INFRASTRUCTURAL SURVEY

FOR THE

DEVELOPMENT OF PASAR

IN

THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

AUGUST 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

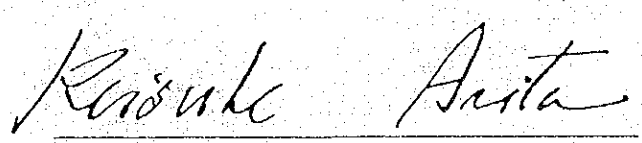
The Japanese Government decided to conduct a survey on the development of water resources related to the establishment of the PASAR (Philippine Associated Smelting and Refining Corporation) Project and entrusted the Japan International Cooperation Agency (JICA) to carry out the survey. JICA sent a survey team headed by Mr. Kanjiro Wakita to the Philippines from March 7 to April 5, 1982.

The team, in consultation with the officials concerned of the Government of the Republic of the Philippines, conducted a field survey (in Leyte Island, Isabel area). After the team returned to Japan, further studies were made and the present report has been prepared.

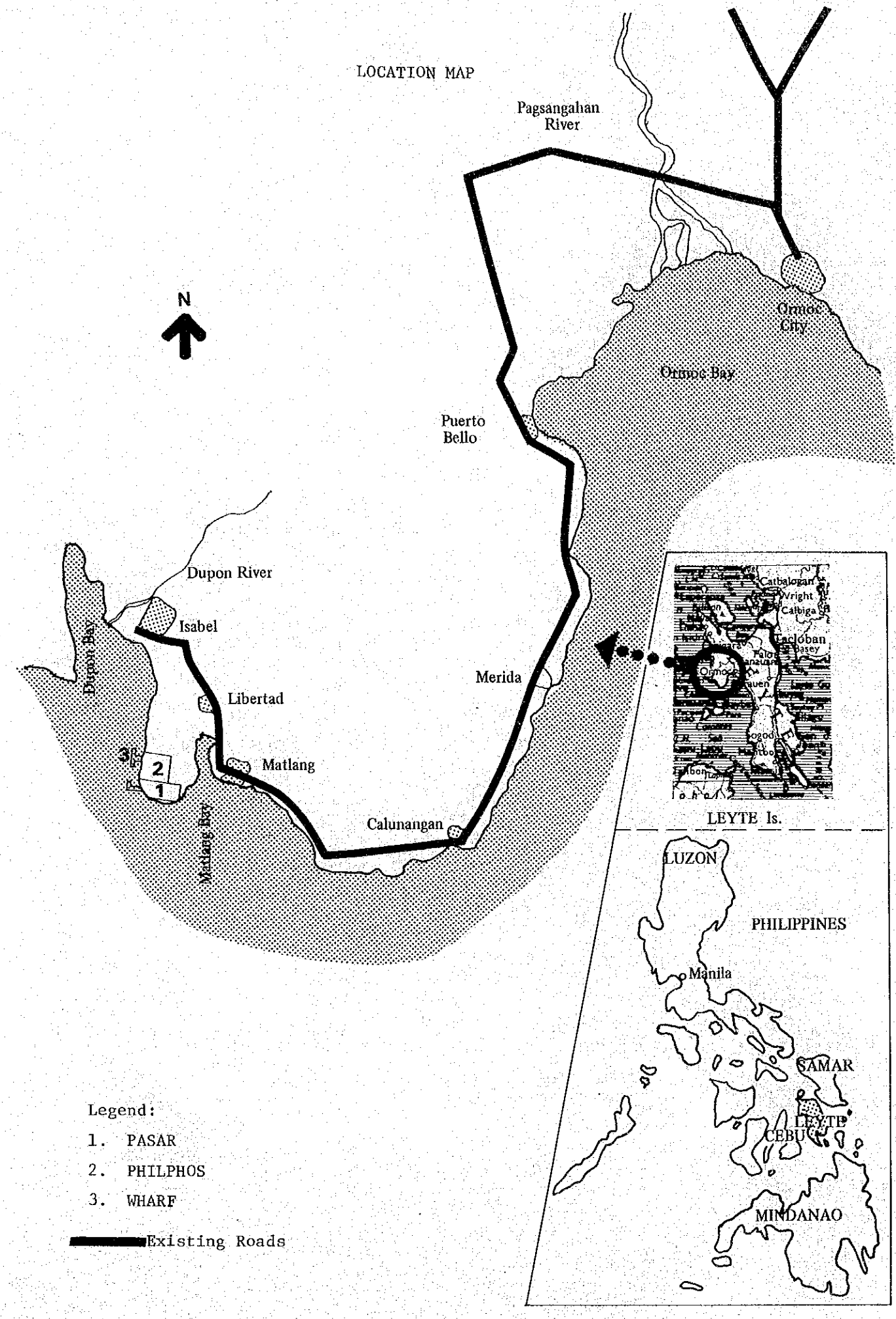
I hope that this report will serve for the development of the Project and contribute to the welfare of community residents.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

August, 1982



Keisuke Arita
President
Japan International Cooperation Agency


LOCATION MAP
Pagsangahan River
N
Ormoc City
Ormoc Bay
Puerto Bello
Dupon River
Isabel
Dupon Bay
Merida
Libertad
3
2
1
Matlang
Matlang Bay
Calunangan
Catbalogan
Wright
Calbiga
Tacloban
Ormoc
LEYTE Is.
LUZON
PHILIPPINES
Manila
SAMAR
LEYTE
CEBU
MINDANAO
Legend:
1. PASAR
2. PHILPHOS
3. WHARF
Existing Roads

SUMMARY

A survey on the development of water resources related to the establishment of PASAR (Philippine Associated Smelting and Refining Corporation) Project was carried out by a survey team headed by Mr. Kanjiro Wakita from March 7 to April 1982.

