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No. 8

LOCAL WATER UTILITIES ADMINISTRATION

SUMMARY
OF
MASTER PLAN AND FEASIBILITY STUDY
OF THE
LOCAL WATER SUPPLY PROJECTS
IN THE
REPUBLIC OF THE PHILIPPINES

JUNE 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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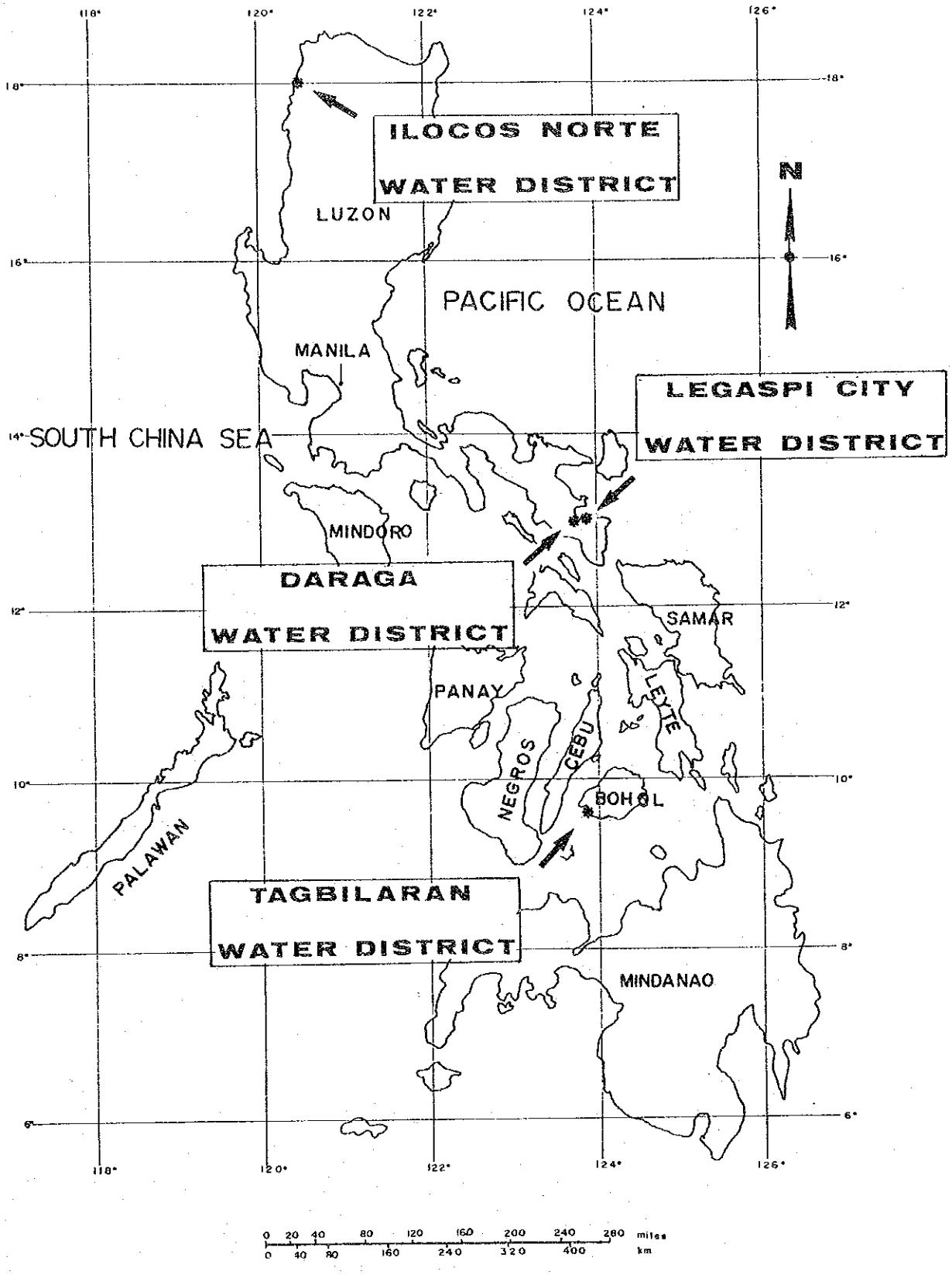


