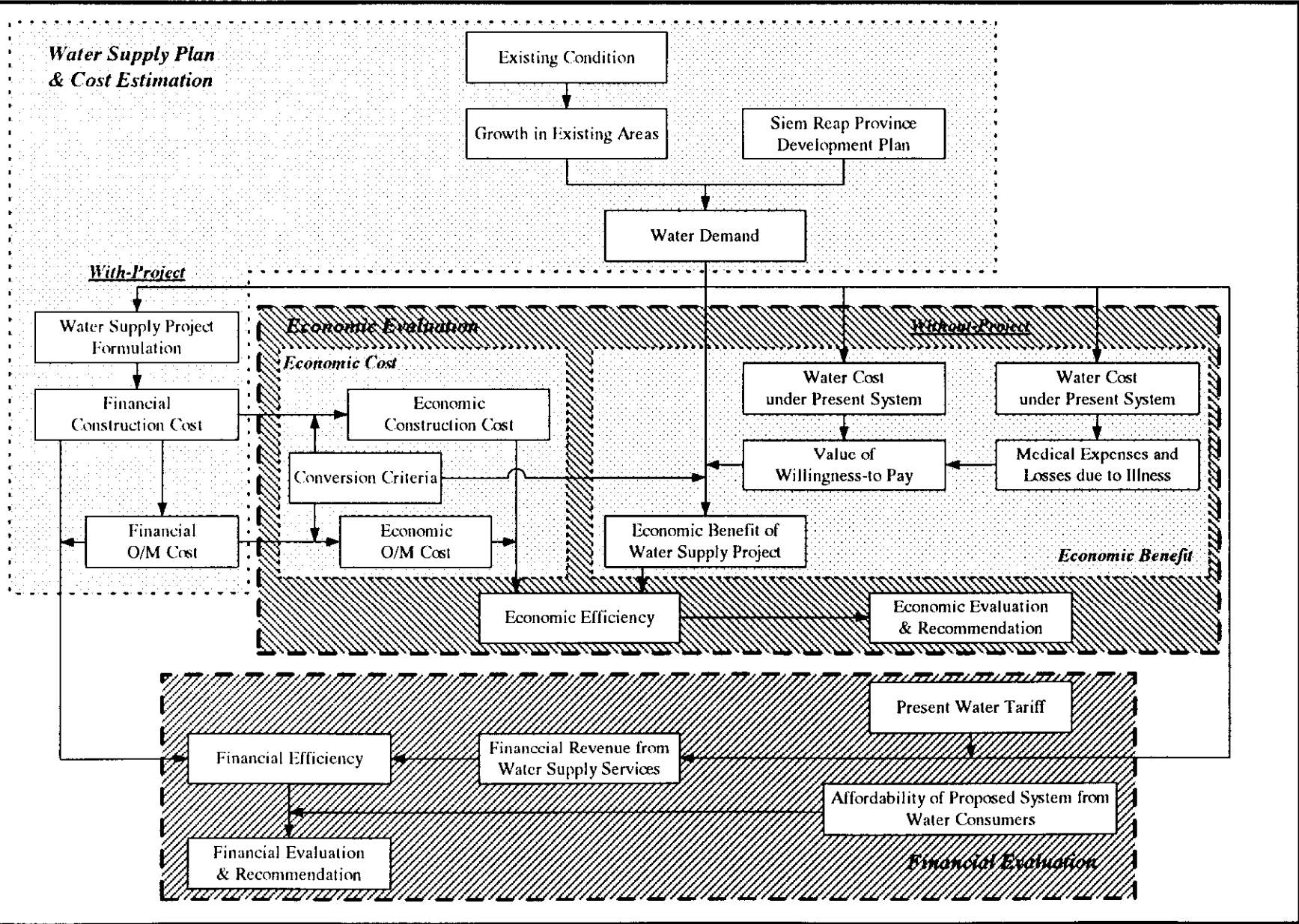
5.1 Overview of Economic Analysis

The project proposed in this Study is analysed on the basis of two quantitative analyses: (1) financial analysis, and (2) economic analysis. The former was discussed in the previous section. In the economic analysis, an economic evaluation is a major part. The economic evaluation is to examine the proposed project from the economic point of view, that is, viability of social investment in the national economy. As mentioned before, the financial evaluation is to inspect the proposed project from the financial point of view, that is, tests of earning capacity and financial efficiency. This is the fundamental difference between the two analyses. The procedure of these project analyses is illustrated in Fig.5.1.1.

The project evaluation is conducted in accordance with the conventional methodology that is commonly applied for evaluation of development project under finance of the World Bank and other international agencies concerning to technical and economic corporation. The methodology suggests that the project evaluation have two steps for quantifying evaluation factors in general. At first, the project cost and benefit are identified and quantified in monetary terms, which arise from implementation of the proposed project. Then, they are compared and condensed into evaluation factors. The factors are Economic Internal Rate of Return (EIRR) for a main index, and Net Present Value (NPV) and Benefit-Cost Ratio (B/C) for supplementary indices.

The EIRR is defined as a special rate of discount that settles the following conditions to the satisfaction:

- 1) The present value of cost is obtained through discounting the all costs incurred during the economic life of the proposed project at the special rate.
- 2) The present value of benefit is obtained through discounting the all benefits accruing from the project during the same lifetime at the special rate.
- 3) As a result, the present value of cost is equal to the present value of benefit.



In the case that this EIRR exceeds the opportunity cost of capital, the proposed project could be judged as viable economically. The NPV shows the magnitude of project incremental benefit. The B/C indicates the gap between the project efficiency and the opportunity cost of capital.

5.2 Assumptions for Economic Evaluation

In economic evaluation, the costs and benefits are estimated on the basis of economic values instead of market values which were applied for financial analysis. The economic values are converted from the financial values basically applying conversion factors.

For the economic evaluation, the following criteria and assumptions are applied to calculate economic values and evaluation indicators in this Study.

(1) Schedule and Evaluation Period

- | | |
|---|--|
| (a) Base Year | The year 2000 |
| (b) Construction Period | Two years (2000 and 2001) for the first stage and one year (2006) for the second stage |
| (c) Economic Life and Evaluation Period | 30 years after the completion of the first stage |
| (d) Timing of Accruing Benefits | The benefits will appear after the completion of the project. The matured benefit is attained in the target year 2010. |
| (e) Price Level | Cost and benefit of the project are set in 1999. |
| (f) Prevailing Exchange Rate | 3,800 Riels per US\$ 1.00 and ¥120 per US\$ 1.00 |
| (g) Opportunity Cost of Capital | 10% per annum |

(2) Basic Conditions and Assumptions

- (a) Conversion Factor: All the costs have to be measured as economic costs, i.e., the real costs or "opportunity costs". In particular, market values are usually distorted by transfer payments such as taxes and subsidies. These have to be eliminated from the market values of cost and benefit as a whole. In the master plan stage, the economic values are assumed to be 90% of the financial costs, referring to the proceeding projects concerned and also referring to Table 5.2.1.

