

CHAPTER 6

ECONOMIC AND FINANCIAL ANALYSIS

CHAPTER 6 ECONOMIC AND FINANCIAL EVALUATION OF PROJECT

6.1 ECONOMIC EVALUATION

6.1.1 Identification Of Economic Benefit

(1) Basic Unit of Economic Water Price

The World Bank has developed a system called as ECOWAT model introduced for estimation of an economic benefit in potable water supply. This approach may also be applied to this Project too because that the Project is almost similar to it.

Basic concept of ECOWAT model to be applied to this Project may roughly be given as follows:

1) Premise

The water supplied by YCDC is not always potable. Almost of the people has already known that the water should be boiled for making drinkable one even if the water is distributed by YCDC. Nevertheless, the people have recognized that the water distributed by YCDC is the best water source for keeping comfortable human life. From this viewpoint, the water distributed by YCDC has dual value so called as (1) basic value and (2) economic value as saving amounts of people's burden to get water from other sources.

2) Basic Value of Water

Following Table 6.1 shows a summary of result of the Consumer Survey made by JICA Study Team in July 2001. Details are shown in Appendix T.1.

According to this Table, the people who do not connect with YCDC's piped water have used the water gotten from (1) private piped water, (2) common tube well, (3) protected dug well, (4) private water tanker, (5) neighbors' tap and/or well, (6) bottled water, and (7) water vendors with a rate of 25 Kyats/m³ of payment in average ranging from 1 Kyat/m³ to 66 Kyats/m³, and a volume of this water to be consumed is around 167 gallons/HH.day (equivalent to 22.775 m³/month, and 126 l/capita.day).

However, if they have no any systematic ways to take water as mentioned above, the people must take water from neighbor's tap and/or well at least with a rate of 66 Kyats/m³ of payment for drinking water and a volume of this water to be consumed is around 126 l/day per person. Furthermore, when they have no neighbors to give them water, they should buy water from water vendors with a rate of 1,320 Kyats/m³ as shown in the following Table 6.2. Therefore, this amount should be assumed as the upper limit of willingness of people to pay.

Table 6.1 Estimation of Existing Water Price Based on Household Expenditure

Description	Expenditure per HH (Kyats/month)	Existing water price estimated based on expenditure (Kyats/m ³)
Overall simple average	367	11.82
Average in HHs who connect with YCDC water supply	293	8.22
Average in HHs who do not connect with YCDC water supply systems	579	25.39
Private piped water	841	36.91
Common Tube Well	827	36.28
Protected dug well	13	0.59
Private water tanker	1,025	44.99
Neighbor's tap/well	1,512	66.38
Bottled water	1,052	46.18

(Note 1)

Average volume of water consumed:	Per day (gallons/HH)	Per month (gallons/HH)	Equivalent (m ³)*	Consumed water volume per person (litres/day)
Overall simple average of Yangon City Area	228	6,832	31	190
Average in HHs who connect with YCDC water supply systems	261	7,843	36	219
Average in HHs who do not connect with YCDC water supply systems	167	5,012	23	126

* 1 gallons = 4.546 litres.

(Note 2)

Average family size:	
Overall simple average	5.44 (persons/HH)
Average in HHs who connect with YCDC water supply systems	5.41 (persons/HH)
Average in HHs who do not connect with YCDC water supply systems	6.01 (persons/HH)

Source: Consumer Survey made by JICA Study Team, July 2001.

Table 6.2 Water Price in Case of Water Vendor

Description	Figures
Water volume packed in a drum	50 gallons
Equivalent to:	227 litres
Water price per drum	300 Kyats in average
Water volume to be consumed	5,012 gallons/HH/month
Total amount of expenditure	30,070 Kyats/HH/month
Unit price equivalent to:	1,320 Kyats/m ³

Source: Field investigation made by JICA Study Team in Nov. 2001.

In addition to the above, if they want to take direct drinkable water, they should buy bottled water with a rate of 6,000 Kyats/m³ as shown below:

Table 6.3 Drinking Water Price of Bottled Water

Description	Figures
Unit price of bottled water	120 Kyats/20ℓ bottle
Buying number of bottle	10 bottles/month
Expenditure	1,200 Kyats/HH/month
Unit price equivalent to:	6,000 Kyats/m ³

Sources: Field investigation made by JICA Study Team in Nov. 2001.

And these amounts of payment for water should be a saved amount of water for people because that, once people have connected with the piped water, people do not have to pay this amount again.

These values of water may also be regarded as saved amount of medical expenditure of the people because that the said amount of water getting from the other sources for keeping good health will not be needed to pay again once people have connected with the piped water.

3) Economic Value of Water

It is assumed that a ground water is an alternative water source as a representative. In this case, the people living in the Yangon City area have to pay at amount of 136 Kyats/m³ with total volume of water consumed is estimated at 126 l/day per person as shown in Table 6.4 hereunder.

Accordingly, a unit price of water is a sum of 136 Kyats/m³ as a water cost for using private wells in average. This price consists of construction cost of wells and hourly cost for drawing up and/or pumping up the water from the wells to each household in the collective house (like apartment house). This means that the public distributed water generally has an economic value by this amount.

Table 6.4 Water Price in Case of Private Deep Well

A. Capital Cost

Description	Unit	Capital cost						Total
		Cost of well to be newly constructed	Pumping facilities with compressor for well to be newly constructed	Cost of casing pipe for well	Under-ground water tank to be newly constructed	Pumping facilities from under-ground water tank to HH to be newly constructed	Cost of pipe from well to under-ground water tank	
Initial investment cost of well facilities	Kyat	30,000	115,000	48,576	200,000	35,000	25,500	
Price increasing rate	%	13.00%	13.00%	13.00%	13.00%	13.00%	13.00%	
Life time	Year	10	10	10	20	10	10	
Capital recovery factor		0.18429	0.18429	0.18429	0.14235	0.18429	0.18429	
Annualized cost	Kyat/annum	5,529	21,193	8,952	28,471	6,450	4,699	
Annualized capital cost per HH***	Kyat/HH annum	691	2,649	1,119	3,559	6,450	4,699	19,168

B. OM Cost

Description	Unit	Capital cost					Total	
		Expenditure for electricity for pumping facilities for well**	Repairing cost of pumping facilities for well to be newly constructed	Cleaning for under-ground water tank*	Expenditure for electricity for pumping facilities for HH from under-ground water tank**	Repairing cost of pumping facilities for HH from under-ground water tank		
Annualized capital cost of well facilities	Kyat	36,500	15,000	2,000	5,475	6,500		
Price increasing rate	%	13.00%	13.00%					
Life time	Year		2					
Capital recovery factor		0.59948	0.59948					
Annualized cost	Kyat/annum	36,500	8,992	2,000	5,475	6,500		
Annual OM cost per HH***	Kyat/HH annum	4,563	1,124	250	5,475	6,500	17,912	
(Note) *: 2 persons ordered out per time. 1,000 Kyat per person. Once a year.		Monthly expenditure for water per HH consisting of capital and OM costs					3,090	(Kyat/HH/month)
**: Electricity tariff: 25 Kyat/kWh for compressor and 10 Kyat/kWh for HH's pump, and 4 hours working per day for well and 1.5 hours per day for HH.		Equivalent to					136	(Kyats/m ³)
***: Number of family members are 8 persons according to a result of the interview survey. So, the calculation results are rather		Monthly expenditure for water per HH OM costs only					1,493	(Kyat/HH/month)
Source: Field interview survey made by JICA Study Team in Nov. 2001.		Equivalent to					66	(Kyats/m ³)

4) Basic Cost of Supplied Water as an Incremental Benefit for the People

Principally, the basic unit of raw water should be estimated taking an existing water transportation/distribution system into account because the system exists already. However,

the cost for this existing system is not clear at present, so that the initial investment cost of this system can not be made clearly to allocate for existing YCDC water supply system.

Therefore, it should be necessary to take another approach to estimate the basic unit of the raw water.

According to the result of the Consumer Survey made by JICA Study Team in July 2001, an end price of potable water connected with YCDC water supply system after treated in the water purification plant may be set at 8 Kyats/m³ as indicated in the above Table 6.1, and it has been cleared that around 24 % of the amount is the operation and maintenance cost (OM cost) for distribution according to the financial situation of the Water Supply Sector of YCDC. This proportion of the OM cost of the water price has been decreased from 40 % in 1991/92. However, the cost for house connection works itself should be burdened by people themselves without any subsidy from YCDC. Therefore, OM cost is no need to consider, but 50 % of an average distribution loss of water so called as an average unaccounted for distribution for water (UfW) should be taken into account.

On the other hand, it has also been cleared that the total common facilities cost consisting of capital and OM costs is around 68 Kyats/m³ with share rate of 50 % in private deep well as shown in the following Table 6.5.

Table 6.5 Breakdown of Water Cost in Private Deep Well

A. Total Cost of Water in Private Deep Well

	Kyats/HH per annum	Kyats/HH per month
Capital cost	19,168	1,597
Common facilities	12,717	1,060
Domestic facilities	6,450	538
OM cost	17,912	1,493
Common facilities	5,937	495
Domestic facilities	11,975	998
Total		3,090

B. Breakdown of Water Cost in Private Deep Well

	Kyats/HH per month	Equivalent to Kyats/m ³	Share rate (%)
Common facilities	1,555	68	50%
Capital cost	1,060	47	
OM cost	495	22	
Domestic facilities	1,535	67	50%
Capital cost	538	24	
OM cost	998	44	
Total	3,090	136	100%

(Remarks) Refer to Table 9.4.

(Note) Domestic facilities means households own facilities.

Based on the above mentioned information and data, the amount 68 Kyats/m³ is a suitable economic water price consisting of consumer surplus and lower limit of willingness of people to pay from the viewpoint that this amount is in-between lower limit of WTP of 8 Kyats/m³ indicated in Table 6.1 and upper limit of WTP of 1,320 Kyats/m³ indicated in Table 6.2. The amount of 6,000 Kyats/m³ in case of bottled water should be excluded as a special case.

Therefore, a basic unit of supplied water by just front of gates of households and/or buildings of collective houses (by the end of the second distribution main), in other words "domestic gate price of water" is estimated at amount of 68 Kyats/m³. Based on this amount, the economic benefit may be estimated taking the annual improvement of UfW and annual increasing of volume to be consumed.

(2) Basic Unit of Income Loss and Medical Expenditure

The Project may contribute to improve a water environment for the people living in Yangon City area. It means that a part of people's living environment could be improved.

If living environment will be improved by these kind projects, some of water borne disease may be decreased and, people's burden for medical cost or fees, or some amount of budget to use for hospitals may be decreased too.

According to information from Department of Health, total patients were 469,089 persons as of 1998 consisting of 241,871 of outpatients and 237,573 of inpatients in Yangon Division. A suffering rate of diseases to the total population was 13 %.

Also according to the information from Department of Health, annual average number of patients caused by water borne disease was 34,701 persons during last 10 years since 1991, and share rate to the total patients was 7.24 %.

On the other hand, the annual average revenue of hospitals in Yangon City area may be estimated at amount of 529.47 million Kyats per annum in average. Based on this information, unit medical cost per patient can be estimated at amount of 1,104 Kyats/patient. This amount of medical cost consists of revenue from patients (namely, the amount of medical expenditure of patients) and from subsidies of the Government.

Following Table 6.6 shows a summary of the information. Details are shown in Appendix T.2.

Table 6.6 Number of Patients and Medical Expenditure

Description	Figures	Suffering rate of overall disease to total population (%)	Remarks
Population	3,691,941		
Overall diseases	479,444	12.99%	To total population
Outpatients	241,871		
Inpatients	237,573		
Water borne disease	34,701		To overall diseases
Unit cost per patient		(Kyats/patient)	1,104

(Note) Annual average revenue of hospitals in Yangon City area consisting revenue from patients and subsidies from the Government.

1999/00	(million Kyats)	368.40
2000/01	(million Kyats)	600.00
2001/02	(million Kyats)	620.00
Annual average since 1999/00		529.47

Source: Ministry of Health.

Using the above mentioned data and information, an average saved amount of medical cost per patient can be estimated.

There should be another kind of benefit concerning the improvement of living environment. If people suffer diseases and should go to a hospital, they should not come to their working places. But in Yangon, if they can get a certificate from such hospitals, salaries or wages are not deducted in case of monthly basis of salaries and wages. However, owners of shops, offices or such working places as companies should pay salaries or wages to their employees without any productive activities of them.

According to the result of the Consumer Survey made by JICA Study Team in 2001, per capita income per month has been estimated at an amount of 22,364 Kyats/month. Following Table 6.7 shows its detail.

Table 6.7 Monthly Per Capita Income

Description	Family size (persons/HH)	Working members (persons/HH)	Income per HH (Kyats/m)
Overall township average	5.44	1.76	39,260
Township average in both of HHs who connect and do not connect with YCDC water supply system	5.41	1.78	36,404
Township average in HHs who do not connect with with YCDC water supply system	6.01	1.95	38,692
Per capita income in overall township average			22,364

Source: Results of the Consumer Survey made by JICA Study Team, July 2001.