LOCATION MAP

PREFACE

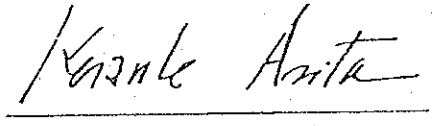
In response to the request of the Government of the Republic of the Philippines, the Japanese Government decided to cooperate in formulating a master plan and making a feasibility study on the Local Water Supply Project and entrusted the work to the Japan International Cooperation Agency (JICA).

The JICA sent to the Philippines a survey team from 28 June 1981 to 27 December 1981. The team exchanged views with the officials concerned of the Government of the Philippines and conducted field surveys in the Ilocos Norte Province (Laoag City, Bacarra Municipality, Pasquin Municipality, Vintar Municipality and Paoay Municipality), the Albay Province (Legaspi City and Daraga Municipality) and the Bohol Province (Tagbilaran City). 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 promotion of friendly relations between our two countries.

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.

June, 1982



Keisuke Arita
President
Japan International
Cooperation Agency

SUMMARY OF PROJECT IMPLEMENTATION

The water supply Master Plan proposed a long term development program up to the year of 2010, and recommended its implementation by stages, namely, Phase I up to 1987, Phase II up to 1993, and Phase III up to the final target year 2010.

In accordance with the above recommendation, the present feasibility study was made with regard to two cases, i.e., Case 1 for Phase I project, of which the major intention is to maximize use of the existing facilities, together with urgent improvements and reinforcement works, and Case 2 for a combined project to Phase I and II, which includes, in addition to the Phase I works, development of a new water source/s and pipeline extension works.

The results of the study of the two cases indicate that both cases are technically and financially feasible, meeting satisfactorily the basic requirements concerning loan ceiling, water rate and consumers' paying ability. Case 2, however, is based on the given conditions that a national subsidy equivalent to 25% - 20% of the total project cost will be provided to the project.