Table 5.2.1 Standard Conversion Factor

(Unit: Billion Riels)

Item	1996	1997	1998
1. Import (CIF)	81.5	105.5	33.8
2. Export (FOB)	1,904.8	2,251.3	2,187.9
3. Sub-total	1,986.3	2,356.8	2,221.7
4. Tax on Foreign Trade	333.5	336.0	369.2
Tax on Import	325.3	325.9	363.9
Tax on Export	8.2	10.0	5.3
5. Subsidies *1	-	23.3	30.5
Subsidies for Export *2	-	1.2	1.5
6. Total	2,303.5	2,673.8	2,581.8
7. Standard Conversion Factor	0.86	0.88	0.86
SCF =====> Average for three years			0.87

Source: Refer to Table 2.4.1.

Note: *1 Refer to Table 2.3.2.

*2 The portion for export promotion subsidy was assumed to be 5% of the total subsidies.

- (b) **Shadow Wage:** Prevailing wages of skilled workers are considered to reflect an opportunity cost of labor, because there is usually a shortage of skilled workers in the labor markets. Therefore, the shadow wage rate of skilled workers is set up as 1.0. On the other hand, unskilled workers are in excess in the labor markets. Thus, the shadow wage rate of unskilled workers is assumed at 0.6 of legislated wage rate.
- (c) **Land Value:** Land areas expropriated for distribution pump station of 1.00 ha and wells of 200 m² in total for the first stage are purchased from the landowners. In the estimate of investment cost, the purchased values of the land areas are figured out in market prices for private land and in no purchased value for public lands. In economic evaluation, however, lands should generally be evaluated on the basis of productivity of the lands for productive plots such as crop cultivation.

In the proposed project, most land areas are used for paddy production with irrigation system. Since the land areas are converted to the plant and well sites, the ceased paddy production is considered as negative benefit for the proposed project. This negative benefit is quantified through values of paddy production for the economic life of the proposed project. The basic information for quantification of paddy production is indicated in Table 5.2.2, which is derived from Tables 5.2.3 to 5.2.6. The values in the table below are measured in economic terms.

Table 5.2.2 Crop Production Data in Land Purchased for Distribution Center

Item	Values
(a) Areas of Lands Purchased	10,200 m ²
(b) Farm-gate Value of Paddy (refer to Table 5.2.3) *1	US\$ 187 per ton
(c) Production Cost of Paddy (refer Table 5.2.5) *2	US\$ 98 per ton
(d) Net income from Paddy Production ((b)-(c))	US\$ 89 per ton
(e) Yield of Paddy in Irrigated Fields (refer Table 5.2.5)	3.6 ton/ha/year
(f) Cropping System in Irrigated Fields (refer to Table 5.2.6)	Two crops per year

Note: *1 An economic value of paddy at farm-gate in Siem Reap is derived from international market value in Bangkok, which is much higher than the local farm-gate price of 500 Riels as shown in Table 5.2.4.

*2 An economic value was calculated applying the standard conversion factor of 0.9 to 414,000 Riels/ton in Table 5.2.5.

An annual net income from paddy cultivation is calculated as a product of paddy yield and net income for a year. The paddy production was estimated as 3.6 tons/ha owing to two crops a year. The net income was estimated at US\$ 89 per ton. Then, the annual net income from paddy production was estimated at US\$ 320 per ha.

Since the land areas purchased are 1.02 ha in total, the annual negative benefit was estimated at US\$ 326. During 30 years of the economic life, the total production value is calculated at US\$ 3,000 at present value, which was discounted at 10% per annum. This value is quite small as compared with the total construction cost and accruing benefits from the proposed project.

Table 5.2.3 Farmgate Price of Paddy Derived from International Market: 1999

(Unit: per ton)

Item	International Value (US\$)	Local Value	
		Financial Value (1000 Riels)	Economic Value (US\$)
1. World Market Price *1 FOB, Bangkok, 5% broken milled white rice. Price projected in 1999 at 1990 constant prices. With 20% discount for quality	285 228		
World Market Price *2 Price projected in 1996 at 1996 prices.	240		
2. Transport (Bangkok to Siem Reap)*3	31		
3. At Siem Reap market 1000 Riels Equivalent*4	271	1,029	271
4. Transport, Handling & Warehouse Charge, etc.*5		182	42
6. Wholesale Price		1,211	313
7. Milling Cost *6		87	20
8. Paddy Equivalent (Yield of Rice from Paddy) *7		731	190
9. Transport & Handling Cost for Milling *8		14	3
10. Farmgate Price of Paddy 1000 Riels Equivalent *4	(=	717 700	187 711)

Source: Global Commodity Markets, A Comprehensive review and price forecast, Jan. 1999, World Bank

Provincial Department of Agriculture

Note: *1 Global Commodity Markets, A Comprehensive review and price forecast, Jan. 1999, World Bank

*2 Applied 124.32 of US GDP deflator (1990=100)

*3 Charged based on average distance of 150km at US\$0.07/ton-km in Cambodia and 400km at US\$0.05/ton-km in Thailand.

*4 Conversion rate of 3,800 riels per US\$1.00 was applied

*5 Charged based on average distance of 40km at US\$0.3/ton-km.

*6 Milling cost equals to the values of by-products such as rice-bran, rice hulls, etc.

*7 65% of yield of rice based on average of private mills.

*8 Charged based on average distance of 10km at US\$0.38/ton-km.

Table 5.2.4 Retail Prices and Farmgate Prices of Paddy in Local Market: 1998

(unit: Riels)

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average	
Retail Prices (Monthly Average) in Siem Reap															
Rice	kg	←—————→						800 to 1,000	—————→						900
Paddy	kg	520	520	520	520	460	480	600	600	530	480	480	480	516	
Farmgate Prices (Monthly Average) in Siem Reap															
Paddy	box	6,000	6,000	6,000	5,000	5,000	5,000	7,000	7,000	7,000	7,000	5,500	5,500	6,000	
	(12 kg/box)											Average of "per kg" ==>	500		