From this monthly per capita income, daily per capita income can be estimated at 1,017 Kyats/day (= 22,364 Kyats/month ÷ 22 working days). Saving amount of salaries and/or wages to be decreased due to diseases can be estimated by using the above mentioned unit income per day multiplying the above mentioned suffering rate of water borne diseases and

following number of days to visit to hospitals for outpatients, and average duration of stay in hospitals in days for inpatients according to the designed service population.

Table 6.8 Visited Days of Outpatients and Duration of Stay of Inpatients To and In Hospitals

Description	Figures
Outpaties	
Administration	241,871
Total outpatients in a year as of 1998	576,756
Average days visited to hospitals	2.38
Inpatients	
Total inpatient-days	1,903,482
Number of discharges and deaths	237,573
Average duation of stay in hospitals	8.01

Source: Hospital Statistics Annual Report 1998, Ministry of Health.

Generally speaking, this kind project can contribute with a rate of around 30 % decrease of water borne diseases based on the similar project in developing countries. But in this case, it consists of both the improvement of potable water supply systems and sanitation systems. In this Project, only the water supply systems are included, so that it is assumed that the Project can contribute with a rate of only 15 % to decrease the suffering rate of water borne diseases.

(3) Identification of Economic Benefit

In the Project, 3 kinds of construction works are proposed for improvement of water supply systems in Yangon City as (1) facilities to take water from the Hlaing River, (2) facilities to take water from reservoirs, and (3) facilities to take water utilizing ground water. Therefore, the whole construction works should be divided into several packages of the works taking construction schedule, technical limitation, and water supply planning into account. After that, water supply volume and service population can be clarified. Annual economic benefits may be estimated from the water supply volume and service population multiplying the said basic unit of the benefits.

1) Economic Benefit in Potable Water Supply

As mentioned above, the basic unit of economic benefit for potable water supply is a sum of 68 Kyats/m³ (equivalent to US\$14/m³) as of 2000. In this case, the incremental benefit may be estimated at 60 Kyats/m³ (= 68 Kyats/m³ - 8 Kyats/m³) for economic evaluation. And, this amount should be converted into present value. As indicated in Table 9.25 in the Master Plan Study, average price increasing ratio was around 18 % per annum during last 17 years. Conservatively, it can be estimated at 73 Kyats/m³ (= 60 Kyats/m³ × (1+0.1)²) as an incremental economic benefit of potable water as of the year 2002.

The construction may be divided into 2 phases as (1) from the beginning of the construction works to the end of 2010 and (2) from the beginning of the year 2011 to the end of 2019 so that the economic and financial benefit due to the Project will realize in 2020 as the target year.

And, the former one, namely the Phase-1 of the Project, is the subject works for feasibility study. Using the water volume to be supplied by completion of Phase-1 works, annual economic benefit can be estimated. Table 6.9 hereunder shows an estimation result of economic benefit due to its water supply.

Table 6.9 Annual Economic Benefit in Potable Water Supply by Stage

Phase	Stage	Year	Water volume to be supplied due to the completion of the works (m ³ /day)	Incremental water volume to be supplied due to the completion of the works (m ³ /day)	Leaked volume to be improved (m ³ /day)	Total	Incremental annual water volume to be supplied (m ³ /annum)	Annual economic benefit	
								(Million Kyats)	(Equivalent to US\$1,000)
		2003	219,700					0	0
Phase-1	Stage-1	2004	232,900	13,200	150,145	163,345	59,620,938	4,352	8,705
		2005	277,900	58,200	160,063	218,263	79,666,047	5,816	11,631
		2006	512,000	292,300	169,976	462,276	168,730,851	12,317	24,635
	Stage-2	2007	521,100	301,400	179,885	481,285	175,668,851	12,824	25,648
		2008	530,200	310,500	189,788	500,288	182,605,050	13,330	26,660
		2009	539,400	319,700	199,686	519,386	189,575,950	13,839	27,678
		2010	823,000	603,300	209,580	812,880	296,701,051	21,659	43,318

(Note 1) Unit value of benefit: 73 (Kyats/m³)

(Note 2) Exchange rate: 500 Kyats = US\$1.00

This Phase consists of 2 stages as Stage-1 and Stage-2 works. Stage-1 includes the works for the period from the year 2004 to 2006, and Stage-2 for the period thereafter to 2010.

2) Saving Amount of Medical Expenditure

The unit value of the medical expenditure is a sum of 1,104 Kyats/patient as mentioned above. Saving amount of medical expenditure as the other kind of economic benefit of the Project can be estimated on the basis of this amount multiplying the number of patients.

Number of patients may be estimated by the water volume to be supplied divided by the average water consumption volume of 140 ℓ/day per person as mentioned above taking suffering rate of water borne diseases. Following Table 6.10 shows the estimation result.

Table 6.10 Annual Economic Benefit in Saving of Medical Expenditure by Phase

(Figures are incremental ones and after completion of works of each phase)

Stage	Water volume to be supplied due to the completion of the works (m3/day)	Annual volume to be supplied (m3/annum)	Service population (persons)	Number of patients*		Medical expenditure by water borne diseases (Million Kyats)	Annual saving amount of medical expenditure	
				Overall diseases	Water borne diseases		(Million Kyats)	(Equivalent to US\$1,000)
Stage-1	512,000	186,880,000	2,560,000	332,544	24,076	27	4	8
Stage-2	311,000	113,515,000	1,555,000	201,995	14,624	16	2	5

(Note 1) Average volume of water consumption

140 (l/day)

(Note 1) Share rate of water consumption of domestic customer

70% (of the total water volume to be supplied)

(Note 2) Suffering rate of overall diseases

12.99% (to the total population)

(Note 3) Suffering rate of water borne diseases:

7.24% (to the overall diseases)

(Note 4) Unit value of medical expenditure:

1,104 (Kyats/patient per year)

(Note 5) Contribution rate of the Project to water borne disease

15.00% (to the total water borne diseases)

(Remarks) * Number of patients consist of outpatients and inpatients.

3) Saving Amount of Personal Income Loss

The unit value of the personal income is a sum of 1,017 Kyats/day (= 22,364 Kyats/month ÷ 22 working days) as mentioned above as per capita income per day. When the people have to visit hospitals, and/or to stay in hospitals, their income should be decreased by this amount daily. Even their actual salaries/wages might not be decreased caused by these medical cares, the employers have to pay salaries/wages to their employees without any productive activities for the working places, and this may also be called as an income loss.

Saving amount of income loss due to the medical cares as the another kind of economic benefit of the Project can be estimated on the basis of this unit value multiplying the number of patients and their number of days to visit to the hospitals (= 2.37 days/annum in average) for outpatients, and duration in days in hospitals (= 8.01 days/annum in average) for inpatients both as mentioned above.

Number of patients may be estimated based on the service population derived from the water volume to be supplied divided by the average water consumption volume of 140 l/day per person as mentioned above taking suffering rate of water borne diseases. Following Table 6.11 shows the estimation result.

Table 6.11 Annual Economic Benefit in Saving of Income Loss by Phase

(Figures are incremental ones and after completion of works of each phase)

Stage	Water volume to be supplied due to the completion of the works (m ³ /day)	Annual volume to be supplied (m ³ /annum)	Service population (persons)	Working population (persons)	Number of inpatients*		Number of outpatients*		Income loss in total (Million Kyats/annum)			Annual saving amount of income loss	
					Overall diseases	Water borne diseases	Overall diseases	Water borne diseases	In-patients	Out-patients	Total	(Million Kyats)	(Equivalent to US\$1,000)
Stage-1	512,000	186,880,000	2,560,000	831,197	53,502	3,874	54,470	3,944	32	10	41	6	12
Stage-2	311,000	113,515,000	1,555,000	504,887	32,498	2,353	33,086	2,395	19	6	25	4	7

- (Note 1) Average volume of water consumption: 140 (l/day)
 (Note 2) Suffering rate of overall diseases: 12.99% (to the total population)
 (Note 3) Average number of inpatients per year: 237,573 (persons/annum)
 (Note 4) Average number of outpatients per year: 241,871 (persons/annum)
 (Note 5) Suffering rate of water borne diseases: 7.24% (to the overall diseases)
 (Note 6) Unit value of income: 1,017 (Kyats/day per capita)
 (Note 7) Contribution rate of the Project to water t: 15.00% (to the total water borne diseases)
 (Note 8) Number of days to be needed to visit hospitals for outpatients: 2.38 (days/annum)
 (Note 9) Average duration to stay in hospitals for inpatients: 8.01 (days/annum)
 (Remarks) * Number of patients consist of outpatients and inpatients.

6.1.2 Identification of Economic Cost

(1) Assumptions for Identifying the Economic Cost

Economic cost of a project is identified as opportunity cost of the project. In this case, if goods and services would be invested in the project under study, they could no longer be utilized for other projects. This implies that the benefits of the other projects could have been created would be sacrificed. These sacrificed benefits of the other projects are called opportunity cost of the project. A project cost consists of foreign currency portion and local currency portion.

Firstly, a gross construction cost is estimated based on unit prices and work volume, and this gross construction cost includes net construction cost, engineering cost for detailed design and supervision, cost for administration, corporation tax, compensation cost for land and/or building to be removed, physical contingency and price contingency.

For calculation of the Project cost, a foreign exchange rate of 500 Kyats = US\$1.00 = Yen 130.00 is applied.

1) Foreign Currency Portion

Using the said financial gross construction cost, an economic cost of the Project is estimated. In this study, the net construction cost includes labor cost, cost for materials, and cost for equipment. For the foreign currency portion, these costs for labor, materials and equipment are usually estimated in Cost-Insurance-Freight price (CIF-price) as the border price. These international prices are assumed to reflect economic cost directly.

Corporation tax is not included in the foreign currency portion because that the said tax should be paid by local currency based on the taxation regulation in Myanmar.

For economic evaluation of the Project, such transfer cost as contractor's overhead and profit should be deducted from the local currency portion, and price contingency should be excluded because that comparison of cost and benefit is made by present value.

2) Local currency portion

Because it is presumed that price controls and other regulations distort local markets in developing countries, prices in the domestic markets do not reflect economic scarcity of goods and services. This means that the prices can not be used to identify economic costs of local procurement and have to be converted into economic prices.

In economic analysis of a project, conversion factors are used to convert the costs in domestic markets into economic costs of the project.

Usually using export and import statistics, and the record of import customs and/or export duties as a part of the Government revenue, a standard conversion factor (SCF) is estimated first.

The SCF is expressed by the following formula:

$$SCF = \frac{I + E}{(I + I_{customs}) + (E - E_{tax} + E_{subsidy})}$$

Where, SCF= standard conversion factor,

I= import amount,

E= export amount

$I_{customs}$ = import customs

E_{tax} = export tax, and

$E_{subsidy}$ = export subsidies.

Following tables show the actual revenue and expenditure of Myanmar and a situation of tax revenue of the nation.

**Table 6.12 Summary of Central Government Budget During Last 10 Years
Since 1990/91**

	(Million Kyats)									
Items of revenues and expenditures	1990/91	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000	
Revenues	14,837.0	21,472.0	28,145.0	32,766.4	40,370.9	55,253.6	88,695.7	118,034.7	107,666.5	
Internal Receipts	14,584.2	20,993.9	27,525.2	32,187.3	39,594.1	54,832.3	86,783.2	116,961.4	107,005.8	
Current account	14,045.1	19,323.0	26,013.6	31,308.1	38,447.1	54,089.0	85,728.7	115,814.3	106,422.9	
Taxes	9,416.7	12,562.6	17,036.1	20,101.2	22,643.7	31,357.0	49,429.2	56,653.0	49,919.8	
Ministries and Departments	1,194.6	1,763.6	2,341.4	3,012.1	5,294.8	6,089.6	9,435.3	15,472.1	12,085.5	
Earnings from the State enterprises	3,433.8	4,996.8	6,636.1	8,194.8	10,508.6	16,642.4	26,864.2	43,689.2	44,417.6	
Capital account (Ministries/Departments)	44.6	892.0	1,198.4	599.0	850.8	490.9	803.4	79.5	407.6	
Financial account	494.5	778.9	313.2	280.2	296.2	252.4	251.1	1,067.6	175.3	
Public debt	492.8	364.2	304.1	276.4	241.7	241.5	213.0	191.9	171.2	
Investment	1.7	414.7	9.1	3.8	54.5	10.9	38.1	875.7	4.1	
Foreign Receipts	252.8	478.1	619.8	579.1	776.8	421.3	1,912.5	1,073.3	660.7	
Foreign loans	141.1	120.2	163.6	149.7	32.0	0.0	301.4	549.3	183.2	
Current loans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Capital loans	141.1	120.2	163.6	149.7	32.0	0.0	301.4	549.3	183.2	
Foreign grants and aids	111.7	357.9	456.2	429.4	744.8	421.3	1,611.1	524.0	477.5	
Current receipts	26.6	289.9	377.5	333.9	678.4	380.1	1,581.4	464.5	422.7	
Capital receipts	85.1	68.0	78.7	95.5	66.4	41.2	29.7	59.5	54.8	
Expenditures	21,708.2	28,494.9	35,888.6	48,493.2	65,527.5	80,439.6	98,462.0	124,751.9	145,403.3	
Current Account	15,381.6	18,045.6	23,280.3	27,654.0	32,875.3	37,009.9	47,836.7	62,953.2	84,523.4	
Ministries and Departments	12,841.4	16,419.5	20,089.4	23,983.8	27,426.2	29,599.2	37,567.5	43,267.9	51,997.9	
Interest	159.6	1,056.5	1,994.4	2,411.3	3,566.4	5,617.4	7,625.0	11,587.7	17,706.9	
Contributions	2,380.6	569.6	1,196.5	1,258.9	1,882.7	1,793.3	2,644.2	8,097.6	14,818.6	
Capital Account (Ministries and Departments)	6,050.1	9,756.8	12,303.9	20,145.4	31,820.9	42,919.6	50,365.0	60,918.7	60,396.1	
Financial Account	180.4	676.5	303.7	615.4	818.5	510.1	260.3	880.0	383.8	
Public debt	125.6	151.3	289.2	250.2	639.8	452.5	227.0	221.9	266.1	
Investment	54.7	525.2	14.4	365.1	178.7	57.6	33.3	656.8	117.7	
Savings	0.1	0.0	0.1	0.1	0.0	0.0	0.0	1.3	0.0	
Reserve fund	96.1	16.0	0.7	78.4	12.8	0.0	0.0	0.0	100.0	
Pre-financing deficit/surplus	-6,871.2	-7,022.9	-7,743.6	-15,726.8	-25,156.6	-25,186.0	-9,766.3	-6,717.2	-37,736.8	

Source : Statistical Year Book 2000, Central Statistic Organization.