The following is a summary of feasibility study conducted for The Development of PASAR in the Republic of the Philippines.

This summary outlines the proposed service area population projections, water demand, development of water sources, transmission route, planned facilities and construction costs.

1. Future Population Projections

   The yearly projected population according to districts is shown in Table 1.

2. Water Demand

   a. The design period for the water supply scheme covers a span of twenty years from 1985 to 2005.

   b. A list of the proposed water districts and the subjects in served areas are shown in Tables 2 and 3.

Table 2 Water Districts

Municipality	Water District	Barangay
MERIDA	Cabaliwan	Cabaliwan
	Puerto Bello	Puerto Bello Can-Unzo Casilda
	Merida	Libas Poblacion Lamanoc
	Calunangan	Macario Libjo Benabaye Mahalit Calunangan
ISABEL	Matlang	Apale Tubod Matlang Tolingon Bilwang
	Isabel	Libertad Sto. Rosario Mahayag Sto. Niño (Poblacion) Sta. Cruz San Roque Marvel (Poblacion)

Table 1 Projected Population for Each Water District

Municipality	District	Barangay & Sitio	Year								
			1985	1986	1987	1988	1989	1990	1995	2000	2005
Merida	Cabaliwan	Cabaliwan	980	989	999	1,009	1,019	1,030	1,082	1,137	1,195
		Total	980	989	999	1,009	1,019	1,030	1,082	1,137	1,195
	Puerto Bello	Puerto Bello	1,602	1,618	1,634	1,650	1,667	1,683	1,769	1,860	1,954
		Casilda	1,173	1,185	1,197	1,208	1,221	1,233	1,296	1,362	1,431
		Can-Unzo	839	847	856	864	873	881	926	974	1,023
		Total	3,614	3,650	3,687	3,722	3,761	3,797	3,991	4,196	4,408
	Merida	Libas	1,296	1,309	1,322	1,335	1,349	1,362	1,431	1,504	1,581
		Lamanoc	1,154	1,166	1,177	1,189	1,201	1,213	1,275	1,340	1,408
		BRGY (Poblacion)	2,211	2,736	2,804	2,888	3,274	3,359	3,853	4,405	4,919
		Total	4,661	5,211	5,303	5,412	5,824	5,934	6,559	7,249	7,908
	Calunangan	Macario	348	427	434	444	501	511	570	637	697
		Mahalit	555	681	692	708	799	815	909	1,016	1,112
		Libjo	580	712	724	740	835	851	909	1,061	1,161
		Calunangan	866	1,063	1,081	1,105	1,247	1,271	1,418	1,585	1,735
		Benabaye	561	689	700	716	808	824	919	1,027	1,124
		Total	2,910	3,572	3,631	3,713	4,190	4,272	4,765	5,326	5,829
Isabel	Matlang	Apale	761	934	950	971	1,096	1,117	1,246	1,395	1,525
		Tolingon	595	730	742	759	857	874	975	1,090	1,193
		Tubod	302	371	377	385	435	443	494	552	604
		Bilwang	1,485	1,823	1,853	1,895	2,139	2,181	2,433	2,720	2,977
		Matlang	2,272	2,789	2,836	2,900	3,273	3,337	3,722	4,161	4,554
		Total	5,415	6,647	6,758	6,910	7,800	7,952	8,870	9,916	10,853
	Isabel	Libertad	1,743	2,140	2,176	2,225	2,511	2,560	2,856	3,193	3,495
		Sta. Cruz Sto. Rosario San Roque	2,141	2,629	2,673	2,733	3,085	3,145	3,508	3,922	4,293
		Mahayag	1,241	1,524	1,549	1,584	1,788	1,823	2,033	2,273	2,488
		Marvel (Poblacion)	1,813	2,226	2,263	2,314	2,612	2,663	2,970	3,321	3,635
		Sto. Nino (Poblacion)	1,973	2,422	2,462	2,518	2,842	2,897	3,232	3,614	3,956
		Total	8,911	10,941	11,123	11,374	12,838	13,088	14,599	16,323	17,867
Grand Total			26,491	31,010	31,501	32,140	35,432	36,073	39,866	44,147	48,060

Table 3 Served Areas

Served Area		Divisions	Classification
(1)	Communities and Others	Communities	Domestic Water Institutional Water Commercial Water
		Other Industries (excluding PASAR)	PHILPHOS WHARF LIGHT INDUSTRIES
(2)	PASAR	Industries	PASAR, LEPANTO Domestic Water Industrial Water Operational Water

c. Service Rate

The water districts were classified into the urban area (Poblacion) and the rural area (Barangay). Water consumers in both areas are expected to switch from the use of public faucets to house connections. Figures 1 and 2 illustrate this predicted trend.

d. Served Population

Table 4 shows the estimated served population.