Source: Provincial Department of Agriculture

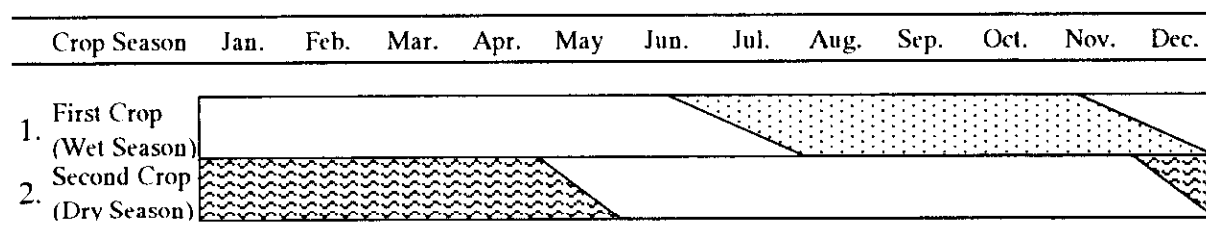
Table 5.2.5 Production Cost of Paddy in Irrigated Fields: 1998-1999

(Unit: 1000 Riels per ha)

Item	Paddy Production by Season				Annual Total
	Dry Season (Second Crop)		Wet Season (First Crop)		
I. Production Cost (1000 Riels per ha)					
1. Seeds	80 kg X 800 Riels	64	80 kg X 600 Riels	48	112
2. Fertilizers					
DAP	1 bag X 74,000Riels	74	1 bag X 74,000Riels	74	148
Urea	1 bag X 40,000Riels	40	1 bag X 40,000Riels	40	80
3. Agro-chemicals	Azodrine or Halathion	20	Azodrine or Halathion	20	40
4. Animal & Machin	Animal	60	Machine	60	120
5. Hired Labor					
Transplant	60 persons X 4,000 Riel	240	50 persons X 4,000 Riels	200	440
Harvesting	25 persons X 4,000 Riel	100	25 persons X 4,000 Riels	100	200
Washing		200		150	350
Total		798		692	1,490
II. Unit Production					
1. Yield per Hectare (tons)		2.000		1.600	3.600
2. Production Cost per Ton (Riels)		399		433	414

Source: Provincial Department of Agriculture

Table 5.2.6 Cropping System of Paddy Production in Irrigated Fields



Source: Provincial Department of Agriculture

5.3 Economic Benefits

5.3.1 Benefits of Proposed Project

One important main goal of water a supply project is to improve public health and well-being. In particular, the urban poor would receive benefit from the project. They rely on contaminated groundwater or polluted streams, rivers and lakes in the project site. Besides these basic benefits, the water supply project gives various advantages to the people and the regional economy in and around the project areas. The following table lists the benefits accruing from the water supply project.

Table 5.3.1 Benefits Accruing from Water Supply Project

(1) Improvement of Public Health	(a) Elimination of poor quality water source
	(b) Reduction of water related diseases
	(c) Reduction of medical expenses
(2) Enhancement of Amenity and Well-being	(a) Elimination of equipment for procuring water source
	(b) Time-savings associated with procuring water source
	(c) Energy-savings associated with boiling water for disinfection
	(d) Reduction of absence from work because of water related illness
(3) Social Issues Related to Water Supply	(a) Effective use of alternative water resources
	(b) Efficient operation of water supply equipment
	(c) Stimulation of the project investment to regional economy
	(d) Prevention of urban disaster by means of fire hydrant
	(e) Improvement of degree of freedom for urban planning
	(f) Increase of land values

Among these benefits, benefits in lines (1) and (2) are considered as direct benefits, which the proposed project directly brings about those benefits to the beneficiaries. Benefits in line (3) are considered as indirect benefits. The project has ripple effects on people or regional environment in relation to the project. On the other hand, the proposed project may bring about negative effects to the people and the regional socioeconomy. These impacts will be discussed in Chapter 6.

5.3.2 Quantifiable Direct Benefits

The benefits listed in the table above are furthermore classified into two categories. They are quantifiable or tangible, and non-quantifiable or intangible. To calculate evaluation indicators for economic evaluation, only tangible benefits are quantified as project benefit. In this Study, the following benefits are chosen as tangible benefit, and they are bound into three components.

- 1) Benefits of (2)-(a), (b) and (c) Water source saving benefit for

- | | |
|--|--|
| | residents |
| 2) Benefits of (1)-(b) & (c) and (2)-(d) | Public health improvement benefit for residents |
| 3) Benefit of (2)-(a) | Water source saving benefit for hotels and other big water consumers |

Benefit of water supply project is generally captured on the basis of willingness-to-pay of beneficiaries. The willingness-to-pay is said as monetary term of usefulness that the beneficiaries consider for procurement of water in their lives. Thus, it includes various factors not only tangible benefits but also intangible ones. The tangible benefits selected above are only some parts of their willingness-to-pay. Anyhow, it is quite difficult to find out the real willingness-to-pay. In this Study, thus, the willingness-to-pay is estimated on the basis of the tangible benefits above.

Benefits are classified into two main categories, i.e., (a) domestic water for residential use and (b) water for hotel business. The water consumption volume of these categories accounts for more than 90% of the total consumption in the project areas. In this evaluation study, then, these main categories are considered to stand for other consumers.

The willingness-to-pay of residents is assumed as a sum of (i) water source saving benefit, (ii) public health improvement benefit and (iii) other intangible direct benefits. Hence, other intangible direct benefits are assumed as 10% of the sum of benefit (i) and (ii). The willingness-to-pay of hotels is assumed as a sum of (i) water source saving benefit and (ii) other intangible direct benefits. In the same manner, other direct benefits are assumed as 10% of the sum of benefit (i).

5.3.3 Estimate of Unit Economic Benefits

(1) Benefits of Domestic Water

The water source saving benefit is estimated based on how the people in the project areas procure water source at present. According to “Public Awareness and Water Use Survey” by the JICA Study Team in 1997, procurement ways of water source in Siem Reap are classified into four types. They are (1) deep well with pump (Type A); (2) well with hand pump (Type B); (3) shallow open well (Type C); and (4) surface water intake (Type D). They are illustrated in Table 5.3.2.