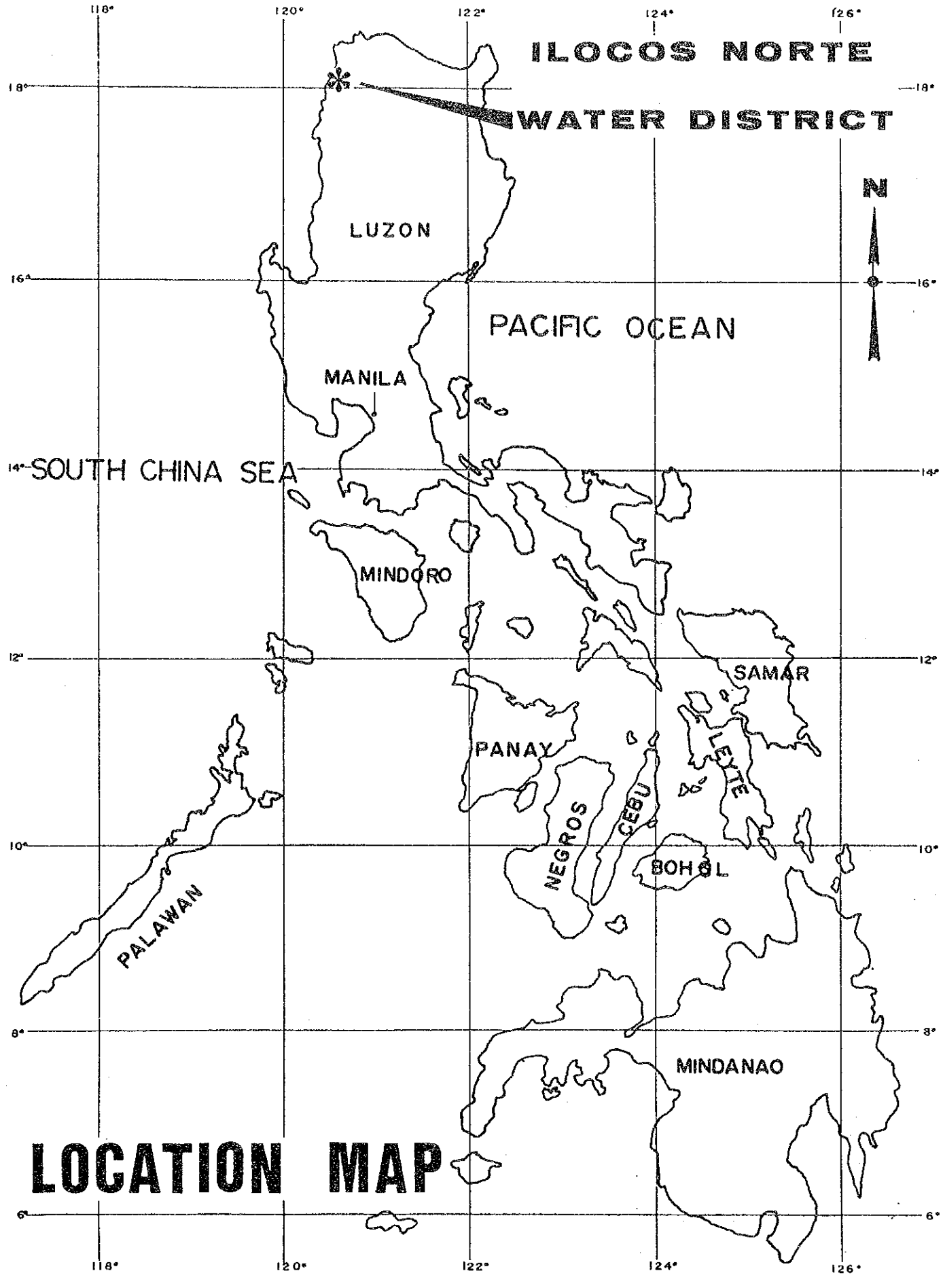
As regards implementing the water supply development project, it is desirable to consider the Case 2 project, because it can meet the water requirement over a medium term future, contributing to the unimpeded social development of the community concerned. Decision of the implementation must be made solely depending on the national policy. If Case 1 should be selected for implementation, the Phase II project should, needless to say, follow immediately the Phase I project.

Summary of Project Cost

Note: - Unit = One million US Dollars
- Including Price Escalation Contingency
- Foreign Exchange Rate:
US$ $1.00 = Peso 7.80 (At July 1981)

Phase	Water District	Project Costs		
		Foreign	Local	Total
Phase I	1) Ilocos Norte	$4.82 M	$3.43 M	$8.25 M
	2) Legaspi City	$1.64 M	$1.37 M	$3.01 M
	3) Daraga	$0.91 M	$0.60 M	$1.51 M
	4) Tagbilaran	$1.89 M	$1.17 M	$3.06 M
	Total	$9.26 M	$6.57 M	$15.83 M
Phase I + II (Combination of Phase I and Phase II)	1) Ilocos Norte	$10.40 M	$6.22 M	$16.62 M
	2) Legaspi City	$4.92 M	$3.72 M	$8.64 M
	3) Daraga	$3.84 M	$2.67 M	$6.51 M
	4) Tagbilaran	$4.05 M	$2.51 M	$6.56 M
	Total	$23.21 M	$15.12 M	$38.33 M

ILOCOS NORTE WATER SUPPLY SYSTEM



LOCATION MAP

SUMMARY

I. General

1.1 Physical and Socioeconomic Conditions

The Project Area includes one city, Laoag, and four municipalities, Pasuquin, Bacarra, Vintar and Paoay. Poblacions of these municipalities are widely scattered generally in the alluvial plains formed by rivers. The area is dotted with low hills and bounded with the sea on the west and high mountains on the north and east. The plains extend beyond the southern boundary of the area. Main features of the Area are as follows.