Table 6.13 Situation on Tax Revenue of the Nation

	(million Kyat)									
Taxes and Duties	1990/91	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	
Taxes on Production and Expenditures	3,941.5	5,723.8	7,302.4	8,318.8	9,593.0	13,284.4	23,990.1	29,136.2	28,434.3	
Commodities and services taxes	199.2	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	
Import license fees	160.5	148.0	200.0	203.0	217.4	220.0	173.9	214.0	170.0	
State lottery	423.5	1,119.4	1,335.3	1,494.7	1,530.0	2,166.4	3,684.1	4,223.8	4,500.0	
Stamps	97.6	261.3	279.7	348.6	490.3	930.4	1,169.0	769.7	600.3	
Transportation tax	46.3	60.8	78.6	78.1	116.1	346.5	758.1	985.3	964.0	
Excise	19.2	46.3	75.7	102.4	117.5	142.3	172.8	223.8	200.0	
Commercial tax	2,995.2	4,088.0	5,333.1	6,092.0	7,121.7	9,478.8	18,029.3	22,719.6	22,000.0	
Customs Duties	2,031.4	2,771.2	3,938.4	4,021.6	4,465.3	7,807.6	8,579.0	5,175.9	5,000.0	
Taxes on Income and Profit	2,806.3	3,180.3	4,640.6	6,740.9	7,793.3	9,216.8	15,276.2	20,514.8	14,910.1	
Taxes on Use of State Properties*	637.5	887.3	1,154.7	1,019.9	792.1	1,048.2	1,583.9	1,826.1	1,575.4	
Land revenue	45.1	49.2	47.0	70.2	59.8	59.2	64.2	66.6	65.0	
Taxes on extraction of forest produce	355.5	503.7	666.2	490.1	275.0	427.1	732.6	692.3	809.4	
Taxes on extraction of mineral produce	5.2	5.8	10.9	13.1	13.2	14.1	16.7	15.3	13.0	
Taxes on fisheries	212.8	308.6	416.9	417.6	418.4	525.2	741.1	1,028.5	665.5	
Water and irrigation tax	18.7	18.4	13.7	26.7	21.9	19.6	26.1	22.4	22.0	
Taxes on rubber	0.2	1.6	0.0	2.2	3.8	3.0	3.2	1.0	0.5	
Total	9,416.7	12,562.6	17,036.1	20,101.2	22,643.7	31,357.0	49,429.2	56,653.0	49,919.8	

Source: Statistical Yearbook 2000, Central Statistic Organization.

(Note) *: Principally, land and all the things on the land are the Government properties. Therefore, the Government levies the taxes on utilizing these things. But some development committees have been transferred these right to use. For example, YCDC has its own water tariff system.

International trade institution is also needed to make clear as a factor for calculation of the SCF. Following Table 6.14 shows a summary of the international trade of Myanmar.

Table 6.14 Summary of International Trade of Myanmar

(million Kyat)				
Year	Export		Import	Trade balance
1985/86	2,566.1		4,802.0	-2,235.9
1990/91	2,952.6		5,522.8	-2,570.2
1992/93	3,590.0		5,365.3	-1,775.3
1993/94	4,227.8		7,923.3	-3,695.5
1994/95	5,405.2		8,332.3	-2,927.1
1995/96	5,032.7		10,301.6	-5,268.9
1996/97	5,487.7		11,778.8	-6,291.1
1997/98	6,446.8		14,366.1	-7,919.3
1998/99	6,755.8		16,871.7	-10,115.9
1999/00	7,103.3		16,264.8	-9,161.5
Annual increasing rate	7.54%		9.11%	

Source : Statistical yearbook 2000, Central Statistic Organization.

Based on the Tables 6.12, 6.13 and 6.14, following factors can be cleared:

Table 6.15 Summary of Custom Duties

(million Kyat)						
Year	Domestic trade		Foreign trade		Total	
	Export tax	Import duty	Export tax	Import duty	Export tax	Import duty
1995/96	72.8	3,910.0	25.0	457.4	97.8	4,367.4
1996/97	76.2	6,997.0	35.4	698.9	111.6	7,695.9
1997/98	72.4	6,925.4	109.2	1,472.0	181.6	8,397.4
1998/99	64.6	4,034.3	1.5	1,075.6	66.1	5,109.9
1999/00	5.1	4,489.4	0.0	679.2	5.1	5,168.6

Source: Selected Monthly Economic Indicators, Nov.-Dec. 2000, Central Statistical Organization.

Using these data, the SCF can be estimated as shown in the following Table:

Table 6.16 Standard Conversion Factor

Year	Import amount	Export amount	Import duties	Export tax	Excise
1995/96	10,301.6	5,032.7	457.4	25.0	117.5
1996/97	11,778.8	5,487.7	698.9	35.4	142.3
1997/98	14,366.1	6,446.8	1,472.0	109.2	172.8
1998/99	16,871.7	6,755.8	1,075.6	1.5	223.8
1999/00	16,264.8	7,103.3	679.2	0.0	200.0
Total	69,583.0	30,826.3	4,383.1	171.1	856.4
				SCF=	0.95195

However, the SCF is applied to only tradable goods. The economic cost of non-tradable goods and services has to be separately evaluated. Conversion factors of land, skilled and non-skilled labors are respectively estimated.

Economic wage of unskilled laborers to be employed for the construction works is assumed to be 50 % of the actual market wage, taking of the employment opportunity of laborers in the study area.

There is no any land acquisition and removal of buildings and/or houses in this Project. So that, the opportunity cost of land is no need to take into account.

Such transfer items as personal and/or corporation income tax, contractors profit and so on should be deducted from the financial cost in case of converting into economic cost. It is temporary assumed that tax rate and contractors profit are respectively 10 % of the construction cost.

(2) Identification of Economic Cost

On the basis of the above mentioned assumptions, the economic cost of the Project as the initial investment cost is estimated by using the financial cost as mentioned in Chapter 5.

Table 6.17 Annual Disbursement of Financial and Economic Cost

(US\$1,000)

Phase	Stage	Year	Overall Project		
			Financial	Economic	
Phase-1	Stage-1	2003	0	0	
		2004	33,585	29,293	
		2005	35,264	30,594	
		2006	129,892	111,774	
	Stage-2	2007	97,844	84,967	
		2008	187,693	157,302	
		2009	144,989	121,934	
		2010	183,101	154,949	
		Phase-1 total		812,366	690,813

Detail of estimation of economic cost converted from financial cost is shown in Appendix T.3. Operation and maintenance cost (OM cost) is to be considered.

Operation and maintenance cost (OM cost) is to be considered. The OM cost consists of personal cost, electricity cost, cost of chemicals and costs for inspection and repairing for water purification plant and other facilities to be newly constructed. The OM cost is estimated by each item as shown in Appendix T.3. Following Table 6.18 shows its detail.

Table 6.18 Annual Operation and Maintenance Cost by Phase

(US\$1,000)

OM work items	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Personal cost	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6
Electricity cost	10	10	199	337	415	415	487	487	487	487	487	487	487	487	487	487	487
Chemical cost	192	192	600	600	928	928	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666
Inspection/repairing cost					791		0	1,076	1,076				1,076				1,076
Financial total	207	207	804	943	2,140	1,349	9,159	9,159	10,234	9,159	9,159	9,159	10,234	9,159	9,159	9,159	10,234
Economic cost	104	104	403	472	1,072	676	4,587	4,587	5,125	4,587	4,587	4,587	5,125	4,587	4,587	4,587	5,125

(US\$1,000)

OM work items	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Personal cost	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Electricity cost	487	487	487	487	487	487	487	487	487	487	487	487	487	487	487	487	487
Chemical cost	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666	8,666
Inspection/repairing cost				1,076				1,076				1,076					1,076
Financial total	9,159	9,159	9,159	10,234	9,159	9,159	9,159	10,234	9,159	9,159	9,159	10,234	9,159	9,159	9,159	10,234	9,159
Economic cost	4,587	4,587	4,587	5,125	4,587	4,587	4,587	5,125	4,587	4,587	4,587	5,125	4,587	4,587	4,587	5,125	4,587

Replacement cost is assumed at 35 % of the direct construction cost. And it is needed at every 20th years after completion of every facility.

6.1.3 Economic Evaluation

The economic benefit and cost should be compared for economic evaluation of the Project. In this case, the benefit and cost should be compared with their present values. For converting the present value, it is assumed a discount rate of 10 % based on similar projects in developing countries.

Project life is set as 50 years after the completion of the construction works based on the similar project in developing countries.

The detail economic evaluation processes are shown in Appendixes T.4 through T.6 attached herewith.

Generally, EIRR of the project under study should be higher than the applied discount rate as an opportunity cost of capital. According to the said Appendixes, the resulted EIRR is slightly higher than the said discount rate in overall works of Phase-1 as 5.03 %. And, it indicates that the EIRR of Stage-1 is quite high as 16.62 %. It may be reflected in the subject of the works of Stage-1. The subject of the Stage-1 mainly includes the rehabilitation works for existing facilities, so it can be expected high effect with low cost.

As suggested by such international institutions as the World Bank, an EIRR is expected to at least be cleared a hurdle of 5.0 % of EIRR from a viewpoint of basic human needs even such a project in developing countries. From this viewpoint, the resulted EIRR is cleared the said hurdle in the case of entire works of Phase-1 with 5.03 % of EIRR. Namely, the Project is sound from the viewpoint of basic human needs in case of executing entire works of Phase-1.

6.1.4 Sensitivity Analysis in Economic Aspect

For the works of Stage-2 or entire works of Phase-1, there is no point in making a sensitivity analysis because that the said resulted EIRR is too much low comparing with the said rate of opportunity cost of capital.

However, there is a point in making the sensitivity analysis for Stage-1 Works because the said EIRR is enough high comparing with the opportunity cost of capital and, this EIRR may change its value depending on the parameters employed for the calculation. Out of these parameters, the construction cost of the works and its benefit are the most important determinants of the economic analysis.

Therefore, a sensitivity analysis is made for 9 combined cases including base case under the benefit of -10 %, -20 % and the cost of +10 %, +20 % taking into account of CPI (the Consumer

Price Index). In Myanmar, the consumer price has been annually increased by the rate of around 18 % in the item “General” during the last 17 years from the 1980 to 1997.

Following Table 6.19 shows a result of sensitivity test, and it is illustrated in Fig.6.1.