Table 5.3.2 Systems' Specification of Potable Water Source Procurement in Residence in Siem Reap

Item	Type A	Type B	Type C	Type D
System	Deep Well with Pump	Well with Hand Pump	Shallow Open Well	Surface Water
Well	Depth: 30 ~ 40 m Diameter: 200 ~ 300 mm	Depth: 10 ~ 15 m Diameter: 100 ~ 150 mm	Depth: 5 m Diameter: 1 m	-
Pump	4m ³ /h × 50m × 750W	Hand Pump	-	-
Pump Operation	Manual On/Off Switching (Without Automatic Control)	Manual Only	-	-
Water Tank	Steel Made Tank of 1500 liters	-	-	-
Fuel for Boiling	LPG	Firewood	Firewood	Firewood
Family Labor for Fetching Water per Day*1	-	Wet Season: 30 minuets-man Dry Season: 30 minuets-man	Wet Season: 30 minuets-man Dry Season: 45 minuets-man	Wet Season: 45 minuets-man Dry Season: 60 minuets-man
System Flow Chart	<p>The diagram shows a cross-section of a house with a ground level (G.L.) indicated by a hatched line. Below the ground level is a well with a water level (W.L.) marked by a triangle. A pump (P) is located at the top of the well. A pipe leads from the pump to an elevated tank on the roof of the house. Another pipe leads from the elevated tank to the house.</p>	<p>The diagram shows a cross-section of a well with a ground level (G.L.) indicated by a hatched line. Below the ground level is a well with a water level (W.L.) marked by a triangle. A hand pump is mounted on the surface of the well, with a bucket attached to it.</p>	<p>The diagram shows a cross-section of a shallow open well with a ground level (G.L.) indicated by a hatched line. Below the ground level is a well with a water level (W.L.) marked by a triangle. A bucket is suspended from the top of the well, and a pipe leads from the bucket to the surface.</p>	
Composition *2	28%	50%	20%	2%

Source: Report on the Cambodian Socio-Economic Survey 1997, June 1998, MOP & UNDP

Remark: *1 Assumed on the basis of table A-31 in the source above.

*2 Assumed the composition in the service area on the basis of the social survey by JICA in 1997.

The water source costs consist of two main factors: investment cost and operation cost. In the case of Type A, for instance, the investment cost includes deep wells, pumps, elevated tanks, and connection pipes linking these facilities. The operation cost composes electric power, liquefied petroleum gas (LPG) for boiling to disinfect groundwater water, and some maintenance cost. On the other hand, Type D has no investment cost. However, it needs family labor to procure water source to their house from the source place. It also needs firewood for boiling to disinfect source water. The water source costs under present conditions were estimated as follows: US\$ 1.20 per m³ for Type A; US\$ 0.46 per m³ for Type B; US\$ 0.41 per m³ for Type C; and US\$0.31 per m³ for Type D. The details of estimation are tabulated in Table 5.3.3. Figure 5.3.1 illustrates source costs of the respective types.

The cost components are furthermore classified into two parts: visible portion and invisible portion. In type A, for example, the operation costs such as electric power and LP gas for boiling are paid every month. The family realizes these costs usually. These costs are perceived as visible portion. This portion is estimated as US\$ 0.38 per m³ for Type A. For Type D, that becomes only US\$ 0.06 per m³. The water source costs of visible portion for all types are lower than the new tariff approved in 1999.

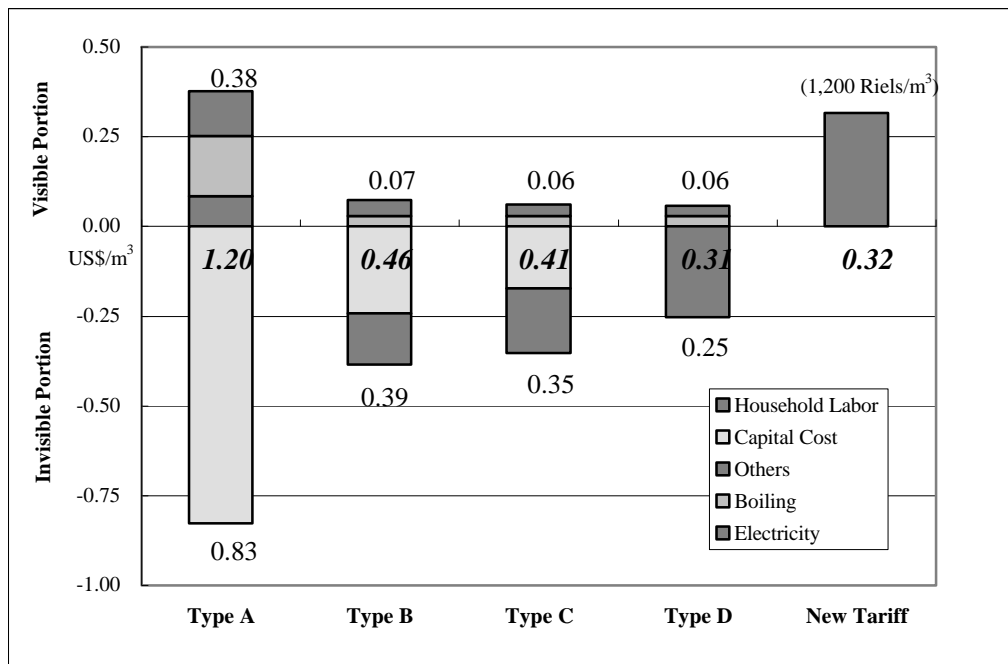


Figure 5.3.1 Water Unit Cost of Domestic Use by Type

Table 5.3.3 Water Source Cost of Potable Water in Residence by Type

(Unit: US\$ in Market Prices)

Item	Type A	Type B	Type C	Type D
	Deep Well with Pump	Well with Hand Pump	Shallow Open Well	Surface Water
1 Equipment Costs (US\$)				
1) Well Digging	350	130	200	-
2) Piping System	180	80	-	-
3) Piping in Yard	50	25	-	-
4) Water Tank	250	-	-	-
5) Piping to Tank	30	-	-	-
6) Miscellaneous (10% of 1) to 5))	86	24	20	-
Total	946	259	220	0
2. Operation & Maintenance Costs (US\$/year)				
1) Electricity	17.6 *1	-	-	-
2) Maintenance *2	18.9	5.2	2.2	0.0
3) Boiling for Potable Water*3	34.8	6.0	6.0	6.0
4) Household Labor for Fetching Water	-	30.0	37.4	52.4
5) Miscellaneous (10% of 1) to 4))	7.1	4.1	4.6	5.8
Total	78.5	45.3	50.2	64.3
3. Annual Costs for Water of Domestic Use (US\$/year)				
1) Annualized Equipment Costs *4				
a. Facilities except Pump	124.6	29.0	35.8	0.0
b. Pump	47.5	21.1	0.0	0.0
2) O&M cost	78.5	45.3	50.2	64.3
Total	250.6	95.5	86.0	64.3
4. Annual Water Demand (m3/year) *5	208	208	208	208
5. Water Source Cost (US\$/m3) under Present Conditions	1.20	0.46	0.41	0.31

Remarks: *1 570 lit / 4,000 lit/h X 0.75 kW / 60% X 365 days X 1030 Riels/kWh / 3800 Riels/US\$

*2 Assumed at the following percentage of equipment costs in a year: 2% for type A and type B, and 1% for type C.

*3 Assumed that 2% of the total volume was boiled by using liquefied petroleum gas for Type A, and firewood for Type B, C and D.

The volume above includes water for directly drinking purposes except for hot water purposes.