District	Service Connection	1985	1986	1987	1988	1989	1990	1995	2000	2005
Cabaliwan	House Connection	0	49	100	151	204	258	541	767	1,016
	Public Faucet	980	940	899	858	815	772	541	370	179
Puerto Bello	House Connection	0	183	369	558	752	949	1,996	2,832	3,747
	Public Faucet	3,614	3,467	3,318	3,164	3,009	2,848	1,995	1,364	661
Merida	House Connection	1,398	1,709	1,883	2,073	2,388	2,599	3,771	5,169	6,722
	Public Faucet	3,263	3,502	3,420	3,339	3,436	3,335	2,788	2,080	1,186
Calunangan	House Connection	0	179	363	557	838	1,068	2,383	3,595	4,955
	Public Faucet	2,910	3,393	3,268	3,156	3,352	3,204	2,382	1,731	874
Matlang	House Connection	1,625	2,180	2,399	2,647	3,198	3,483	5,100	7,070	9,225
	Public Faucet	3,790	4,467	4,359	4,263	4,602	4,469	3,770	2,846	1,628
Isabel	House Connection	2,673	3,589	3,949	4,356	5,264	5,733	8,394	11,638	15,187
	Public Faucet	6,238	7,352	7,174	7,018	7,574	7,355	6,205	4,685	2,680
Total	House Connection	5,696	7,889	9,063	10,342	12,644	14,090	22,185	31,071	40,852
	Public Faucet	20,795	23,121	22,438	21,798	22,788	21,983	17,681	13,076	7,208

Fig. 2 Service Rate (Poblacion)

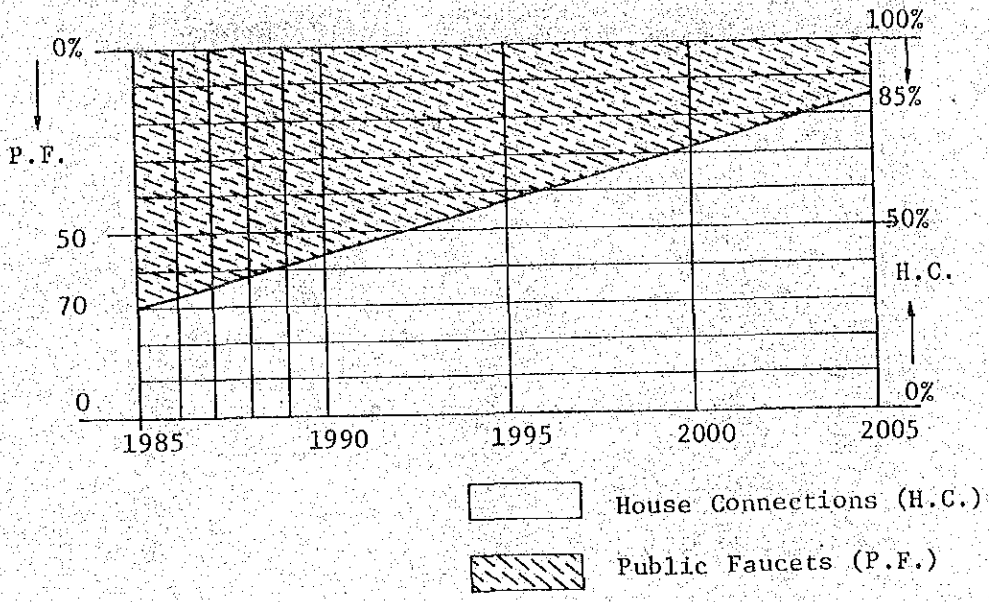
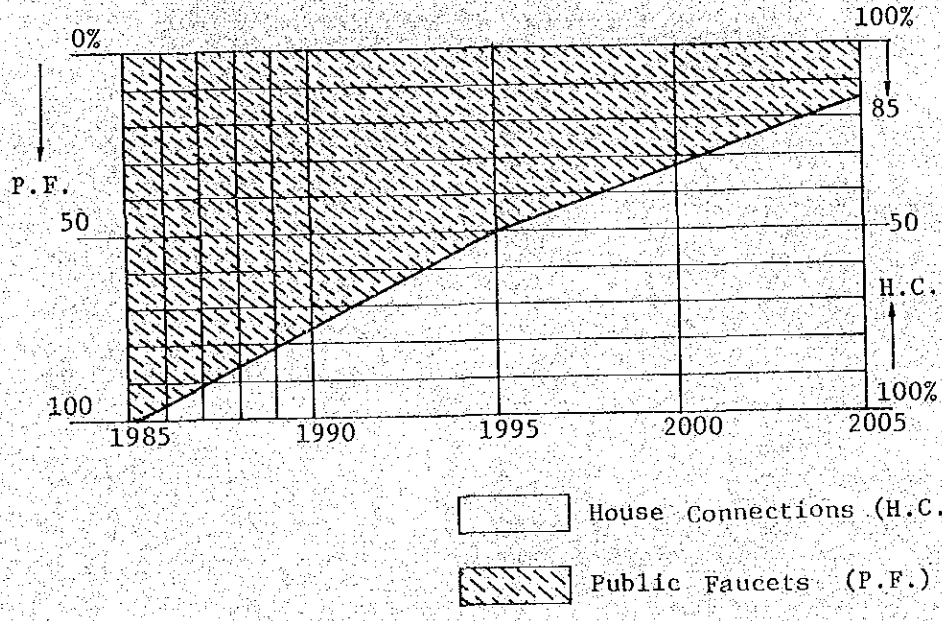


Fig. 3 Service Rate (Barangay & Sitios)



e. Planned Industrial Production

Table 5 shows the production targets of PHILPHOS and PASAR from 1984 to 2000. The data was provided by the firms themselves.