(1)	Location:	North-western tip of Luzon Island in the Philippines
(2)	Topography:	Consisting of alluvium, hills 30 to 60 m high, mountains, and dunes
(3)	Climate:	Rainfall = 2,100 mm/year (May to October in wet season)
(4)	Population:	151,210 in 1980, with 1.23% of annual growth rate
(5)	Socio-Economic Conditions:	Identified as an agricultural area Dialect: Ilocano (99%) Road Condition: Better than other provinces Public Water Supply: Existing, however supply conditions poor Sewerage System: Not existing Electricity: 71% in electrification Transportation: Accessible to various points in the island by roads

1.2 Existing Water Supply

Most outstanding is overall deterioration of the existing facilities due to long-term use for the past fifty years, resulting in leaks and low water pressure. Although some facilities have been added to strengthen the supply capacity, the present supply conditions are far from satisfactory. There are some wells and an infiltration gallery constructed recently, but they have not been put in use yet, because pumps and power supply facilities are not installed. Meters are very insufficient and so no accurate records of production and consumption are available. Major features of the existing water supply are summed up as below.

(1)	System:	Started in 1930's with springs. Currently owned and operated by the Ilocos Notre Metropolitan Waterworks.
(2)	Water Source:	Springs, riverbed water and groundwater
(3)	Distribution System:	Storage facilities and distribution networks: Transmission pipelines (24,500 m in length and 300-200 mm in diameter) and distribution pipelines (32,700 m in length and 250-75 mm in diameter)
(4)	Present Water Use:	Maximum amount of supply = 5,180 cu m/day Served Population = 25,000 Service Connections = Total 3,166
(5)	Water Rate:	Peso 20.0 per month for domestic use in Laoag and Peso 15.0 per month in Bacarra and Pasuquin (Minimum change for the first 10 cu m)

II. Master Plan

For master planning the water supply system, a period from the present up to the year 2010 was taken for the design period. Served population was assumed to gradually rise from the present 25,000 (17% of total population) to 127,600 (62%) at the end of the design period. Based on the served population, future water demand was projected.

All potential water sources to meet the projected water demand were investigated in the project area, including springs, groundwater and riverbed water. As for the use of water sources, all water sources were arranged in the design so that the distance between the source and the served area is as close as possible.

The whole design period was divided into Phases I, II and III. Phase I intends to utilize fully the existing water sources, with some improvement and addition of facilities to alleviate the chronic water shortage within a rather short period up to the year 1987. Phase II intends to expand the water supply system in the middle term future up to the year 1993, for which plan more reliable design factors, to be gained by the Phase I project, will be used. The remaining period of the design period is termed Phase III.

Major figures and items of work are tabulated below.

(1) Target Year:

Phase I = 1987
Phase II = 1993
Phase III = 2010

(2) Service Area:

Present	:	1,280 ha
1987	:	2,701 ha
1993	:	4,906 ha
2010	:	10,531 ha

(3) Population Projection:

Present	: 151,210
1987	: 166,410
1993	: 178,090
2010	: 204,870

(4) Served Population:

Present	:	25,000 (17%)
1987	:	44,130 (27%)
1993	:	72,980 (41%)
2010	:	127,660 (62%)

(5) Water Demand:

Present	:	6,060 cu m/day
1987	:	10,230 cu m/day
1993	:	14,980 cu m/day
2010	:	27,530 cu m/day

(6) Water Sources:

See page 5.

(7) Facilities to be Constructed:

See page 6.