Energy consumption = 208 m3/year X 2% X (100 - 25) = 312,000 kcal/year

Type A: Gas cost = 156,000 kcal/year / 60% (efficiency) / 9,000 kcal/kg * (US\$9/15kg) = US\$34.8/year

Type B, C and D: Firewood cost = 156,000 kcal/year / 20% (efficiency) / 3,500 kcal/kg * 50 Riels/kg / 3,800 Riels/US\$ = US\$6.0/year

*4 In order to calculate annualized costs, Capital Recovery Factor (CRF) is applied on condition that an economic life (n) is 5 years for pump and 10 years for other equipment, and an interest rate (r) is 10%.

Hence, $CRF = r / (1 - 1 / (1 + r)^n)$

Then, CRF of equipment = 0.1627 and CRF of pump = 0.2638

*5 Estimated on the basis of average family size of 5.7 persons and unit consumption of 100 liter/day/capita

On the other hand, the capital cost is paid at the first investment time, so it is not conceived as monthly charges. However, it should be counted as a part of water source costs. Then, it is converted to annualized cost, applying Capital Recovery Factor (CRF). For Type A, the annualized capital cost is estimated at US\$ 0.83 per m³. Furthermore, the cost of family labor is not charged as water procurement cost in general. Thus, the cost is also conceived as invisible portion. The family labor cost is estimated at US\$ 0.25 per m³ for Type D, for example.

As mentioned above, the total water source costs are estimated as US\$ 1.20 per m³ for Type A; US\$ 0.46 per m³ for Type B; US\$ 0.41 per m³ for Type C; and US\$ 0.31 per m³ for Type D. These costs could be eliminated once the water supply project is introduced in the project site. According to the social survey in 1997, these types are composed as follows: 28% for Type A, 50% for Type B, 20% for Type C and 2% for Type D. Finally, the weighted average water source cost was estimated as US\$ 0.66 per m³. However, the water source value was estimated in market prices. In economic evaluation, these values are converted to economic value. Applying conversion factors of 0.9 for general cost items and 0.6 only for unskilled labor cost item, the economic source water value was converted to US\$ 0.57 per m³ in economic terms.

In addition to water source saving benefit, the public health improvement benefit was estimated as reduction of medical expenses by beneficiaries and as the same time reduction of labor opportunity losses due to illness. The amounts of these losses are estimated on the basis of medical data which were provided by “SocioEconomic Survey 1997, National Institute of Statistics and UNDP” and which came from Ministry of Health, Headquarters and Provincial Department of Health in Siem Reap. The medical annual expenses were estimated at around 108,000 Riels per household in 1999. The annual labor losses were estimated at around 30,000 Riels per household. Then, the total annual losses due to ill conditions were estimated at 138,000 Riels or equivalent US\$ 36 per household. This estimation is shown in Table 5.3.4. The losses were re-calculated at US\$ 0.17 per m³, because a household consumed 208 m³ per year. Finally, it was converted to US\$ 0.16 per m³ per year in economic terms.

Accordingly, the water cost of domestic use in Siem Reap was estimated as at least US\$ 0.73 per m³, which includes not only visible portion but also invisible portion. In other words, the people in Siem Reap pay for around US\$ 0.73 per m³ on average to procure water.

Table 5.3.4 Household Medical Expenses and Losses due to Ill Health in Urban Areas

I. Percentage Distribution of Water Related Diseases*1 in Entire Diseases

		1997	1998	Applied Figure
1. Water Related Diseases in Entire Patients in Siem Reap (%) *2				
(1) Out-patients		100.0	100.0	} 20 %
1) Diarrhea		10.6	9.2	
2) Dysentery		9.6	9.8	
(2) In-patients		100.0	100.0	
1) Diarrhea		1.0	1.8	} 3 %
2) Dysentery		0.6	1.1	
3) Typhoid		0.9	1.3	
2. Age Distribution of Persons Suffering from any Illness or Injury (%) *3				
		1997		Applied Figure
	Less Than 9 Years Old	25.1		25 %
	More Than 10 Years Old	74.9		75 %
3. Average Household Size (persons per Household)				5.2

II. Annual Expenditure for Household Medical Treatment due to Water Related Diseases *3

	1997	1999*4
1. Out-patient Treatment (Riels/Household)	7,148	8,650
35,742 Riels/month×20%		
2. In-patient Treatment (Riels/Household)	303	367
10,104 Riels/month×3%		
3. Average Annual Expenditure for Medical Treatment (Riels/Household)	89,418	108,196
4. Annual Expenditure for Medical Treatment per 1,000 Population (in US\$)	4,525	5,476

III. Annual Losses due to Ill Health

1. Morbidity Rates of Patients	2.0%	
Who Stopped Doing Their Usual Activities *3 (% in Month)		
2. Mean Number of Days	5.9	
for Which They Stopped Doing Their Usual Activities (in Month)		
	1997	1999*4
3. Average Monthly Household Expenditure *3 (Riels)	403,253	487,936
4. Average Monthly Income (Assumed as the same as expenditure)	403,253	487,936
5. Number of Income Earners (Assumed on Average)	3.5	3.5
6. Average Monthly Income per Income Earner in Household	115,215	139,410
7. Income Losses due to Ill Health Condition (per Month per Earner) (Number of Days of Impairment)×(Average Income)	27,191	32,901
8. Average Monthly Losses due to Illness (Riels per Household) 5.2 persons ×2.0%×75%×(Income Losses of Patient)	2,097	2,537
9. Average Annual Losses due to Illness per Household (in Riels)	25,160	30,444
10. Average Annual Losses due to Illness per 1,000 Population (in US\$)	1,273	1,541

Remark: *1 The following three diseases: diarrhea, typhoid and dysentery.

*2 Refer to Table 2.7.3.

*3 Refer to "Other Urban Areas" in Table 2.7.2.

*4 Inflation rate was assumed at 10% per year as discussed in Table 2.4.1.

According to the social survey 1997, about 76% of respondents are willing to pay for future piped water supply. Once the people recognize the water resource cost and conceive intangible benefits shown in the benefit table, the willingness-to-pay could become more than this estimated value of US\$ 0.73 per m³. In this Study, it was assumed from the economic point of view that this willingness-to-pay might be 10% more than the estimated value, taking intangible direct benefits into consideration. Thus, it resulted in US\$ 0.80 per m³.

(2) Benefits from Hotel Water

The tourism is one of the most important industries in Siem Reap. More than 20% of the total water demand is occupied by hotel service sector. In this sector, thus, the water source saving benefit is considered to be one of the most important tangible benefits.