Table 5 Planned Industrial Production

Year / Firm	1984	1985	1986	1987	1988	1989	1990	2000
PASAR (1000MT)	138	138	276	276	276	414	414	
PHILPHOS (%)	30	55	65	70	80	85	85	85

f. Water demand

Shown below is the rate of water demand. (Table 6)

Table 6 Water Demand

[Unit: gpm*]

YEAR / OBJECT	1985	1986	1978	1988	1989	1990	1995	2000	2005
PASAR	1,200	1,600	1,600	1,700	2,100	2,100	2,100	2,100	2,100
PHILPHOS	1,800	1,940	2,080	2,520	2,560	2,600	2,600	2,600	2,600
COMMUNI-TIES	915	1,089	1,134	1,183	1,331	1,373	1,650	1,972	2,315
TOTAL	3,915	4,629	4,814	5,403	5,991	6,073	6,350	6,672	7,015

* gpm = gallon per minute

3. Development of Water Sources

After investigating and studying possible water sources (ground water and surface water), it has been decided to make use of the ground water found in the plains of Ormoc.

Water intake facilities (deep wells and pumping facilities) are to be constructed in the Malunao area in the form of eleven deep wells (including one stand-by well) which would supply the water requirement amounting to 38,240 cu.m/day. The eleven wells shall form two circles with a junction well at the center. Each well pump shall be linked directly to the junction well. From the junction well, the water shall be transmitted to a receiving basin by means of an aqueduct with a ϕ600mm. diameter. Electric power for the well shall be supplied by the National Power Corporation. However, diesel generators shall also be installed to provide electric power in case of power failure. The two substations and control rooms which shall house these facilities shall be built near the two junction wells and shall be linked to each well.

The specifications for the wells are listed below:

(a) Wells

Diameter - ϕ400 (ϕ18') Casing ϕ300 (ϕ12')
Depth - 200 m. No. of wells - 11 (1 stand-by)
Lifting Capacity - 4,000 cu.m./day/well

(b) Submersible Pump

ϕ150 volute pump Q = 2.8 cum/min./pump
H = 51 m. W = 45 kW
No. of Pumps = 11 (1 stand-by) No. of Electromagnetic Flow Meters = 11

(c) Junction Well :

No. of wells = 2 200 cu. each (10^m x 7^m x 3^m)

(d) Junction Pipes:

Well to Junction well - ϕ250, L $\leq$ 1.0 km

Junction well to Junction well - ϕ400, L $\leq$ 2.0 km

(e) Substation and Control Room - 2

Transformer (Indocr Type) 4,160 v./480 v.

No. - 2 units (each with a power capacity for 5 pumps.)

Control panels - with a power capacity for 10 pumps

Control disc - with a power capacity for 10 pumps

Generator & Panel - 2 units (each with a power capacity for 5 pumps)

4. Conveyance Facilities

Conveyance facilities consist of the aqueduct and the receiving tank.

Aqueduct: ϕ600 L = 6.0 Km, pressure -reducing valve, sluice valve

Receiving Basin: 800 cum. (15m x 15m x 4.0m) - 1 unit

5. Transmission Facilities:

From the receiving tank, water shall be transmitted to fixed destinations through transmission mains with the aid of transmission pumps and booster pumps. En route to its final destination (Isabel), water shall be distributed to six water districts. To prevent the occurence of water hammer during

the sudden suspension of the pumps' operations, flywheels and one-way surge tanks (in 3 places) shall be installed.

(a) Transmission Main - ϕ700 L = 36.0 Km (ductile cast iron pipes or steel pipes)

One-way surge tanks in 3 places - (8 m^3, 16 m^3 & 6 m^3)

(b) Transmission Pumping Station :

Pump - double suction volute pump, 250ϕ x 150ϕ.
8.9 cum./min./unit
H = 67 m. 160 kW/pump
No. of pumps - 4 units (including one stand-by)

Valve - 4 units

Hoisting crane - 1 unit - 2 tons capacity

Auxiliary equipment - lump sum

Control Panel - lump sum

Generator & Panel - 1 unit

(c) Booster Pumping Station

Pump - Double suction volute pump, 250ϕ x 150ϕ,
8.1 cum./min,/unit
H - 67 m 160 kW
No. of pumps - 4 units (1 stand-by)

Valve - 4 units,

Hoisting crane - 1 unit - 2 tons capacity

Auxiliary equipment - lump sum

Control Panel - lump sum

Generator & Panel - 1 unit

6. Distribution Facilities

Water shall be distributed to six water districts along the transmission route. Six distribution tanks shall store water for distribution to the served areas through the public

faucets although house connections shall become more prevalent with the passage of time. The structure of distribution tank shall be taken to prevent water hammer from affecting the distribution main and service pipes. Each tank shall be equipped with disinfecting facilities. Disinfection shall be realized by chlorination (in this case, the injection of chlorine powder).

Moreover, a booster pump shall be installed in Cabaliwan to supplement insufficient water pressure.

(a) Distribution Tank - for each of the six water districts
- Elevated tanks or Non-elevated tanks.

(b) Distribution main and service pipes - $\phi 50 \sim \phi 300$
L = 38 Km in total length for all districts.

(c) Booster pump - 1 unit.