Table 6.19 Result of Sensitivity Test

		Benefit alternative		
		Base	-10 %	-20 %
Cost alternative	Base	16.62%	14.43%	12.32%
	+10 %	14.63%	12.70%	10.82%
	+20 %	13.02%	11.28%	9.58%

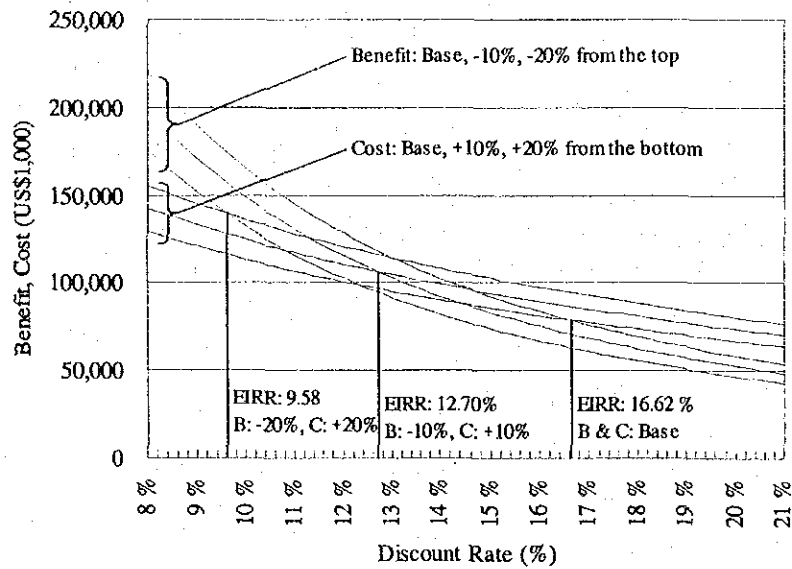


Fig 6.1 Result of Sensitivity Test

As indicated above Table and figure, even in most pessimistic case, the resulted EIRR is still keeping a nearly equal rate of opportunity cost of capital of 10 %. It means that the works of Stage-1 of Phase-1 has quite high feasibility to execute, and it may entirely be said that the Project can contribute to the people living in Yangon City to save their expenditure.

6.2 FINANCIAL EVALUATION

6.2.1 Identification Of Financial Benefit

(1) Identification of Financial Benefit

1) Water Price for Recovering the Full Cost to Be Needed

As mentioned in the report of Progress-1 (Master Plan Study), the unit price of water to be supplied is estimated at amount of US\$28.81/m³ (equivalent to 144 Kyat/m³) as a specific cost (levelized cost)* of capital and operation and maintenance for the whole Project completed in case of assuming that per capita water volume to be consumed is 140 l/day and average family size is 7 persons/HH. Following Table 6.20 shows its detail.

Table 6.20 Development of Modified Tariff System for Water Supply

Sector	Share rate of water volume to be consumed by sector	Existing tariff structure		Revenue by sector when total sold water volume is 1 m ³ without project	Necessary revenue by sector when total sold water volume is 1 m ³ with project in proportion of the existing tariff structure	Tariff structure with project in proportion of the existing tariff structure		Average expenditure for water per HH per month
		Kyats/1,000 gal.	US\$/m ³	US\$	US\$	US\$/m ³	Kyats/1,000 gal.	(Kyats/HH. month)
Domestic	0.70	30	1.32	0.92	12.54	17.92	407	2,634
Government	0.10	20	0.88	0.09	1.19	11.95	272	
Industry/commercial	0.20	135	5.94	1.19	16.13	80.65	1,833	
Total revenue when total sold water volume is 1 m ³ (US\$/m ³)				2.20	29.87			

(Note)

Targeted overall average price of water:	29.87 (US\$/m ³) (To cover the initial investment cost)
Conversion rate:	4.546 (l/gallon)
Exchange rate:	500 (Kyats/US\$)
Per capita water consumption:	140 (l/day/capita)
Average family size:	7 (persons/HH)

2) Development of Recommendable Tariff Structure

Also, following tariff schedule is recommended in the said Master Plan Study based on the income increasing projection in households being in minimum income level.

Multiplying the tariffs in each sector shown in the above Table by the water volume to be supplied, the financial benefit (the amount of revenue) can be estimated.

* "The costs of Generating Electricity in Nuclear and Coal Fired Power Stations" – A Report by an Expert Group of the Nuclear Energy Agency, OECD, 1983, and Kam W. Li and A. Paul Priddy Ed. "Power Plant System Design" John Wiley & Sons, Inc., 1985, USA.

Table 6.21 Tariff Schedule Over the Future

Description	Tariff schedule							
	2005		2010		2015		2020	
	(Kyats/m ³)	(Kyats/ 1,000 Gal)	(Kyats/m ³)	(Kyats/ 1,000 Gal)	(Kyats/m ³)	(Kyats/ 1,000 Gal)	(Kyats/m ³)	(Kyats/ 1,000 Gal)
Domestic sector (Metered rate)	42.35	193	63.26	288	78.10	355	89.61	407
(Equivalent to US\$/m ³)	8.47		12.65		15.62		17.92	
Public sector (Metered rate)	28.23	128	42.17	192	52.06	237	59.74	272
(Equivalent to US\$/m ³)	5.65		8.43		10.41		11.95	
Industrial/commercial sector (Metered rate)	190.57	866	284.67	1,294	351.43	1,598	403.23	1,833
(Equivalent to US\$/m ³)	38.11		56.93		70.29		80.65	
(Remarks)								
Average monthly expenditure for water per household (Kyats/month per HH):	1,245		1,860		2,296		2,634	
Increasing ratio (existing: 194 Kyats/HH.m):	542%		49%		23%		15%	
(Note) Exchange rate:	500 (Kyats/US\$)							

6.2.2 Identification Of Financial Cost

The financial cost has already been estimated as shown in the Table 6.17 in previous sub-clause.

6.2.3 Financial Evaluation

(1) Financial Evaluation of Project

Based on the said tariff schedule, project evaluation is made again in case of modified tariff system. Evaluation processes are shown in Appendixes T.7, T.8, and T.9.

Generally, FIRR of the project under study should be higher than the applied discount rate as an opportunity cost of capital as mentioned in previous sub-clause for Economic Evaluation. According to the said Appendixes, the resulted FIRR is lower than the said discount rate in entire works of Phase-1. But, it indicates that the FIRR of Stage-1 is quite high as 17.62 %. It may be reflected in the subject of the works of Stage-1. The subject of the Stage-1 mainly includes the rehabilitation works for existing facilities, so it can be expected to keep healthy accounting in YCDC.

As suggested by such international institutions as the World Bank, an EIRR is expected to at least be cleared a hurdle of 5.0 % of FIRR from a viewpoint of basic human needs even such a project is in developing countries. From this viewpoint, the resulted FIRR for overall works of Phase-1 is cleared the said hurdle with enough rooms as 8.27 %. Namely, it may be totally said that the Project is sound from the viewpoint of basic human needs in case of executing entire works of Phase-1.

(2) Sensitivity Analysis

For the works of Stage-2 or entire works of Phase-1, there is no point in making a sensitivity analysis because that the said resulted EIRR is too much low comparing with the said rate of opportunity cost of capital.

However, there is a point in making the sensitivity analysis for the Stage-1 Works because the said FIRR is enough high comparing with the opportunity cost of capital and, this FIRR may

change its value depending on the parameters employed for the calculation. Out of these parameters, the construction cost of the works and its benefit are the most important determinants of the economic analysis.

Therefore, a sensitivity analysis is made for 9 combined cases including base case under the benefit of -20 % (10 % of outstanding collection and 10 % of price fluctuation), -30 % (10 % of outstanding collection and 20 % of price fluctuation) and the cost of +10 %, +20 % taking into account of CPI (the Consumer Price Index) and some parameters affecting outstanding charges for financial benefit as indicated in the Table 6.22 hereunder. Furthermore, in Myanmar, the consumer price has been annually increased by the rate of around 18 % in the item "General" during the last 17 years from the 1980 to 1997 according to the Statistic Data.

Table 6.22 Some Parameters and Their Rate to Affect Revenue

(A) Moderate Case							(B) Pessimistic Case				
Sector	Share rate	Out-standing charge	Free connection rate	Non-billing rate	Com-munal tapping	Total	Out-standing charge	Free connection rate	Non-billing rate	Com-munal tapping	Total
Domestic sector	70%	0.50%	1.75%	0.50%	2.00%	4.75%	2.00%	3.50%	2.00%	3.70%	11.20%
Public sector	10%	5.00%	5.00%	0.95%	0.00%	10.95%	10.00%	10.00%	2.00%	0.00%	22.00%
Industrial/commercial sector	20%	0.00%	0.00%	0.00%	0.00%	0.00%	1.00%	0.00%	1.00%	0.00%	2.00%
Weighted average		0.85%	1.73%	0.45%	1.40%	4.42%	2.60%	3.45%	1.80%	2.59%	10.44%

(Note) Assumed that house connection will be fully realized because of Project's policy.

Following Table 6.23 shows a result of sensitivity test, and it is illustrated in Fig.6.2 hereunder.

Table 6.23 Result of Sensitivity Test for Stage-1 Works

Cost		Benefit	Benefit alternative		
			Base	-20 %	-30 %
Cost alternative	Base		17.65%	14.21%	12.46%
	+10 %		16.10%	12.94%	11.32%
	+20 %		14.79%	11.87%	10.35%

As shown in above mentioned Table and Figure, even in the most pessimistic case under the condition of benefit decrease by -30 % and const increase by +20 %, FIRR is still higher than 10 % with enough rooms. It means that, if the total amount of outstanding collections consisting of (1) outstanding charge, (2) free connection rate, and (3) non-billing rate, will be kept at 10 %, the Stage-1 works of Phase-1 still has a high financial sustainability.

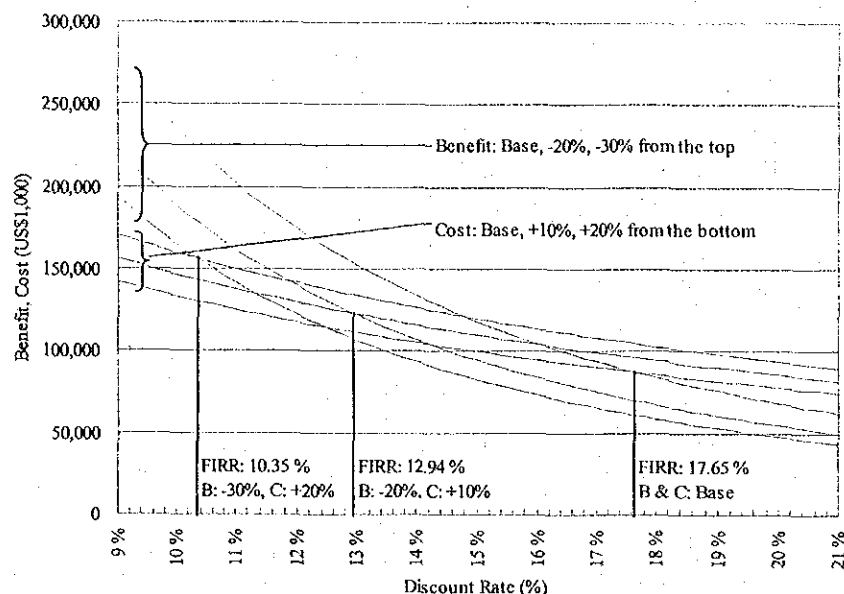


Fig. 6.2 Results of Sensitivity Test for Stage-1 Works of Phase-1

6.2.4 Tariff System To Be Recommended

Following Table 6.24 and Fig.6.3 show relationships between income and expenditure for water of the households in minimum income level:

Table 6.24 Relationships between Monthly Income and Expenditure for Water of Households in Minimum Income Level

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
A. Household income*										
(1) Minimum level Kyats/HH/month	13,844	15,228	16,751	18,426	20,269	22,295	24,525	26,978	29,675	32,643
(2) Maximum level Kyats/HH/month	85,464	94,010	103,411	113,752	125,127	137,640	151,404	166,544	183,199	201,519
(3) Average Kyats/HH/month	39,260	43,186	47,595	52,255	57,481	63,229	69,552	76,507	84,158	92,574
B. Water consumption[†] m³/HH/month	29	29	29	29	29	29	29	29	29	29
gallons/HH/month	6,467	6,467	6,467	6,467	6,467	6,467	6,467	6,467	6,467	6,467
C. Water tariff										
US\$/m ³	1.32	1.32	1.32	1.32	8.47	8.47	8.47	8.47	8.47	12.65
Kyats/m ³	6.60	6.60	6.60	6.60	42.35	42.35	42.35	42.35	42.35	63.26
Kyats/10 ³ gallon	30	30	30	30	193	193	193	193	193	288
Revised rate					541.71%					49.38%
D. Expenditure for wat US\$/HH month	38.80	38.80	38.80	38.80	249.01	249.01	249.01	249.01	249.01	371.97
(4) Kyats/HH month	194	194	194	194	1,245	1,245	1,245	1,245	1,245	1,860
Expenditure share rate: (4)/(1)	1.40%	1.27%	1.16%	1.05%	6.14%	5.58%	5.08%	4.62%	4.20%	5.70%
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A. Household income*										
(1) Minimum level Kyats/HH/month	35,907	39,498	43,448	47,792	52,572	57,829	63,612	69,973	76,970	84,667
(2) Maximum level Kyats/HH/month	221,671	243,838	268,222	295,044	324,548	357,003	392,703	431,973	475,171	522,688
(3) Average Kyats/HH/month	101,831	112,014	123,216	135,537	149,091	164,000	180,400	198,440	218,284	240,113
B. Water consumption[†] m³/HH/month	29	29	29	29	29	29	29	29	29	29
gallons/HH/month	6,467	6,467	6,467	6,467	6,467	6,467	6,467	6,467	6,467	6,467
C. Water tariff										
US\$/m ³	12.65	12.65	12.65	12.65	15.62	15.62	15.62	15.62	15.62	17.92
Kyats/m ³	63.26	63.26	63.26	63.26	78.10	78.10	78.10	78.10	78.10	89.61
Kyats/10 ³ gallon	288	288	288	288	355	355	355	355	355	407
Revised rate					23.45%					14.74%
D. Expenditure for wat US\$/HH month	371.97	371.97	371.97	371.97	459.21	459.21	459.21	459.21	459.21	526.88
(4) Kyats/HH month	1,860	1,860	1,860	1,860	2,296	2,296	2,296	2,296	2,296	2,634
Expenditure share rate: (4)/(1)	5.18%	4.71%	4.28%	3.89%	4.37%	3.97%	3.61%	3.28%	2.98%	3.11%

*1 Increasing ratios of income level is assumed at 10% based on CPI taking moderate case into account comparing with per capita GDP increasing ratio. The base income level is based on the Consumer Survey as shown in Appendix M.1.