In this Study, two recent hotels were investigated in terms of water source procurement system and water supply facilities. The water system's specification is listed in the Table 5.3.5. The hotel example A gets water source from their two deep wells. The source water is lifted up to raw water tanks through water pumps. After that, it is filtrated and disinfected through filtration system and goes into a clear water tank. Then, the clear water is again lifted up to elevated tanks by main pumps. The clear water is distributed to guestrooms from the elevated tanks through gravity flow.

The installations enclosed by the dotted line in Table 5.3.5 would be eliminated, once the water supply system is introduced in the project areas. Some capacity of power generator for pumping groundwater could be eliminated as well, because the power generator is supplying electricity to operate pumps. Other installations are still necessary to function the water supply system in the hotel. Thus, the installations in the dotted line are considered to correspond to water source cost.

The hotel example B has a little different flow from the example A. Its basic flow is almost the same as the example A. Room capacity of the example B is almost twice as many as the number of guestrooms of the example A. Anyhow, the installations enclosed by the dotted line could be eliminated as mentioned in the previous paragraph, if the water supply system provides clear water to the hotel.

Table 5.3.5 Systems' Specification of Potable Water Source Procurement in Hotels in Siem Reap

Item	Example A	Example B
Water Demand	22 m ³ /day for 55 rooms	44 m ³ /day for 110 rooms
Wells	Well: 30m depth × 100 mm Number of Wells: 2 wells	40m depth × 200mm × 1 well; 30m depth × 60 mm × 3 wells; and 20m × 45 mm × 2 wells
Well Pumps	35mm × 0.2 m ³ /min × H30m × 1.5kW × 2 units	60mm × 0.4 m ³ /min × H60m × 5.5kW × 1 unit; and 5 pumps
Raw Water Tanks	15m ³ (3m ³ × 5 plastic tanks)	10m ³ (1 stainless steel tank)
Filter Pump	35mm × 0.2 m ³ /min × H30m × 1.5kW	N.A.
Filtration System	Filter tanks with chemical infusion	2 Filter tanks with chemical infusion
Clear Water Tank	30 m ³ (Underground receiving tank, RC made)	70 m ³ (Underground receiving tank, RC made)
Main Pumps	35mm × 0.2 m ³ /min × H30m × 1.5kW × 2 units	60mm × 0.4 m ³ /min × H40m × 3.7kW × 2 units
Elevated Water Tanks	12 m ³ (6 m ³ × 2 tanks, steel made)	120 m ³ (20 m ³ × 6 tanks, RC made)
Power Generator	Power generators are installed to cover the whole power demand in the hotel: 200 kVA; 150 kVA; and 30 kVA.	Power generators are installed to cover the whole electric power demand in the hotel.
Operation Technicians	One technician for operation and maintenance of water system and other mechanical installations	One technician for operation and maintenance of water system and other mechanical installations
System Flow Chart *1	<p>The diagram for Example A shows a water supply system. It includes two wells on the left, each with a well pump. A dashed box encloses the wells, pumps, raw water tank, and filtration system. Water flows from the wells through the pumps into a raw water tank, then through a filtration system into a clear water reservoir. From the reservoir, main pumps draw water and supply it to an elevated tank. The hotel is shown with a ground level (GL) line. A power generator and diesel engine are also connected to the system.</p>	<p>The diagram for Example B shows a water supply system. It includes three wells on the left, each with a well pump. A dashed box encloses the wells, pumps, raw water tank, and filtration system. Water flows from the wells through the pumps into a raw water tank, then through a filtration system into a clear water reservoir. From the reservoir, main pumps draw water and supply it to an elevated tank. The hotel is shown with a ground level (GL) line. A power generator and diesel engine are also connected to the system.</p>
Source	Hotel along route 6, established in 1997	Hotel along route 6, established in 1999

Remark: *1 The installations surrounded by the “” mark could be eliminated from the complete system when the water supply system is introduced.

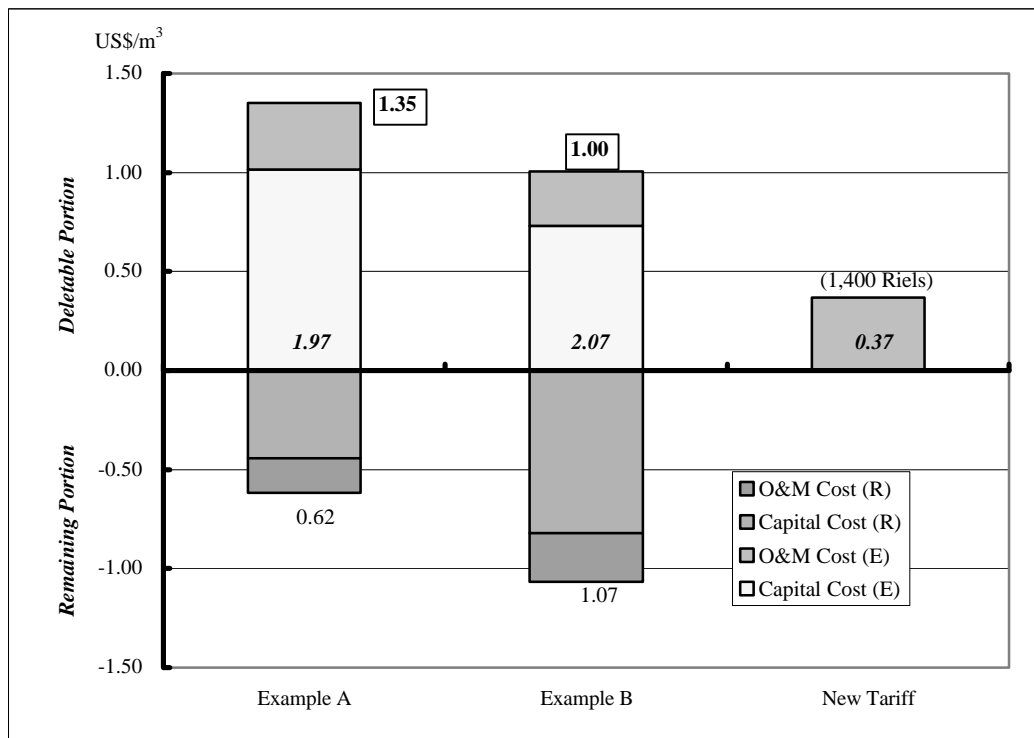


Figure 5.3.2 Water Source Costs of Hotels

The water source cost of the hotel is estimated in the same manner of the calculation for the domestic water. The water cost in the water system's installation is estimated at US\$ 1.97 per m³ for the example A and US\$ 2.07 per m³ for the example B, as shown in Table 5.3.6 and Figure 5.3.2. However, the water source cost is a part of the water costs, as mentioned above. The water source cost corresponds to the deletable portion. Then, the water source cost is US\$ 1.35 per m³ for the example A and US\$ 1.00 per m³ for the example B. Thus, the unit benefit of water source saving was estimated at US\$ 1.18 per m³ as an average of these examples. However, the water source value was estimated in market prices, so it was converted to US\$ 1.06 per m³ in economic terms, applying the conversion factor of 0.9. Furthermore, it was assumed from the economic point of view that the willingness-to-pay might be 10% more than the estimated value, taking consideration of intangible benefits in Siem Reap. Thus, it resulted in US\$ 1.16 per m³.