(8) Project Cost:

	Phase I	Phase II	Phase III
Foreign	$2.95 M	$4.23 M	$7.90 M
Local	$2.03 M	$2.55 M	$4.62 M
Total	$4.98 M	$6.78 M	$12.52 M

(Costs as of July 1981: Not including price escalation)

Water Sources for Master Plan

Phase	Laoag	Pasuquin	Bacarra	Vintar	Paoay	Total
Existing Water Sources 1/ and Production	E-I/G-680 W-I/G-1,080 B-I/G-1,600 D-1,820	Dilumot	Dilumot	None	None	5,180
Phase I Water Demand 2/ Water Sources and Production	6,300 E-I/G-860 W-I/G-2,000 B-I/G-1,280 Deep Well-2,160	950 Dilumot -950	1,610 Dilumot-870 Bacarra I/G- 740	800 Vintar I/G- 800	580 (Nangalisan I/G-580) 3/	10,240 10,240
Phase II Water Demand Water Sources and Production	8,920 Existing-6,920 (San Mateo I/G -1,450 (Nangalisan I/G-550)	1,580 Dilumot -1,580	2,430 Dilumot-240 (Bacarra I/G II-2,190)	1,180 Vintar I/G- 1,180	870 Nangalisan I/G-870	14,980 14,980
Phase III Water Demand Water Sources	15,630 Existing-6,880 (San Mateo I/G -5,944) (Nangalisan I/G-2,806)	2,490 Dilumot-1,820 (Bacarra I/G II-670)	4,410 (Bacarra I/G II-4,410)	2,690 (Vintar I/G -2,200) (Bacarra I/G II-490)	2,320 (Nangalisan I/G-2,320)	27,540 27,540

1/ Production (cu m/d)
E-I/G: Ermita Infiltration Gallery
W-I/G: West Riverside Infiltration Gallery
B-I/G: Bacarra Infiltration Gallery