*2 Per capita water consumption: 140 l/day/capita
Average family size: 7 /HH
Conversion rate: 4.546 l/gallon

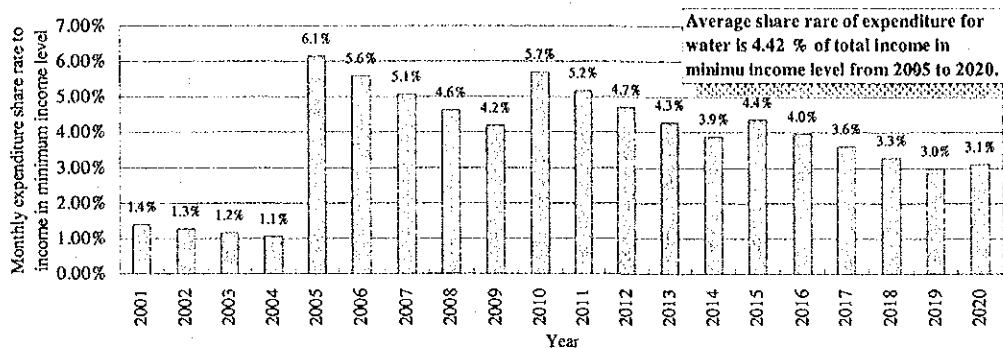


Fig. 6.3 Share Rates of Expenditure for Water to Average Income

Five (5) % of total income is the upper limit of affordability of people to pay for water as mentioned above. As indicated in the above Table and Figure, monthly share rates of expenditure for water against monthly income level exceed the 5 % at 5 times in 2005 (6.1 %), 2006 (5.6 %), 2008 (5.1 %), 2010 (5.7 %) and 2011 (5.2 %) in case of minimum income level. However, the average share rate during the period from 2005 to 2020 is lower than 5 % as 4.47 %.

Furthermore, as mentioned above, the trial tariff schedule indicates a financial sustainability from the viewpoint of basic human needs.

In addition to those specific water charge mentioned above, a house connection fee consisting of (1) basic charge, (2) approval fee for sanitation and (3) approval fee for tapping from YCDC pipe should be collected from customers according to the existing house connection system.

However, this tariff schedule is formed by the specific water charges only. In a policy of the Project, complete application of specific water charge system is to be realized in the year 2020 as the target year of the Project because that the works for water-meter installation takes a time to achieve at 100 per cent fitting to all the water customers, namely domestic customers, connected with YCDC water supply system. Accordingly, it should also be needed to set flat rate tariff system during the period by the target year of 2020.

Following Table shows existing tariff system in Yangon City:

Table 6.25 Existing Water Tariff System of Yangon City

Rate system	Domestic customers (Kyats)	Government offices (Kyats)	Commercial/ industries (Kyats)	Foreign customers (US\$)	Remarks
Flat rate	120	80 to 107,000	405 to 25,000	25	Per month
Specific rate	30	20	135	*	Per 1,000 gallons

(Note) * US\$ 2.00 for HH, and US\$4.00 for commercial/industries.

Existing rate of water meter fitting is 22 % of the total customers who connected with existing YCDC water supply system according to a result of questionnaire survey made by JICA Study Team in 2001. Based on the above mentioned tariff schedule and taking the existing tariff system into account, following new tariff system may be recommended. In this case, it is assumed that the rate of water meter fitting is linearly increased until the year 2020 as the target year of 100 per cent fitting to be realized.

Table 6.26 Tariff System to Be Recommended

As of 2005					
Rate system	Domestic customers (Kyats)	Government offices (Kyats)	Commercial/industries (Kyats)	Foreign customers (US\$)	Remarks
Flat rate	1,262	*	*	*	Per month per customer
Specific rate	193	128	866	*	Per 1,000 gallons
As of 2010					
Rate system	Domestic customers (Kyats)	Government offices (Kyats)	Commercial/industries (Kyats)	Foreign customers (US\$)	Remarks
Flat rate	1,886	*	*	*	Per month per customer
Specific rate	288	192	1,294	*	Per 1,000 gallons
As of 2015					
Rate system	Domestic customers (Kyats)	Government offices (Kyats)	Commercial/industries (Kyats)	Foreign customers (US\$)	Remarks
Flat rate	2,328	*	*	*	Per month per customer
Specific rate	355	237	1,598	*	Per 1,000 gallons
As of 2020					
Rate system	Domestic customers (Kyats)	Government offices (Kyats)	Commercial/industries (Kyats)	Foreign customers (US\$)	Remarks
Flat rate	No flat rate	*	*	*	Per month per customer
Specific rate	407	272	1,833	*	Per 1,000 gallons

(Note) * To be decided by YCDC itself based on domestic situation.

6.2.5 Analysis of Repayment Ability of the Project

The Project cost as an initial construction cost is a huge amount. Therefore, it seems that the preparation of this cost is to be quite difficult for the municipal authority of Yangon City or YCDC and/or the Central Government of Myanmar by themselves.

Therefore, the analysis for repayment ability of the Project is to be made assuming that the necessary initial cost is financed by a loan from some donors based on the said recommended tariff system.

(1) Loan Amount

Usually, a loan amount excludes such local cost as costs to be needed for land acquisition, housing compensation, administration cost, but should include a price contingency because that the time of commencement of the construction works is generally several years later than

the time when the cost is estimated, so if price contingency is not included, the construction works themselves might not be executed. In this case, a price escalation rate should firstly be set for both the FC portion and LC portion.

The price fluctuation rate in these several years in Myanmar is actually 18 % per annum according to the statistical data as mentioned in previous sub-clause. Nevertheless, if a Japanese loan can be utilized, there is an example that the price escalation rates for FC portion and LC portion have been as 0.8 % per annum and 0.1 % per annum respectively in a similar developing country for the similar project.

Accordingly, in this Project, the price escalation rates are applied as 1.0 % per annum for FC portion and 0.5 % per annum for LC portion tentatively because that the loan policy is usually depending upon countries' situation and disbursement timing. Following Table 6.27 shows a summary of a result of loan amount estimation.

Table 6.27 Annual Disbursement of Loan Amount for Phase-1

(US\$1,000)

Year	For Phase-1		
	FC	LC	Total
2003	0	0	0
2004	31,875	2,361	34,236
2005	33,380	2,908	36,288
2006	121,799	13,105	134,903
2007	94,693	7,943	102,635
2008	168,339	29,994	198,333
2009	132,470	22,193	154,663
2010	171,576	25,656	197,233
Total	754,131	104,160	858,291

(2) Loan Repayment Ability of YCDC by Revenue Due to Water Charge Collection

Following Table 6.28 shows a part of repayment cash flow for Phase-1 from the construction works to the end of repayment of loan as an example. Details are shown in Appendix T.10. In this case, it is assumed that the financing source is Japan Bank for International Cooperation (JBIC).

In the case indicated in the above Table, an amount of annual equal payment including interest and principal is calculated at US\$ 43,064 × 10³ with an interest rate of 1.30 % per annum and 30 years of repayment period including 10 years of grace period.

As indicated in the above, a subsidy to the Project from YCDC or from the central Government of Myanmar (or some domestic financing sources) will be needed at the early stage of execution of construction works and at the time to be needed large scale of construction cost to invest. However, when the water charge is collected smoothly, YCDC can cover such deficit in any case as mentioned hereunder for accounting projection.

Table 6.28 Repayment Ability of Loan for the Works of Phase-1

Year in order	Year	(US\$1,000)						(US\$1,000)			Subsidy to the Project from YCDC or Central Government of Myanmar	
		Outflow			In flow			Cash balance				
		Construction cost		Foreign borrow		OM cost	Total		Foreign borrow	Revenue in total		In flow in total
Loan portion	Local portion	Interest	Principal									
-1	2001	0	0	0	0	0	0	0	0	0	0	0
0	2002	0	0	0	0	0	0	0	0	0	0	0
1	2003	0	0	0	0	0	0	0	0	0	0	0
2	2004	31,875	2,361	0	0	207	34,444	31,875	1,312	33,186	-1,257	1,257
3	2005	33,380	2,908	414	0	207	36,910	33,380	11,246	44,626	7,716	
4	2006	121,799	13,105	848	0	804	136,556	121,799	23,818	145,617	9,061	
5	2007	94,693	7,943	2,432	0	943	106,010	94,693	24,797	119,490	13,480	
6	2008	168,339	29,994	3,663	0	2,140	204,136	168,339	25,777	194,115	-10,020	10,020
7	2009	132,470	22,193	5,851	0	1,349	161,863	132,470	26,761	159,230	-2,633	2,633
8	2010	171,576	25,656	7,573	0	9,159	213,964	171,576	62,564	234,140	20,176	
9	2011			9,804	0	9,159	18,962		62,564	62,564	43,602	
10	2012			9,804	0	10,234	20,038		62,564	62,564	42,526	
11	2013			9,804	33,260	9,159	52,222		62,564	62,564	10,342	
12	2014			9,371	33,692	9,159	52,222		62,564	62,564	10,342	
13	2015			8,933	34,130	9,159	52,222		77,238	77,238	25,016	
26	2028			2,693	40,371	10,234	53,298		88,620	88,620	35,322	
27	2029			2,168	40,895	9,159	52,222		88,620	88,620	36,398	
28	2030			1,637	41,427	9,159	52,222		88,620	88,620	36,398	
29	2031			1,098	41,966	9,159	52,222		88,620	88,620	36,398	
30	2032			553	42,511	10,234	53,298		88,620	88,620	35,322	
31	2033					9,159	9,159		88,620	88,620	79,462	
Total		754,131						754,131				

(Note)

- (1) Interest rate of foreign loan: 1.30%
 (2) Equal annual repayment amount of capital for foreign loan (US\$1,000): 43,064

It means that, if the recommended tariff system will be applied for public water supply system in Yangon City, even the construction cost is a huge amount, the amount of revenue will be more than the said construction cost. Namely, the Project is very sound from the financial viewpoint.

6.2.6 Cash Flow Analysis for Accounting of YCDC

(1) Existing Accounting Status of YCDC

For making financially sound management of fiscal administration, a robust financial outlook is required. However, YCDC has no authorized fiscal statements at present. They are keeping books by means of using a paying-in book and a disbursement record without any balance-sheet and profit and loss statement.

Therefore, there is no any record on their assets and liabilities, and it is very difficult to make clear their actual profits and losses at the present situation.

Overview of the Accounting System of YCDC

Being an institution of Ministerial status in Myanmar, YCDC is a separate financial body in its own right. Similar to other viable financial institutions, the current policy of YCDC is to collect money from customers for the services rendered. This includes the policy of charging for town water supply and other connected services such as connection fees from their

customers. The YCDC is empowered to collect revenue and impose penalties on defaulters by the law.

The current budgetary policy envisages that all revenues collected by each of the 21 departments of YCDC including the WSS (Water & Sanitation) Engineering Department are credited to the general account. The Budget and Finance Department is responsible for the management of the general account. Funds from this account are allocated to each of the 21 departments based on their individual annual operational budgetary requirements. Under the current policy, the individual departments including the WSS have no authority to determine areas for capital expenditure within their operations. Similarly, the departments are not authorized to include items of expenditure requiring policy directives in their forecasts. Such matters have to be cleared by the executive committee of the YCDC before sanctioning.

Each department prepares a budgetary forecast of its intended revenue and expenditure for the period 1st April to 31st March of the following year. This is submitted to the Budget and Accounts department for approval. It is the responsibility of each department to operate within the approved budget during the fiscal year. The annual forecast is reviewed in mid-year in order to determine any financial short falls and/or excess. This exercise is followed by the actual adjustment of revenue and expenditure against the approved annual budget.

The strategy for financial operations involves reimbursement of expenditure already incurred on any item on submission of receipts to the Budget and Accounts Department. In this process, the relevant department prepares a work authority for each potential item of expenditure. This is submitted to the Coordination Department for checking, auditing and making adjustments if necessary before passing over to the Budget and Accounts Department for payment. Actual expenditure against the approved work authority is paid to the relevant department or the work team on submission of claims, in installments.