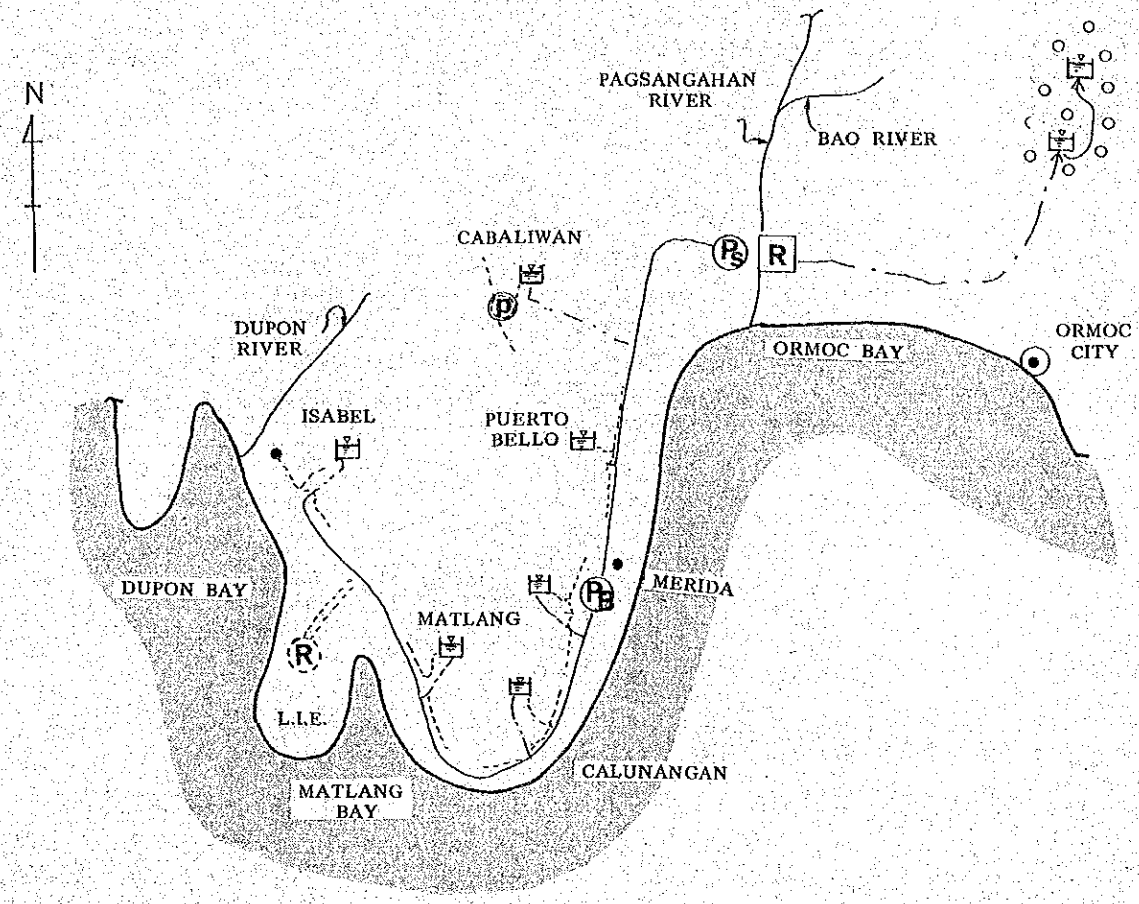
7. Control System :

Considering the difficulties involved in operating and managing the whole system, the adoption of a telephone hot-line which shall link the intake facilities, pumping stations and reservoirs (PASAR) has been decided in liue of a centralized control system. All communications regarding water level observations and the like shall be conducted via the telephone.

8. Outline of the Facilities

Figures 3 and 4 respectively show the outline of the facilities and the entire system.