Incidentally, the water tariff for big consumers is 1,400 Riels per m³ in the new tariff approved in 1999. This is equivalent to US\$ 0.37 per m³. This unit price is quite small, as compared with the water source costs discussed above. The water source costs seem to be much higher than the present tariff. These phenomena might result in a good economic performance in the future.

Table 5.3.6 Water Source Cost of Potable Water in Hotels

Item	Example A				Example B			
	Number of Installed	Unit Price	Complete Amount	Deletable*1 Amount	Number of Installed	Unit Price	Complete Amount	Deletable*1 Amount
1 Installation Costs (US\$)								
1) Wells	2	200	400	400	6	350	2,100	2,100
2) Well Pumps	2	200	400	400	6	300	1,800	1,800
3) First Water Tank(s)	1	2,000	2,000	2,000	1	1,400	1,400	1,400
4) Filter Pump	1	200	200	200	-	-	-	-
5) Filtration System	1	11,000	11,000	11,000	1	10,000	10,000	10,000
6) Clear Water Tank (installed in hotel building)	1	3,000	3,000	0	1	10,000	10,000	0
7) Main Pumps	2	200	400	0	2	400	800	0
8) Elevated Water Tanks	1	1,900	1,900	0	6	2,000	12,000	0
9) Connecting pipes and structures of pumps, etc.	1	-	29,000	21,000	1	-	57,200	23,000
10) Power Generator (a part of entire power output)			8,300	5,000			24,900	18,800
Total			56,600	40,000			120,200	57,100
2. Operation & Maintenance Costs (US\$/year)								
1) Fuel for Power Generation *2			100	59			402	239
2) Maintenance *3			1,132	800			2,404	1,142
3) Change of Filter Contents *4			288	288			300	300
4) Operation mechanics			900	450			1,800	900
5) Miscellaneous (10% of 1) to 5))			242	160			491	258
Total			2,662	1,757			5,397	2,839
3. Annual Costs for Water of Hotel Use (US\$/year)								
1) Annualized Installation Costs *5								
a. Facilities except Pumps			7,417	5,181			15,675	7,272
b. Pumps			205	123			534	370
2) O&M cost			2,662	1,757			5,397	2,839
Total			10,284	7,061			21,606	10,481
4. Annual Water Demand (m3/year) *6			5,220	5,220			10,439	10,439
5. Water Source Cost (US\$/m3) under Present Conditions			1.97	1.35			2.07	1.00

Remarks *1 Costs of installations and O&M could be eliminated from the complete system owing to introduction of water supply system.

*2 (Pump operating hours for conveyance of water) / 60% X 365 days * 0.25 lit./kWh(generator efficiency) X \$0.3/lit(diesel oil)

*3 Assumed at 2% of installation costs in a year.

*4 Filter contents are changed at the cost of US\$120 per every 5 months for Example A case.

*5 In order to calculate annualized costs, Capital Recovery Factor (CRF) is applied on condition that an economic life (n) is 7 years for pump and 15 years for other installation, and an interest rate (r) is 10%.

Hence, $CRF = r/(1-1/(1+r)^n)$

Then, CRF of installation = 0.1315 and CRF of pump = 0.2054

*6 Assumed at an occupancy rate of 65%.

5.3.4 Estimate of Economic Benefits

The benefit of water supply services is calculated as a product of water volume consumed and unit economic benefit. As discussed above, unit benefits are US\$ 0.80 per m³ for domestic water and US\$ 1.16 per m³ for hotel water. Hence, a unit benefit of non-residential consumer other than hotel is assumed to be the same as that of hotel, i.e., US\$ 1.16 per m³. The total water consumption volume for the respective years during the project life is estimated in Section 4.1.

The total benefits were calculated as a product of unit economic benefits of the respective categories and total consumption volumes of the corresponding categories. Finally, the total economic benefits were estimated at US\$ 0.613 million in 2002 and US\$ 2.639 million in 2010. The details are shown in Table 5.3.7.

Table 5.3.7 Estimate of Economic Benefits

Item	2002	2010
I. Water Demand (1000 m ³ /Year)		
Domestic Demand	341	1,746
Non-residential Demand*1	292	1,068
Total	633	2,814
II. Benefit (US\$1000/Year)		
Domestic Demand	273	1,397
Non-residential Demand	340	1,242
Total	613	2,639

Note: *1 Special use is included in this category in economic analysis.

5.4 Economic Costs

The estimate of the proposed project was already described in Section 4.3 in this ANNEX. The estimate, however, was enumerated in market prices, what is called “financial value”. In economic evaluation, the financial value has to be converted into economic value. The procedure of this conversion was already discussed in Section 5.2 in this ANNEX.

The total economic cost of the proposed project was calculated at US\$ 13.2 million in the first stage and US\$ 2.3 million in the second stage. The economic costs are broken down in Table 5.4.1.

The construction costs are disbursed in compliance with the construction schedule of two years in the first stage. Then, the disbursement of construction costs is as follows: US\$ 1.530 million in 2000 and US\$ 11.683 million in 2001 for the first stage. In the second stage, US\$ 2.308 million is disbursed in 2006. In addition to these investment costs, the installation costs of connection works such as service pipes and water meter are invested in accordance with the increase of new consumers.

Table 5.4.1 Economic and Financial Costs of Proposed Project

(Unit: US\$ 1000)

Description	Financial Cost		Economic Cost	
	First Stage	Second Stage	First Stage	Second Stage
1. Construction Cost	11,242	1,963	10,118	1,767
2. Land Acquisition Cost	250	0	0	0
3. Administration Cost	225	40	207	37
4. Engineering Services	1,687	295	1,687	295
5. Physical Contingency	1,316	230	1,201	210
6. Price Contingency	1,472	253	0	0
Total	16,192	2,781	13,213	2,308

The pipeline facilities of the respective projects are considered to last 30 years long. So, the evaluation period is set up as 30 years. On the other hand, the machinery such as submersible pump and booster pump is considered to last 15 years. These machines have to be replaced during the system's life, as mentioned above. In the disbursement schedule, the replacement costs of these machines are appropriated every 15 years. Thus, these replacement costs were estimated in economic terms as follows: US\$ 1.599 million in 2016 and US\$ 0.376 million in 2021

After the evaluation period of 30 years, the replaced machines will still be able to work well, because they are in their durable period after the replacement. In the evaluation procedure, however, these residual values were neglected because they were quite small at the end of evaluation period.