Furthermore, officers holding specified positions are issued with advance funds to be disbursed on various items of expenditure. For example the district WSS engineer in charge of dealing with district facilities has 50,000 Kyats advance account while a township engineer has an advance of 10,000 Kyats to be spent on urgent small-scale work items.

Although the revenue collected is credited to the General Account and the expenditure incurred in the provision of water service is provided from this account, the actual revenue and expenditure accounts of the WSS are kept separately. This makes it possible to analyze water sector financial position fairly accurately.

Table 6.29 hereunder shows YCDC's Revenue and Expenditure during last 10 years.

Table 6.29 Revenue and Expenditure of YCDC During Last 10 Years

Year	Revenue			Expenditure			Balance
	Current account	Capital account	Total	Current account	Capital account	Total	
1991/92	675	595	1,270	348	834	1,182	87
1992/93	852	375	1,227	453	878	1,330	-103
1993/94	1,070	363	1,432	560	1,076	1,637	-204
1994/95	1,557	712	2,268	694	1,063	1,757	512
1995/96	2,400	635	3,034	915	1,854	2,769	265
1996/97	3,568	1,468	5,036	1,561	3,617	5,178	-142
1997/98	5,517	2,381	7,899	2,528	4,234	6,762	1,136
1998/99	5,899	2,484	8,383	2,925	3,676	6,601	1,782
1999/00	6,539	2,136	8,675	3,766	5,386	9,152	-477
2000/00	7,354	3,150	10,503	5,423	5,358	10,781	-278
Annual average increase (%)			23.53%			24.74%	

Source: YCDC.

Water Sector Revenue and Expenditure

As already mentioned in the above, the WSS Department collects revenue for various services provided to its customers. It receives funds from the General Account to pay for the expenditure incurred.

The WSS Department's annual undiscounted revenue ranged from 58 millions Kyats in 1991/92 to 530 millions Kyats in 2000/01. This represents an increase in revenue by 10 times during the past decade. The undiscounted mean annual revenue for the past ten years stood at Ks. 302.43 millions.

The revenue for WSS operations is brought about by 3 main sources as (1) water tariffs, (2) connection fee and (3) other revenue. The total revenue itself and the contribution to the total by each source have registered a consistent increase (except for 1998/99) over the last 10 years. The possible reason for lower revenue in 1998/99 may be due to the civil disturbance in Yangon in that year.

WSS's expenditure in the provision of water service includes the salaries and wages paid for its staff (personal cost), maintenance cost for infrastructure and the operation cost. The capital expenditure incurred by the WSS Department is not available for analysis because that all assets belong to YCDC. It is to be noted that the maintenance cost does not include operation costs of vehicles in connection with the provision of water services.

Following Table 6.30 shows Revenue and Expenditure of WSS Department during last 10 years.

Table 6.30 Revenue and Expenditure of WSS Department During Last 10 Years

(Million Kyats)

Year	Revenue				Expenditure				Balance	
	Government offices	Private customers	Connection fee	Others	Total	Salaries & wages	Overhead expenses	Cost for maintenance		Total
1991/92	21	28	8	1	58	10	19	20	49	9
1992/93	28	36	10	3	77	13	23	19	55	22
1993/94	28	44	11	1	85	16	25	17	58	27
1994/95	45	97	20	3	164	16	32	15	63	100
1995/96	49	194	60	9	311	15	35	18	67	244
1996/97	58	207	74	9	349	15	35	24	74	275
1997/98	58	282	126	7	473	15	53	31	99	374
1998/99	63	245	104	13	426	16	84	44	144	282
1999/00	74	259	201	18	553	18	92	47	157	395
2000/01	69	249	194	17	530	73	108	60	241	289
Annual average increase (%)	12.77%	24.56%	36.98%	31.32%	24.74%	5.85%	18.86%	11.74%	17.23%	41.59%

Revenue due to water charge collection is supported by the following number of customers as:

Table 6.31 Number of Customers by Sector

Year	Public Sector (Government Offices, etc.)	Industrial/ Commercial Sector	Domestic Sector	Total
1995/96	1,077	8,005	86,950	96,032
1996/97	1,080	7,765	77,037	85,882
1997/98	1,140	6,711	84,945	92,796
1998/99	1,154	7,726	88,684	97,564
1999/00	1,219	9,639	93,027	103,885
2000/01	1,255	9,923	98,785	109,963
Annual average increase (%)	3.11%	4.39%	2.59%	2.75%

Source: YCDC.

(2) Fiscal Projection for Accounting of YCDC in Implementation of Project

Following Table 6.32 shows a result of projection of Profit and Loss of WSS Department until the 2020.

In this case, it is assumed that total outstanding collections are to be most pessimistic case as 10 % consisting of (1) outstanding charge: 2.60 %, (2) free connection rate: 3.45 %, (3) non-billing rate: 1.80 % and (4) the rate of communal water tapping: 2.59 % in average as mentioned previous sub-clause.

As indicated in the above Table, there is only once to register a deficit in the fiscal year 2009/10 during the period the year 2020 even in case of most pessimistic case from the viewpoint of one-year-budget.

Table 6.32 Projection of Profit and Loss of WSS Department of YCDC

(US\$1,000)

	(Note)	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
A. Revenue due to water charge collection		2,371	12,305	24,877	25,857	26,836	27,820	63,623
B. Outstanding collection			1,286	2,600	2,702	2,804	2,907	6,649
Outstanding charge	2.60%		320	647	672	698	723	1,654
Free connection rate	3.45%		425	858	892	926	960	2,195
Non-billing rate	1.80%		221	448	465	483	501	1,145
Communal water tapping	2.60%		320	647	672	698	723	1,654
C. Governmental and/or YCDC cross subsidy		0	0	0	0	0	0	0
D. Subtotal (A - B + C)		2,371	11,019	22,277	23,155	24,031	24,912	56,975
E. OM cost for YCDC own operation		0	0	0	0	0	0	0
F. OM cost for the Project		207	207	804	943	2,140	1,349	9,159
G. Replacement cost		657	1,350	3,954	5,735	9,173	11,818	15,152
H. Depreciation		0	1,016	2,088	6,116	8,871	14,188	18,280
I. Subtotal (E+F+G+H)		864	2,573	6,846	12,794	20,184	27,355	42,591
J. Profit before Tax (D - I)		1,507	8,446	15,432	10,360	3,847	-2,443	14,384
K. Income tax		0	0	0	0	0	0	0
Net Profit (J - K)		1,507	8,446	15,432	10,360	3,847	-2,443	14,384

(Note)

- Communal water tapping is used by lowest income levels with share rate of 3.7 % of total households connected with YCDC Water Supply System.
- However, total domestic users shared at 70 % of total water volume to be supplied. So, it is assumed that the rate of communal water tapping users is to be 2.60 % of the water volume to be supplied (= 3.7 % * 70 %).

Based on the above projection of profit and loss of WSS Department, a projection of fund flow of WSS Department is made. This table indicates a situation of balance sheet in each year over the future. Following Table 6.33 is shown its results:

As indicated in the below Table, a deficit of net profit in 2009/10 may be covered by the accumulated available cash (disposable cash balance at the end of each year). Also, in the year 2008, 2013 and 2014, working capitals will be booked in credit side as indicated in the above Table. They are caused by high investment cost in 2008, and just starting time of repayment in 2013 and 2014. However, these are also balanced out by the accumulated available cash. Accordingly, YCDC can keep sound accounting until the year 2020 and thereafter.

Table 6.33 Projection of Fund Flow of WSS Department of YCDC

(US\$1,000)

	2004	2005	2006	2007	2008	2009	2010
A. Source of Fund (B+E+F)	35,743	45,750	152,422	119,111	211,051	166,408	229,897
B. Internal fund generation (C+D)	1,507	9,462	17,519	16,476	12,718	11,745	32,664
C. Depreciation		1,016	2,088	6,116	8,871	14,188	18,280
D. Net profit	1,507	8,446	15,432	10,360	3,847	-2,443	14,384
E. Credit of International Financing Institution to the Project	31,875	33,380	121,799	94,693	168,339	132,470	171,576
F. Counterpart contribution by YCDC (Local currency portion)	2,361	2,908	13,105	7,943	29,994	22,193	25,656
G. Application of fund (I+J+K)	35,743	45,750	152,422	119,111	211,051	166,408	229,897
I. Investment for the Project	34,236	36,288	134,903	102,635	198,333	154,663	197,233
J. Debt retirement	0	414	848	2,432	3,663	5,851	7,573
1) Repayment of principal for Phase-1	0	0	0	0	0	0	0
2) Interest payment of loan amount for Phase-1	0	414	848	2,432	3,663	5,851	7,573
K. Working capital	1,507	9,047	16,671	14,044	9,056	5,894	25,091
Available cash	1,507	10,554	27,225	41,269	50,325	56,219	81,310

(US\$1,000)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
A.	33,612	33,485	35,509	36,458	37,406	37,279	39,303	40,252	41,200	41,073	43,097	44,045	44,994
B.	33,612	33,485	35,509	36,458	37,406	37,279	39,303	40,252	41,200	41,073	43,097	44,045	44,994
C.	23,437	23,437	23,437	23,437	23,437	23,437	23,437	23,437	23,437	23,437	23,437	23,437	23,437
D.	10,176	10,049	12,073	13,021	13,970	13,842	15,867	16,815	17,763	17,636	19,660	20,609	21,557
E.	0	0	0	0	0	0	0	0	0	0	0	0	0
F.	0	0	0	0	0	0	0	0	0	0	0	0	0
G.	33,612	33,485	35,509	36,458	37,406	37,279	39,303	40,252	41,200	41,073	43,097	44,045	44,994
I.	0	0	0	0	0	0	0	0	0	0	0	0	0
J.	9,804	9,804	43,064	43,064	43,064	43,064	43,064	43,064	43,064	43,064	43,064	43,064	43,064
1)	0	0	33,260	33,692	34,130	34,574	35,024	35,479	35,940	36,407	36,881	37,360	37,846
2)	9,804	9,804	9,804	9,371	8,933	8,490	8,040	7,585	7,124	6,656	6,183	5,704	5,218
K.	23,809	23,681	-7,554	-6,606	-5,658	-5,785	-3,761	-2,812	-1,864	-1,991	33	982	1,930
Available cash	104,992	97,437	90,831	85,174	79,389	75,628	72,816	70,952	68,961	68,994	69,976	71,906	

After the year 2011, it is assumed that the net profit will be constant because that analysis in this time is only for the works of Phase-1 of the entire Project, which is ending in the year 2010. Even though, the net profit will be increased year by year until 2020 because of increasing of water volume to be supplied and of using the above mentioned newly setting tariff schedule.

CHAPTER 7
**ENVIRONMENTAL
IMPACT
ASSESSMENT**

CHAPTER 7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 DESCRIPTION OF PRIORITY PROJECT

Priority projects that will be scheduled to implement divided into two stages specified by similar aim of public benefit and urgent execution required. The outline of each stage is explained following paragraphs describing core projects mainly.

7.1.1 Stage 1 (2004-2006)

(1) Ngamoeyeik Reservoir System (Transmission & Pumping Station (P/S))

The project of concern is the secure water source that corresponds to the current demand as designated in the Master Plan. The newly transmission pipeline from the Ngamoeyeik Reservoir will be able to provide over 409,000 m³/day of new water source.

The transmission pipes with 5 pumps will be linked to the Hlawga Lake. There is no water treatment plant with sedimentation, flocculation, filtration and disinfection processes. However, the Hlawga Water Treatment Plant with modernized equipment was planned to install for Phase-2 nearby the lake starting from 2020 within the adopted scenario of the Master Plan.

One transmission pipe has already been completed. However, its total length is only 13 km with 1,400 mm diameter pipe from the inlet channel of the Hlawga Lake. The existing pipe shall also be utilized. To relieve a high friction loss problem of the existing pipe, same length of additional pipe with 1,100 mm diameter must be installed along with the existing one. Newly installation of 1,800 mm pipe will be laid from the end of dual pipes to Ngamoeyeik Reservoir. It is supposed that access road for construction will be required. A construction will be completed by the end of 2006.

(2) Replacement of Aged Distribution Pipes

Replacement of about 156 km of aged distribution pipes that was calculated on the Network Analysis Study is required in Stage 1 of Phase-1. The project categorized into 2 components by an installation age. One is older than 80 years; the other is from 50 to 80 years. The latter will be performed in Stage 2. As a well-known fact, elder townships located in the southern part of Yangon City must be exchanged for brand-new one. In spite of installation age, rehabilitation of upstream of distribution mains must be conceivable more effective and higher advantage for other priority projects.

(3) Other Components

The Terminal Reservoir with transmission P/S with 40,000 m³ storage volumes that is half (2/4) of designed capacity will start constructing in 2005 connecting to the Hlawga No.1 P/S, other 20,000 m³ (1/4) will be got ready by completion of Hlaing WTP (see below for further

details) on Phase-1. It means that existing transmission pipe from Hlawga No.1 P/S to Kokine Service Reservoir will be utilised even if after completion of Terminal Reservoir. Gyobyu Connection Pipe with 1,400 mm will be installed for the purpose of link Terminal P/S with existing Gyobyu transmission pipe. An additional transmission pump will set up in Phugyi P/S. Three existing pumps in Gyobyu P/S will be totally renewed for getting rid of superannuation.