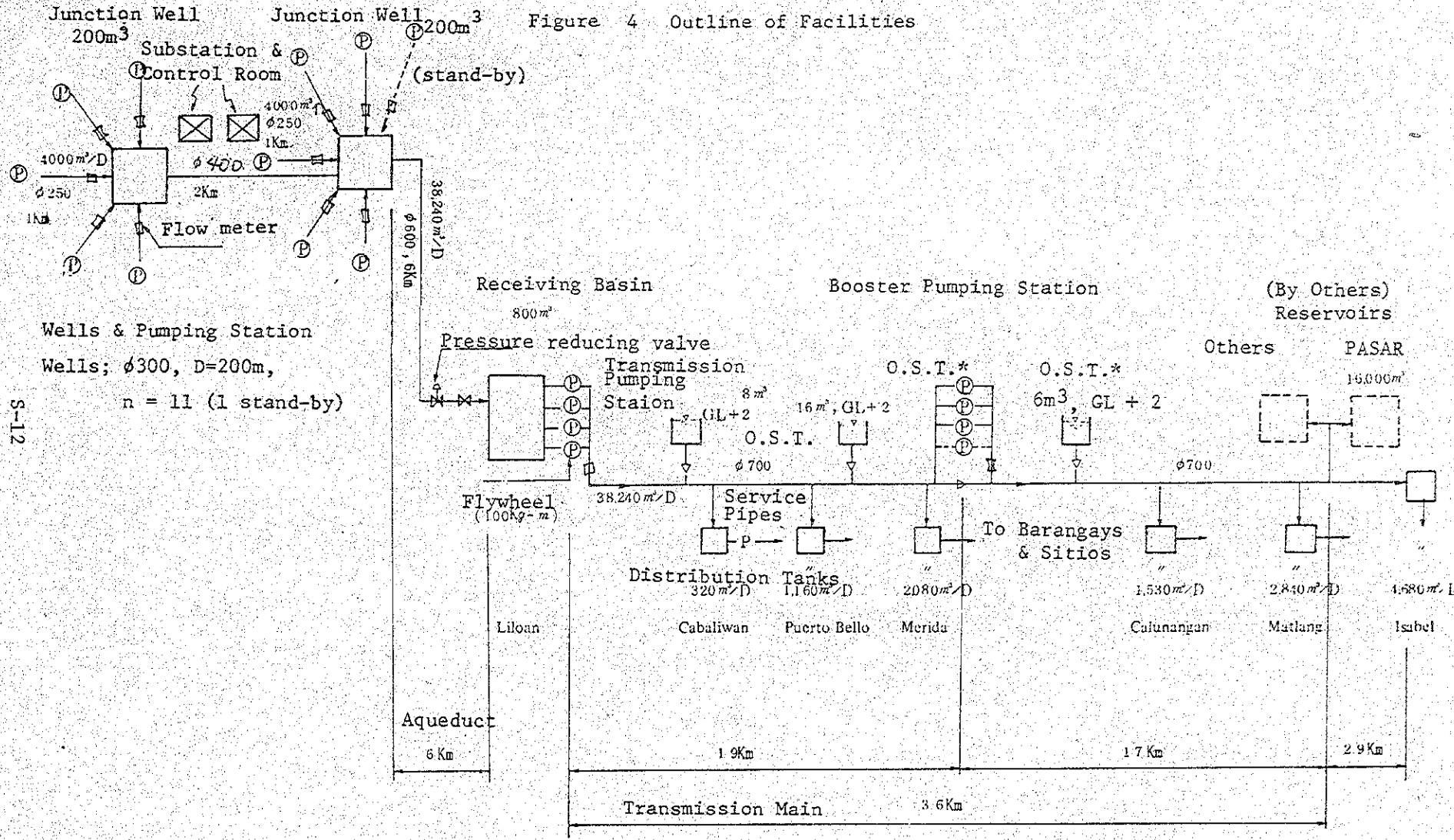
Figure 3 Outline of the Facilities



LEGEND

- Aqueduct
- Transmission Main
- Distribution Main
- Service Pipe
- Transmission Pumping Station
- Booster Pumping Station
- Booster Pump in Water District
- Receiving Basin
- Junction Well
- Distribution Tank
- Group of Wells
- Regulating Reservoir (By others)

Figure 4 Outline of Facilities



Wells & Pumping Station

Wells; φ300, D=200m,

n = 11 (1 stand-by)

*O.S.T. = One-way Surge Tank

9. Construction Costs and Construction Schedule

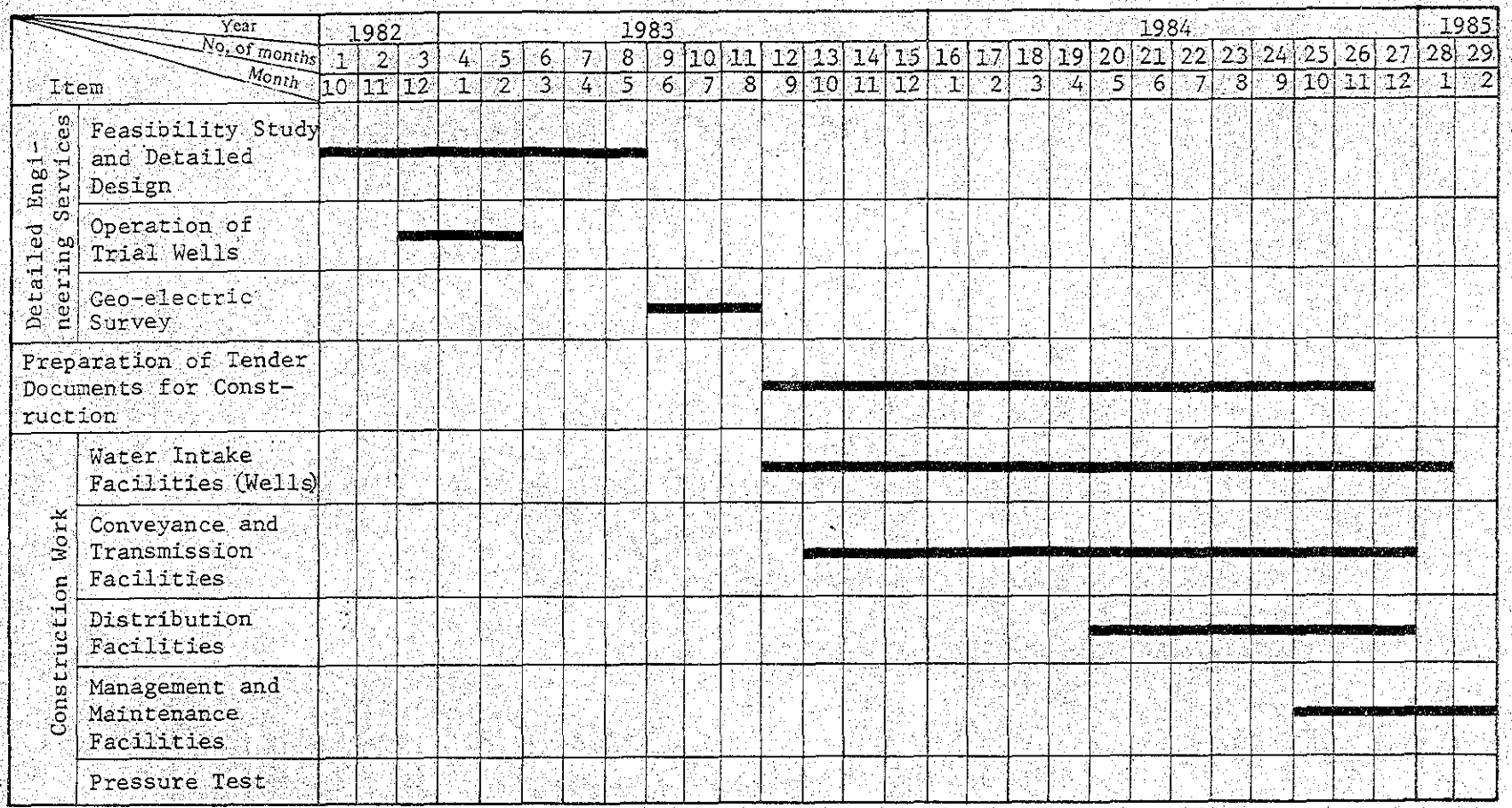
An estimate of the construction cost and the proposed construction schedule for Scheme I are shown in Table-7 and Figure-5.