The O&M cost is annually paid during the economic life of the proposed project. The O&M unit cost in economic terms was estimated at US\$ 0.122 per m³ during the first stage and US\$ 0.104 after the completion of the second stage. The annual O&M costs are tabulated in Table 5.5.1.

5.5 Economic Efficiency

Economic costs and benefits during the economic evaluation period are shown in Table 5.5.1. The evaluation indices were 10.5% of EIRR, 1.04 of B/C and US\$ 0.56 million of NPV. Thus, the proposed project could be viable from the economic point of view, because its EIRR exceeded the opportunity cost of capital, 10%.

Table 5.5.1 Economic Cost and Benefit Stream of Proposed Project

(Unit: US\$1000 in Economic Terms)

Year	Cost				Benefit			Balance
	Capital	O&M	Replacement	Total	Domestic	Non-Domestic	Total	
1	2000	1,530						-1,530
2	2001	11,683						-11,683
3	2002	168	55		273	340	613	390
4	2003	92	102		406	527	932	738
5	2004	102	156		562	743	1,305	1,047
6	2005	108	204		746	863	1,610	1,297
7	2006	2,384	240		894	941	1,835	-789
8	2007	132	274		1,100	1,019	2,119	1,713
9	2008	100	306		1,254	1,097	2,351	1,946
10	2009	50	325		1,329	1,169	2,498	2,123
11	2010	46	343		1,397	1,242	2,639	2,250
12	2011		343		1,397	1,242	2,639	2,297
13	2012		343		1,397	1,242	2,639	2,297
14	2013		343		1,397	1,242	2,639	2,297
15	2014		343		1,397	1,242	2,639	2,297
16	2015		343		1,397	1,242	2,639	2,297
17	2016		343	1,599	1,397	1,242	2,639	698
18	2017		343		1,397	1,242	2,639	2,297
19	2018		343		1,397	1,242	2,639	2,297
20	2019		343		1,397	1,242	2,639	2,297
21	2020		343		1,397	1,242	2,639	2,297
22	2021		343	376	1,397	1,242	2,639	1,921
23	2022		343		1,397	1,242	2,639	2,297
24	2023		343		1,397	1,242	2,639	2,297
25	2024		343		1,397	1,242	2,639	2,297
26	2025		343		1,397	1,242	2,639	2,297
27	2026		343		1,397	1,242	2,639	2,297
28	2027		343		1,397	1,242	2,639	2,297
29	2028		343		1,397	1,242	2,639	2,297
30	2029		343		1,397	1,242	2,639	2,297
31	2030		343		1,397	1,242	2,639	2,297
32	2031		343		1,397	1,242	2,639	2,297

Evaluation Indices NPV: 560 thousand US\$
 B/C: 1.04
 EIRR: 10.5%

Note: *1 Discounted at 10%

6 Socioeconomic Impacts

6.1 Impact on Regional Economy

It is obvious that commencement of construction works such as water supply project induces regional economy to activate in the sectors related to construction works as well as construction sector itself. In general, one unit of construction work could induce 1.50 to 2.00 units of economic effects in the national and regional economy. In other words, a construction work would bring about 50% to 100% ripple effect on related works in various economic sectors in monetary terms in addition to the said construction work. This effect could stimulate the regional economy in Siem Reap.

According to “Siem Reap 1998, Provincial Development Plan”, about a hundred thousand people were not unemployed, accounting for 22% of the labor force. The investment of the proposed project would activate the regional economy and at the same time create opportunities for temporary jobs during the construction period. Accordingly, it would be clear that the investment proposes new labor opportunities for the people unemployed and underemployed in the province.

6.2 Impact on Public Finance

The total investment cost was estimated at US\$ 16.2 million in the first stage and US\$ 2.8 million in the second stage, or 61.5 billion Riels and 10.6 billion Riels. The total amount of 72.1 billion Riels in these two stages accounts for 3.4% of the total expenditure of the central government in 1999. It also accounts for 19.0% of the capital expenditure. Although this amount is not disbursed within a year, it is still heavy burden for the government. As mentioned in Section 2.3 in this ANNEX, the capital expenditure of the central government has relied on the foreign project assistance generally so far. For implementation of this proposed project, there would be no other way that the capital cost would depend on foreign financial assistance.

Even so, the water supply business has to be managed as independent autonomous entity, after the project is implemented. To put this policy into practice, the following basic management principle should be carried out in the management of water supply business.

- (1) The revenue from water sales at least covers the O&M costs of water production during the initial operating period. In the future, it covers the whole water production costs.
- (2) Working fund is procured by the water supply entity not through public finance but through private self-financial options.
- (3) Taking into consideration of re-investment and replacement in the near future, surplus has to be reserved as much as possible in water supply management.

6.3 Impact on Household Economy

According to “Cambodia Socioeconomic Survey 1997”, the water charge of a family accounted for 1.4% of the total household expenditure in urban areas excluding Phnom Penh. The annual amount of the water charge was estimated at around 67,600 Riels on average, since the monthly amount was reported as 5,631 Riels. On the other hand, the annual total expenditure was also estimated at 4,839,000 Riels on average. Although the total income was not reported in the survey, it could be assumed as almost the same amount as the expenditure.

As of September 1999, the water rate of domestic use is 1,200 Riels per m³ as indicated in Table 3.2.2. Annual consumption of domestic water is estimated at 208 m³ per household, so annual charge is calculated as 246,200 Riels per household. An annual family income in 1999 is estimated at 5,855,000 Riels, which come from 4,839,000 Riels of annual income in 1997 mentioned in the previous paragraph and price increase rate of 10% per annum as mentioned in Section 2.5, a water charge of a household is estimated to account for 4.2% on average. This rate is much higher than that of 1.4% in the survey above. The rate is almost three times of the survey result of 1.4%. Thus, it might be a controversial issue that every domestic consumer within the service areas of water supply system could afford to accept this water tariff.

Yet, the World Bank report of “Investing in Development, 1985” described that the price of the minimum block of water is commonly set at 3 to 5 percent of household income, which experience suggests is affordable. The above rate of 4.2% seems to be within the block, although it is on the high side. Anyhow, the actual income of an average household is reported not to be more than the household expenditure, so the present tariff might appear to be expensive for the domestic consumers in water supply service areas.

As discussed in “Financial Evaluation”, the water rate of domestic water might be increased to 3.2 times more than the present one, if the capital investment is not subsidized by the public sectors and moreover if the water supply is managed on the basis of independent autonomy. In this case, a water charge of a household is estimated to account for 13% of the total household expenditure on average. Almost all households could not afford to accept water supplied by the water supply system.