CB Hlawga Service Reservoir will be installed near Terminal Reservoir covering Hlawga area (Zone 4). Simultaneously, it was planned that CB North Service Reservoir that is joined with Hlawga Service Reservoir makes up for distribution of Central North area (Zone 5).

7.1.2 Stage 2 (2007-2010)

(1) Hlaing Water Treatment Plant and Supplemental Facilities

Presently, Gyobyu Water Treatment Plant (WTP) is only equipped treatment facility under jurisdiction of YCDC. In the Master Plan study, construction of two water treatment plants was proposed. From 2006 to 2009, a half scale of Hlaing WTP will be constructed to meet a future water demand and to achieve an acceptable drinking water quality. Proposed site of WTP is located in Gwedanshe village where is near the main road (1) upstream of Hlaing River about 50 km from the heart of Yangon. The total required area for the new WTP would be of 165,000 m². Another half capacity will be extend during next decade for the perfection.

The priority project consists in introducing the modernized treatment plant. Proposed treatment process forms of coagulated sedimentation and rapid sand filtration process. Main facilities are Intake Pump including intake tower structure, conveying pipe, receiving well, mixing chamber, flocculation basin, sedimentation basin, filter pond, chlorination channel, clear water reservoir, transmission pump, backwash wastewater storage tank and sludge-drying lagoon. The Hlaing WTP is designed 940,000 m³/day full-capacity, that is, it constitutes two parallel systems of 470,000 m³/day capacity facilities. About 33 km of one transmission pipeline with 1,900 mm diameter will be laid from Hlaing WTP to Terminal Reservoir by each project phase. Construction of Hlaing WTP will be performed as a half scale capacity from 2008 and the full-scale of WTP will start operating from the end of 2020, accordingly.

(2) Rehabilitation of Regular Well, Well Construction and Service Reservoir

Strictly speaking, newly groundwater development in West North area (Zone 11) will be begun at the end of Stage 1 (2007). However, the project will be in progress for the most part. It is necessary to develop for new wells within the western part of Yangon have been recognized to correspond to water because of geographical disadvantage for obstruction by Hlaing River. According to the fact, updating of existing tube well facilities and newly development of new wells were planned as one of a priority project. Well development will

continue constructing from 2007 to 2020 step by step. Concerning of the Hlaingthaya area, a half scale of the West Block North Service Reservoir will be scheduled to construct in Stage 2 by 2008.

(3) Other Components

2 service reservoirs preparing 100,000 m³ of design capacity will be constructed in the Central Block (CB), named CB West Service Reservoir and CB Downtown East Service Reservoir. At the same time, newly transmission pipeline of Central West (Zone 3) and Downtown East (Zone 2) areas, water supply will be provided by 2005. A transmission pumping station will be required at Terminal Reservoir for CB West Service Reservoir and a distribution P/S at CB Downtown East Service Reservoir for distribution network of concerned area.

7.2 STATE OF ENVIRONMENT OF PROJECT SITES

7.2.1 General Presentation

The state of environment review, which is the most delicate aspect of the study, has been made from field observation, use of background data already processed in Chapter 10 of the Interim Report, and use of data collected by JICA study team on the field through social environmental impact survey. The study team has engaged social environmental impact survey to local staff in charge of hearing about both potential and expected impacts of social aspect for establishment of the state of environment of project sites.

Social environment data are the result of field investigation made by field awareness survey during 10 days in March 2002. The role of the field survey investigation was also to heighten public awareness of the target residents about living environment and implementation of the priority project by 2010.

Social survey has consisted into a survey about communities living close to the service reservoir and transmission pipeline sites and a survey about urban communities in several roads and streets concerned by the distribution network improvement projects. The later has been done on a sampling of 3 or 4 service zones, which explains that results of survey are not always representative of the studied community and need interpretation.

The detailed description of the state of environment of priority project sites can be referred to in Appendix L. Only the most important aspects for understanding the environmental sensitivities of the sites have been considered and summarized below.

7.2.2 New Transmission and Distribution Pipes & Replacement of Aged Pipe Project Site and Service Reservoirs

(1) General Presentation

The priority project of network systems of distribution pipelines covers most townships of Yangon City either urban, peripheral or satellite community. These townships have been unmistakable as densely populated areas. Accordingly, the project has been classified one of the most valuable and effective for economical/financial aspects described in Chapter 8 of Master Plan report. It is known that the about 60% population of Yangon doesn't enjoy piped water. Even though the area where already covered piped water supply system, those people are also suffering poor water supply conditions all the time.

The project site can be divided into 3 areas.

- High population density and built-up area (Earlier developed townships)
- Middle population density area (Newly developed townships)
- Satellite townships

Especially, high population density and built-up area has a lot of living environmental issues enough as it is. However, it is thought that positive impacts for improvement of living conditions and direct benefit for concerned residents are expected after completion of the project.

(2) Living Environment

During a construction period, most residents will be put to inconvenience for cutting off and detour the main road, because replacement or newly installation of pipe is generally required road works to a greater or less. Moreover, generation of noise with construction will be expected by excavation work, concreting work and soil refilling. It is more difficult to implement rehabilitation of aged pipe in Zone 1 that consists of comparatively old townships because there are a lot of residents in a densely built-up area. Depends upon circumstances, temporary forced removal must be required for the construction smoothly.

Proposed service reservoir sites both Central Block Downtown East and East Block South are located relatively close to residential and commercial quarters. Those areas may be environmentally influenced by the projects. According to circumstances, the transmigration of inhabitants or land acquisition for agriculture in those areas is necessary for implementation of the projects.

(3) Women

Women in development is very sensitive issue of social environment aspect not only water supply project but other basic human needs one. Even now, obtaining of living water is an important role of women & children as well as another developing country. Some residents who are living specified area of Yangon City are suffering from unstable or poor water service all year around. After completion of this project, most resident will be able to get water thorough the pipe fairly.

(4) Cultural and Traditional Patrimony

Myanmar is one of the most devout Buddhism countries of the world; there are many Pagodas (religious temple with related facilities) throughout the country. It is widely known that Pagoda is the holy place for all believers of Buddhism. For example, whenever visitor passes through the gate of Pagoda, they must remove their shoes and socks before entering the entrance. Proposed plan of priority projects, there is no significant infringe such a cultural properties. If the religious lot is located on proposed project sites, it will be obliged to make alternations in consideration of mitigation of impacts.

Box 7.1 Environmental and Traditional in Myanmar Culture

(1) Sacredness of natural environment

In the pre-Buddhist religion such as animism, tree worship was widespread among indigenous races of Myanmar. Tree god was revered as benefactor friend. Other natural phenomena such as mountain, lake, river, etc. were also respected and paid homage not only because of their utility for human beings, but also because of their sacredness as they were believed to be the abodes of benevolent spirits.

When Buddhism came to Myanmar, respect for and preservation of natural environment became an act of religious merit because of the Buddha's association with natural environment. Great events of the Buddha's last life took place in a forest or park. The importance of a forest as a haven for recluses to achieve spiritual attainment was preached the Buddha.

7.2.3 Hlaing Water Treatment Plant and Supplemental Facilities

(1) General Presentation

The project of Hlaing Water Treatment Plant and supplemental facilities will be constructed nearby Gwedanshe village. Proposed Water Treatment Plant will be planned installation along the main road from Yangon and intake facilities are located at riverside. River water was recommended as raw water source by investigating of both quantity and quality aspects on Master Plan study. In year 2020, about 1 million m³ of treated water will be produced to satisfy the future water demand.

This area is a rice and pulse producing district where is received benefit from fertile soils by annually flood. According to Plant Protection Division of Myanmar Agriculture Service, some pesticides have been used for those farming lands in recent years, mostly pulse fields. Probably, fatal influences of residual chemicals are very little, but a continuous monitoring is necessary to execute the project not only before designing level but also after operating the water treatment plant.

(2) Living Environment

The proposed project site is a typical remote country place and there is nothing but some small communities. Most residents are making livelihood by farming and petty fishery activities. Although full-designed intake volume of river water would be fetched from the Hlaing River, it is thought that there is no aggravation loss for a means of livelihood. By virtue of project installation, living environment of concerned area may be slightly changed for employment conditions because job opportunity related with water treatment plant will be expected both construction phase and operation phase.

(3) Natural Environment

According to field observation, ecological condition of proposal sites is well protected and there is no unpardonable environmental degradation presently. Impacts are not very troublesome as well as other project such as an agricultural development. Occurrence of redundant deforestation will not be anticipated in the proposed sites. At the same time, it is hard to break out of secondary environmental impacts such as soil erosion and destruction of wetland, a paradise of wild birds.

7.3 IMPACTS OF THE PROJECT ON ENVIRONMENT

7.3.1 Presentation of Results

(1) Method of Identification

The identification of impacts is made from crossing data of the state of environment with key issues of environmental evaluation. Issues of the checklist presented in Table 7.1 had been previously defined for the major part in the Initial Environmental Examination (Chapter 10.2 of Master Plan report (Part I)).

The range of possible impacts of the project on environment is large because of the many components of projects, variety of issues and various intensities of impacts. Then, only the important impacts as they emerged from the screening through the checklist of Table 7.1 have been retained and presented in this study.

The presentation of main impacts which is proposed here includes impacts that may be both positive and negative according to the case. These impacts are further classified into 2 categories:

- Potential impacts
- Expected impacts

(2) Definition of Main Impacts

Main potential impacts are those impacts that would certainly occur if no measure was taken at the project design level, but that can be avoided through technical measures adopted with execution of the project. In such case, the environmental receptor is sensitive but can be preserved to maintain initial conditions.

Main expected impacts are those impacts that will necessarily occur with execution of the project without possibility of mitigation through technical design of the project. In such case, initial conditions cannot be maintained. It is however possible to set up protection and/or compensation measures. In this case and at the difference of potential impacts, measures do focus on protection instead of conservation of the environment. It means that in some way measures are able to preserve an environmental value in spite of the loss of initial site. In such figure, new environmental value can also be created.

Main impacts are summarised in the Table 7.2 below, according to projects. Table 7.2 shows that the impacts both Stage 1 and Stage 2 are nearly same.

Table 7.1 Checklist for Evaluation of Impact

Grouping	Items
1. Social life & living environment	1. Resettlement 2. Livelihood 3. Quality of the living environment 4. Life style and social behaviour 5. Community life and social conflicts 6. Change of economic activity and employment 7. Protection of sensitive groups and promotion of women
2. Public health	8. Public health 9. Occupational health and sanitation
3. Pollution and nuisances	10. Water quality 11. Air pollution and offensive odour 12. Urban nuisances and risks (traffic, accidents, noise) 13. Wastes
4. Natural patrimony	14. Habitats, fauna and flora species 15. Conservation of river banks and prevention of sanding 16. Conservation of soil 17. Conservation of groundwater 18. Disaster
5. Cultural patrimony	19. Landscape, amenities, aesthetic values 20. Remains and assets

Table 7.2 Relevance of Main Impacts According to Project

Items	Stage 1	Stage 2
Main Potential Impacts		
Worsening of the living environment	X	X
Main Expected Impacts		
Improvement of sanitation and health	X	X
Exposure to pollution and nuisance	X	X
Loss of environmental asset	X	X
Improvement of tap water quality	X	X
Livelihood	X±	X±

(3) Impacts on the Natural Environment

The study has shown that there are almost nothing potential impacts and expected impacts both stages. On the whole, components of all projects have few impacts on the natural environment. The aquatic ecosystems of Hlaing River downstream of Gwedanshe should be

preserved thanks to an appropriate intake volume of river water and to be invariable for its quality. It seems that there is no demolition of the habitats both fauna and flora.

Excess sludge by the coagulation process of Hlaing WTP will be disposed of for a harmless dried cake thanks to the implementation of the sludge drying bed.

(4) Impacts on the Social Environment

Table 7.3 provides a ranking of the main social issues raised by the review of the impacts induced by the project. Items retained for this table are of both types:

- Social indicators of sensitivity, which are simply the size of population and its roots in the place of living
- Main expected negative impacts which have been raised as a result of study within the field of the social environment. Main potential impacts have not been considered in this table in order to focus on most critical aspects.

Ranking of issues in the table is made according to 3 classes of strength, which means importance of the sensitivity in one case, and importance of the impact in other case. The most optimistic alternative has been retained for scoring. The total scoring provides an estimate of the global importance of impacts of the project on the site, according to 4 qualifications: Critical, severe, moderate, and negligible.

Presently, field survey of social environment investigation with an individual interview method is undertaken by local researchers until the end of 3rd week of March. Reconsideration of social environmental aspect for the priority project will be necessary based on examination of field survey result.