Table 7 Construction Cost
(Scheme I)

Unit (Pesos)

Item		Construction Cost	Notes	
Basic Construction Cost	Well	23,419,622		
	Transmission	107,911,248		
	Distribution	16,915,067		
	Administration Building	635,000		
	Operational Center	500,000		
	Subtotal	149,380,937		
Engineering Fee		11,950,475		
	Subtotal	161,331,412		1
Contingencies		8,066,571	5% of 1= 161331412 x 0.05	2
Land		1,000,000		3
Total		170,397,983	1 + 2 + 3	

Figure 5 Construction Schedule



10. Financial and Economic Analysis

(1) The following analyses were done to evaluate the base case. The interest rates used in this study are only assumptions and do not bind all parties concerned.

	Assumptions 1/		
Case	Goods to be supplied	Method of raising the fund for construction 2/	Main factors determining unit water price
Base case	Industrial and water supply	70% of the funds with annual interest rate 3.5% and 30% at 8.0%	Redestribution of income, construction cost to be borne by water supplier
Case 1	Industrial water only	All funds with annual interest rate 8.0% 3/	-
Case 2	Industrial and water supply	Ditto	Rate set by opinion of residents 4/
Case 3	Ditto	The same as in Base case	Ditto
Case 4	Ditto	Ditto	The same as in Base case

1/ Besides the framework, the following conditions are common to all cases.

a.	Management policy of the operating entity	Maintaining equilibrium between the revenues and the expenses for 21 years.
b.	Method of raising the operating funds	Borrowing from the Philippine government (expecting annual interest rate : 9%)

2/ Method of the amortization of funds ..... 20 year fixed amortization

3/ The banks in Japan are expected to supply the funds at an annual interest rate of 8.0%. However, when actually raising the funds, the financing conditions will become as follows:

a. Annual interest rate ..... around 9%
b. Terms of financing ..... about 10 years

4/ The unit water price into which consideration of the opinion of residents on the water rate is taken is deducted from the facts that the water rate per month and per household will be around 5 pesos in 1985 - 1987. This is within their income level.

The representative findings of the above four cases in comparison with the ones of base case are as follows.

Case	Representative findings Unit price of Industrial and	Financial situation of the operating entity 1/
Case 1	The industrial water unit price will be approximately the same as that of the base case.	Same as that of base case (because of being treated as a precondition in this case)
Case 2	The industrial water unit price is a little higher than that of base case. The water unit price will be 1/4 ∿ 1/3 of that of base case. So, the users payment is decreased.	The breakdown point will be in 1977, three years later than that of base case. However, dissolution of the cumulative ordinary losses and repayment of debt from the government will not be finished by 2005. The operating entity will probably be on the verge of bankruptcy even after 2005.
Case 3	Ditto	Same as that of base case
Case 4	Both of industrial water and water supply unit price will become higher than those of base case. There is a problem of water unit price from the standpoint of income level.	Bad financial situation will continue for 2∿3 years longer than that of base case.

1/ This data can be presented from the following three standpoints.

a. The point of time when the operating entity breaks even.

b. The point of time when the operating entity covers the ordinary cumulative losses.

c. The point of time when the operating entity repays the government loan.

The following conclusions are derived from representative findings of the four cases outlined above.

i) It is not industrial water but domestic water supply which will receive the incremental financial benefit over the base case (from comparison of base case with Case 1).

ii) In setting the unit water price of the base case, equilibrium between the revenues and expenses, construction cost to be borne water supplier, redistribution of income, etc. were taken into consideration.
If other factors are considered, (e.g. taking account of user opinion on the water rate) to set the actual unit water rate, the water rate system will become more favorable to improvement of welfare in the area. In such a case, however, the incremental burden to be borned by the industrial water will remain relatively small (in comparison with Case 2 and Case 3).

iii) On the assumption that the operating entity will supply both industrial water and domestic water and that it raises the total funds necessary for the construction of the facilities from commercial banks (assuming the annual interest rate: 8%), it is foreseen that the operating entity will not be financially solvent (from the comparison with Case 2). If the conditions of funding are worse than the ones in base case, the financial situation will become naturally worse (from comparison with Case 4).

Based on the above findings, the base case is found to be financially acceptable.

(2) A public entity is believed to be the most suitable operator to supply the industrial and domestic water, maintains its facilities and manage the water supply business.