Table 7.3 Statements of Social Impacts in Project Sites

	Stage 1	Stage 2
Indicators of sensitivity		
Size of population directly exposed to impacts	2	1
Cultural roots with the place of living	0	1
Scoring A	2	2
Main expected negative impacts		
Exposure to pollution and nuisance	2	2
Loss of environment asset	1	1
Loss of livelihood	1	1
Scoring B	4	4
Total scoring A × B	8	8
Comprehensive Qualification Rate	Negligible	Negligible

Ranking order in most optimistic alternative: 0 negligible; 1 moderate; 2 important; 3 very important;

(5) General Conclusion

The global impact of the project on environment is basically positive for the welfare and quality of life of people in Yangon City. The negative impacts of the project are raised for the local communities living in the project sites.

The Hlaing WTP of Stage 2 has some effects on the natural environment, through the loss of some vegetation, and by contributing to the urbanisation of the Hlaing river bank and degradation of the riverside landscape potential.

Since the environmental benefit of the project for public health of Yangon population is not questionable, few measures to solve the problems identified have been proposed. These measures, which are mainly prevention, mitigation and remediation measures, aim at making the impacts acceptable for the local community and respectful of the right of each citizen to enjoy a healthy living environment.

7.3.2 Main Potential Impacts

(1) Worsening of the Living Environment

The installation of the distribution network in the priority zones has both positive and negative impacts on the living environment. Positive impacts are the improvement of sanitation conditions.

On the other hand, the improved water supply service will increase the quantity of wastewater generated in populated townships. If the sewerage is not improved, it can lead to unhygienic conditions in the concerned areas. The environment will deteriorate and the health of the people endangered. However, sewerage should be regarded as a project itself and it is not taken as a mitigation of the projects.

Countermeasures of sewerage collection / treatment would induce a definitively positive impact on the living environment. The potential negative impact of open sewers is mentioned to insist on the importance of a simple measure like closing sewers to eliminate negative effects.

The choice of the good solutions will have the following positive impacts if maintenance of sewers is properly done:

- Elimination of habitats favourable to the malaria vector and pests.
- Containment of unpleasant smells.
- Clean and sanitary environment of living.
- Facilitating accesses especially during the rainy season.

7.3.3 Main Expected Impacts

(1) Improvement of Sanitation and Health

The construction of a suitable water supply system will guarantee the adequate provision of secure and stable water supply for the population thereby improving their health situation. The primary impact of the project is determined by its objective, which is the improvement of salubrity and sanitary conditions of the Yangon City. All priority projects that will be taken in Phase-1 will contribute to improve the sanitary conditions of populated areas of Yangon City. On the whole, numbers of residents and particularly children who can not make normal use of water will be significantly reduced.

At the level of each community around priority zones, there will be mainly improving trends in comparison with present. Population living around the targeted areas is already seriously suffered with terrible water supply conditions. The implementation / rehabilitation of water supply facilities have to sweep away water shortage issue.

(2) Exposure to Pollution and Nuisance

Proposed pipeline layout in the residential or commercial area will be careful considered along the main road that has comparatively broad.

The village community of Gwedanshe will be directly exposed to nuisances that can be expected only during construction phase. Land acquisition in the proposed area may be taken place unwillingly. And proposed site of Central Block Downtown East service reservoir is located next to a football field, by any chance undesirable requisitioning of land for soccer enthusiasts may be caused in accordance with further detailed design of the facilities. In case of aged pipe rehabilitation site, residents are living in the site jostling each other. They will be exposed to noise and dust during the construction phase.

(3) Loss of Environmental Asset

The implantation of the service reservoir will cause the loss of thickets and contribute to the degradation of a green-planting of Yangon City. Especially, proposed sites of Central Block West reservoir, Hlawga reservoir and Terminal reservoir are located on the outskirts of Yangon with an abundance of forest resources. With regard to proposed Central Block West reservoir site, it is situated on the hummock covered with broadleaf trees near 15th-Hole tee ground in the City Golf Resort. When construction of the reservoir will be completed, impacts will be caused not only loss of trees but also unsightly landscape.

Moreover, it seems that the requirement of leaving a 10m width strip of land along conveyance pipeline route is respected by the localisation of the project, although it might be at the limit.

(4) Improvement of Tap Water Quality

Improvement of water quality will be a synergic effect of better management of water treatment plant and installation of pipeline network. An important and direct benefit for improved water quality comes from the elimination of turbidity and the chlorination for disinfection.

The quality of tap water with modernized treatment process will be carried out the international Standards, e.g. WHO. Then, achievement of these objectives by the WTP will contribute to extinct all micro organisms. The role of the water treatment plant improving water quality is explained in *Chapter 2* of the Part.

(5) Livelihood

The impact of the project on the livelihood and income of inhabitants results from the loss of farm land housing and grazing fields at the construction sites (service reservoir treatment plant and pipelines, etc.). The trench excavation for laying the pipelines adjacent to the urban dwellers might cause damage or cracking of the building.

Loss of livelihood, namely a market gardening, is insignificant impact in the case of construction for large facility building, such as water treatment plant and service reservoir. This impact induces the other one, which is the potential loss of income and welfare for the women in charge of the distribution of market garden produces. As a matter of fact, there are extended market gardens along both sides of existing transmission mains with huge diameter. There is a tacit understanding between an administrator and a gardener.

At Hlaing WTP intake site, a little loss of paddy and pulse fields will be limited to a nearby the Hlaing River, where space will be required for protecting. This impact should remain of secondary order, but could be amplified by the alternative of relocating people in response to the pollution and nuisance problem.

The project will generated a significant number of short term employment opportunities during construction period and also a number of permanent vacancies with different levels of education.

7.4 ENVIRONMENT MANAGEMENT PLAN

7.4.1 Proposed Management Activities For Phase-1 Projects

Main measures are summarised in Table 7.4 according to 3 types of measures.

(1) Plan of Environmental Measures During Construction

The construction of service reservoirs, water treatment plant and pipe laying are certainly part of water supply project. During the construction phase, the excavation will take place along the pipelines both transmission and distribution. This will cause inconveniences for traffic and people. The access to houses may be limited to some extent. The vegetation and some cultivation crops may have to be cleared during the excavation. In rocky areas where blasting is needed for trench excavation care must be taken in order to avoid harming of houses, people or any other environment. The civil contractor has to make temporary arrangement to allow access during the construction where found necessary.

The construction of the pipelines must be organized in such a way that open ditch lengths are minimized and where needed shields, fences, warning signboard etc. shall be used. In conveniences caused by noise and dust should be reduced by proper construction methods, shields and appropriate selection of machinery. Measures for protection of the natural environment include the proper disposal of excavation materials.

The localisation of the access road should be different with the existing access road, in order to avoid heavy nuisances and risks of accidents for residents and for people coming to the Pagoda (Temple), Mosque and Church.

Backfilling and compaction of the pipeline trenches and structure sites must be done with good construction practices. The pipelines and reservoir construction sites must be cleaned from all construction materials when the works have been done. The constructed areas must be returned at least to the same standard as before and in reservoir sites and in sensitive areas of the environment should be improved by suitable gardening.

Measures for protection of the human environment consist in minimising nuisances like noise, dust and others. The plan of transportation of materials should insist on aspects like prevention of worsening traffic conditions. Employment of local people for construction works is strongly recommended.

If any archaeologically valuable antiquities are found during the works, the construction activities must be stopped until proper authorities have been consulted.

(2) Prevention of Inadequate Project Site

Preventing the formation of inadequate project site is possible at the stage of planning of the project. It is recommended to re-evaluate the proposed project site in order to find more

efficiency and adequate in the use of land. The riverside area and the woody area should be considered as the most valuable place and then restricted as much as possible. However the project sites in urbanized area have no environmental value and it would be fruitful to decide the alternative site of the project by putting its limits on these both sides, instead of leaving a free space along the streets. For example, proposed route of transmission mains in urban area is extending along the broad-width main road with greenery central reservation strip, but actual laying route should be kept from such a green belt.

On the one hand, such revision of the project planning area will help to avoid the constitution of land favourable to the constitution of unworthy of the environment.

Table 7.4 Plan of Measures for Phase-1

	Social life and living Environment	Public health	Pollution, nuisances	Natural environment	Landscape, amenities
Prevention measures					
(1) Plan of measures during construction	X		X		X
(2) Prevention of inadequate project site		X	X		X
(3) Environmental monitoring			X	X	
Mitigation and remediation measures					
(4) Settling a greenery buffer zone	X		X	X	X
(5) Plan of social reinsertion	X				
(6) Community participation	X				
Sustainability measures					
(7) Sanitary use of dried sludge		X			
(8) Collection of domestic wastewater		X			

(3) Environmental Monitoring

Environmental monitoring of raw water quality must be done in order to verify suitability of the projects because man-made pollution may be getting greater year after year. A monitoring plan of groundwater quality should be set up, with sampling in water wells around the site.

Moreover, sensitive population of animals and plants must be monitored uninterruptedly taking the initiative by Ministry of Forestry.

(4) Settling a Greenery Buffer Zone

Settling a greenery buffer zone with planted trees is an easy task, especially with the availability of water resource in the plant, once the several advantages for environmental purpose have been understood. Planting area should be in priority in front of the structures of water supply, and then the inside borders of the facilities.

- Compensation for the loss of valuable tree species.
- Creating a buffer zone between the plant and the city.
- Maintaining some continuity of greenery landscape along the fencing.
- Compensating the greenhouse effect that could occur from energy consumption.

Meanwhile, a planting campaign in Yangon City area is promoted by YCDC with administrative policy. Amount of yearly plantation of trees has been steadily increasing since 1989.

(5) Plan of Social Reinsertion

A plan of social reinsertion should be established by the project execution unit of YCDC in order to provide a minimum attention and assistance to the gardeners concerned by the loss of their livelihood with implementation of the project. The objectives of such plan are dictated by the national policy of struggle against poverty. Possibilities of reinsertion are:

- Giving a priority to gardeners for job opportunities induced by the construction works.
- In case of opportunity of work for the operation phase, affected gardeners should receive priority.
- The case of the woman gardener needs specific attention, because she will face more difficulties than men to find a substitute activity.
- Since these gardeners are young should be able to find other gardening job, since there are plans for extension of market gardening in Yangon; they need to receive some support to this end.
- Providing to the gardeners some information about the possibilities to find a new job.

(6) Community Participation

Community participation will be necessary in view to solve the critical issues raised by the project. Participation to the decision making process of the project must be promoted by the ward level. The ward will identify NGOs of concern that could support and play a role of intermediate with the village community. A women association would be appropriate. Participation of the population will be done through representation in working committees of the project planning process and through direct discussion and meetings organised on the field. The purpose will be to find a way to conciliate development objective of the site with preservation of the resources and way of life of inhabitants around the site.

(7) Sanitary Use of Dried Sludge

Disposal of sludge is insufficient or made in bad conditions, which mainly depends on the time of retention in drying beds. It is not sure that drying conditions during the rainy season are satisfying for the efficient elimination of desiccation.

A sludge recycle management plan should be prepared to make sure that reuse is made in the best possible sanitary conditions. The sludge may not compose very much organic substances but be productive soil that can be utilized as a soil conditioner. Inside the plant, the basic requirement is to make sure that sludge has been sufficiently dried before use for agriculture. When not suitable for use, the sludge should be managed as an ordinary solid waste.

(8) Collection of Domestic Wastewater

As a result of improvement of water supply in Yangon City, domestic wastewater, that is sewage, will be increased as a matter of course. Even now, wastewater issue is one of the most apprehensive urban problems not only Myanmar but also other neighboring countries. A common method of sewerage facility in each household is septic tank system. The existing sewer system which covers the old-established townships was first installed at the end of 19th century. The system expanded in 1928 covering a total area of about only 9 km². After this, it stopped further expansion any longer.

People living outside sewerage covered area where is under the jurisdiction of YCDC depend either on common or individual septic tanks or other forms of onsite disposal system. Practically, all of the residents living in the newly-developed townships are using the septic tank system. As those area developed, it would be impossible to treat properly due to exceeding a permissible amount.

The existing master plan of sewerage system in Yangon was established in the 1960's and it still has not been revised at all. In order to avoid offsetting benefit of water supply, it is extremely recommended that a new master plan of sewerage / drainage must be worked out immediately.

7.4.2 Conditions of Implementation of Measures

The institutional capacity to manage environment is a key issue for implementation of measures and environment management plan within the scope of the project. This management capacity is now under developing in Myanmar. The role of the YCDC in concluding the environmental measures of the project and controlling their application on the field is essential. The lack of material means makes however difficult the good achievement this task and the development of this capacity of control of the YCDC could constitute a first condition for the application of measures given by the environment management plan of the project. The work of the YCDC should be coordinated with the work of the National Commission for Environmental Affairs in evaluating the conditions of application of measures in project sites and the effects on the population of concern.

Moreover, the acceptability of the impacts through application of measures is not only a matter of institutional capacity to manage the environment. It is also a matter of public participation and public awareness, which still remains a weakening point in Yangon in the field of environmental protection. Public participation needs to be promoted and supported for the environmental plan of the project. Public participation is more generally required for the good maintenance of sanitation infrastructure and for contributing to a cleaner city. Public awareness campaigns are the basic tool toward communities' participation to planning and decision-making.

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