PASAR CO., LTD. is in charge of raising the funds for construction of the necessary facilities and constructing them. Thereafter, the newly created public entity will purchase the facilities from PASAR on credit with repayment of a fixed amount (P15,972,000 per year) for twenty years.

(3) FIRR (Financial Internal Rate of Return) and EIRR (Economic Internal Rate of Return) of this business are as follows.

FIRR	———————		7.9%
	———————	Base case	16.0%
EIRR	———————	Construction Cost down 10%	17.4%
	———————	Construction Cost up 10%	14.8%

FIRR is fair compared with water projects in other Districts in the Philippines in spite of the relatively large scale of Construction cost of this project.

The EIRR of the three cases listed above are higher or approximately the same as the opportunity cost of capital in the Philippines. (12-15%).

Accordingly, it can be concluded that this business is feasible both from financial and economic viewpoints.

(4) As for the total funds for construction of facilities, the funds for construction of house connections and operation which the operating entity will raise are as follows.

Kinds of funds	Amount of funds (₱1000)	Source of Funding	Time of funding	Reamrks
Funds for construction of facilities	198,900.7 (current price) 170,398.0 (at 1982 constant price)	Japan	1983, 1984	
Operating Funds	56,753.1	Domestic	1985 - 1990	Annual interest rate: 9%

The operating entity will raise the funds for construction of house connections from the Philippine Government, construct the house connections and will collect the funds (including interest) from the user over 30 years and then make payment to the government.

(5) Industrial water and domestic unit water prices of the base case are as follows:

(i) The price of water to be set on the premise that the revenues and expenses of the business entity shall be balanced not yearly but for 21 years, provided that the forecasted demand for water supply shall be realized.

(ii) Aside from the above condition, income redistribution and the people's solvency for water rate shall also be taken into consideration.

The prices of water are shown below:

Unit Water Rate Cost Summary

(Unit: ₱/m^3, current price

Period	Industrial water	Water supply through house connection	Water supply through public faucet	(only for reference) Growth Index	(only for reference) Annual growth rate (%)
1982	1.123	0.802	0.723	1.000	
1985 ∿ 1987	1.504	1.074	0.968	1.339	10.2%
1988 ∿ 1990	2.001	1.429	0.288	1.782	10.0
1991 ∿ 1993	2.664	1.902	1.715	2.372	10.0
1994 ∿ 1996	3.545	2.532	2.283	5.157	10.0
1997 ∿ 1999	4.719	3.370	3.038	4.202	10.0
2000 ∿ 2002	5.780	4.128	3.721	5.147	7.0
2003 ∿ 2005	5.780	4.128	3.721	5.147	0

The above prices must be qualified in the following respects.

i With these prices, the revenues and expenses of the operating entity balance for 21 years, on the assumption that the forecasted demand for water supply will be realized.

ii In setting the above prices, the redistribution of income and the user income level have been taken into account in addition to the conditions described in para i above.

iii The water rate which is calculated on the basis of the unit water price is much higher than the existing water rate (₱ 5∿10/month/household), and is near the maximum rate which can be afforded by users in terms of their household income.

iv. Therfore, at the time of setting the actual unit water price, it will be necessary to give a careful consideration to user opinions in the area in addition to the main factors and conditions described in para i and ii above.
And also, it is essential for the actual water unit price to be high enough to prevent users from abusing the water supply.

(6) It is possible for the operating entity to repay the funds for construction of the facilities with a 20 year period between 1985 and 2004 (annual amount of repayment : ₱ 15,972,000).

At the same time, it must be pointed out that the annual amount of the repayment puts a heavy burden on the yearly balance of revenues and expenses of the operating entity.

(7) The annual amount of the repayment is relatively large in comparison to the annual revenue for the first five or six years. This situation will bring about a shortage of operating funds and therefore an introduction of funding from the Philippine Government will be needed. In addition for the second period, the operating entity will be burdened with the repayment of the governmental loan and with the amoritization of the loan for the construction of facilities.

Breakeven year for the operating entity	1994	10th year after start of operations
Cumulative Breakeven point for the operating entity	1998	14th year "
Final year to be amoritize the loan from the Government	2001	17th year after start of operations

The cases in which financial conditions or raising the fund for construction are worse than those of base case are as follows.

	Case 2	Case 4
Breakeven year	1994	1994
Cumulative Breakeven point	After 2005 The cumulative losses at end of 2005: ₱ 49.72 millions	2000
Final year to amoritize the loan from the government	After 2005 The debt at end of 2005: ₱ 165.84 millions	2004

(8) Based on reasons stated below, this project is considered to benefit regional development and to be "public" in nature.

a. It is expected that the constant supply of hygienic water will lead to a remarkable decrease in diseases, especially of diseases related to the digestive system. This will not only decrease personal medical expenses but also help stabilize the livelihood of the residents in the area.

Consequently, this project is expected to have a large economic impact.

b. Through the installation of fire hydrants, losses from fire will decrease.

c. In the base case, the population will receive a large amount of social benefit.

d. This project has a good possibility to directly and indirectly increase regional employment in secondary land teritiary industries.

e. The above benefits will raise the standard of living of the area which will help stumilate mental and economic attitudes promoting the economic development of the area.

(9) This project is indispensable for PASAR; however, it is impossible to initiate and maintain the project from a commercial base. Since, however, this project has a large impact on regional development and is in the public domain, it is suitable to receive funding from the Japan International Cooperation Agency (JICA).