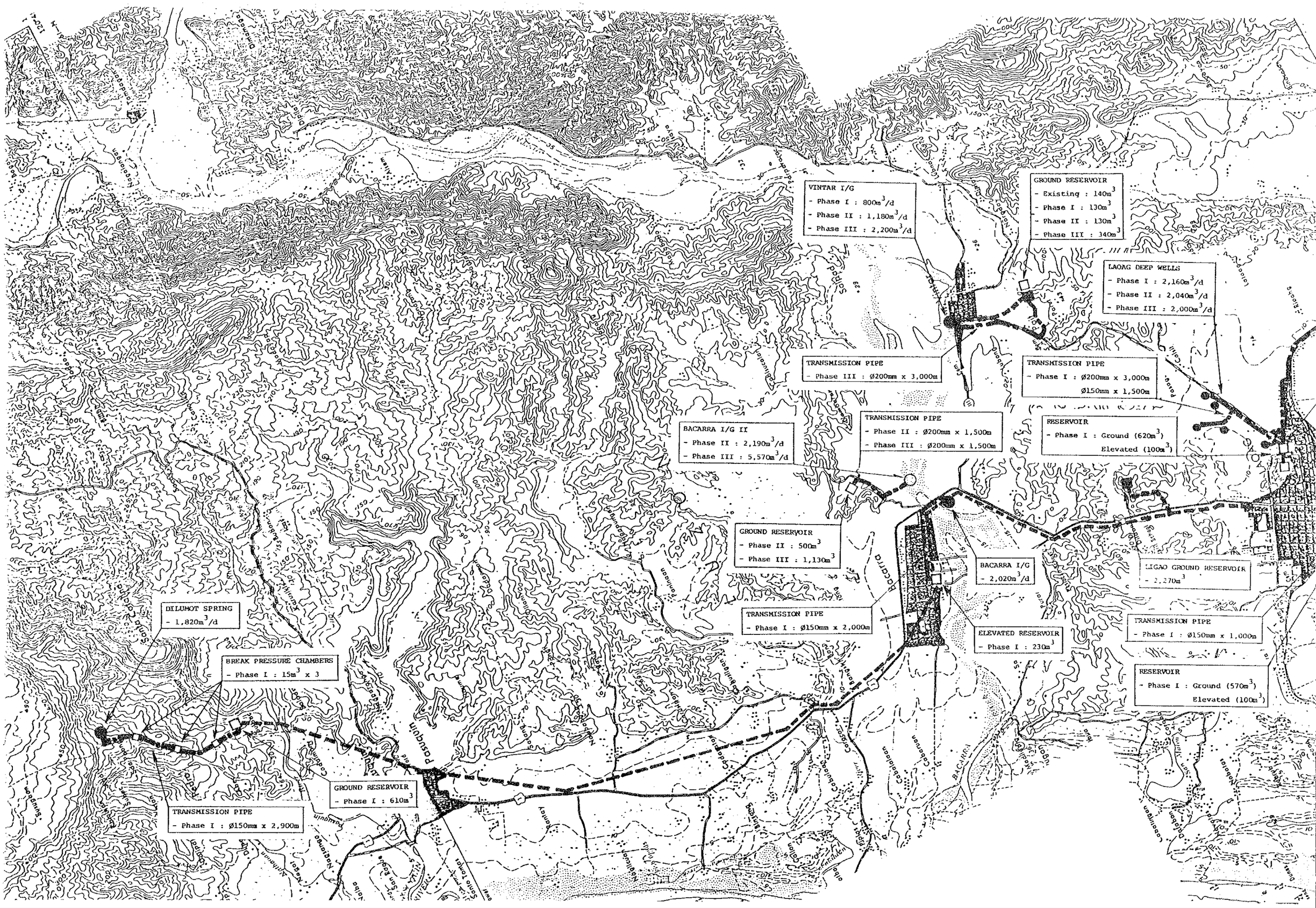
2/ Maximum Day Demand

3/ ( ) Water Sources to be Developed

Ilocos

Facilities to be Constructed

Phase I	Phase II	Phase III
A. Dilumot Spring a) Transmission Pipe b) Break Pressure Chamber c) Ground Reservoir B. Bacarra I/G a) Intake Pump Station b) Transmission Pipe c) Elevated Reservoir d) Roofing of Ligao Reservoir C. West Riverside I/G a) Intake Pump b) Transmission Pipe c) Ground Reservoir d) Distribution Pump Station e) Elevated Reservoir D. Vintar I/G a) Intake Pump b) Ground Reservoir E. Laoag Deep Wells a) Pump Station b) Transmission Pipe c) Ground Reservoir d) Distribution Pump Station e) Elevated Reservoir F. Nangalisan I/G a) Infiltration Gallery b) Intake Pump Station c) Transmission Pipe d) Ground Reservoir G. Distribution Pipe H. Valve I. Fire Hydrant J. Bulk Meter K. Chlorinator L. Service Meter M. Stored Material N. Vehicle	A. San Mateo I/G a) Infiltration Gallery b) Intake Pump Station c) Transmission Pipe d) Ground Reservoir e) Distribution Pump B. Bacarra I/G II a) Infiltration Gallery b) Intake Pump Station c) Transmission Pipe d) Ground Reservoir C. Vintar I/G Ground Reservoir D. Bacarra I/G Intake Pump Station E. Nangalisan I/G a) Infiltration Gallery b) Intake Pump Station c) Transmission Pipe d) Elevated Reservoir e) Ground Reservoir F. Distribution Pipe G. Valve H. Fire Hydrant I. Bulk Meter J. Chlorinator K. Service Meter L. Stored Material M. Administrative Building N. Operational Center O. Vehicle	A. Bacarra I/G II a) Infiltration Gallery b) Intake Pump c) Transmission Pipe d) Ground Reservoir B. Vintar I/G a) Infiltration Gallery b) Intake Pump c) Transmission Pipe d) Ground Reservoir C. San Mateo I/G a) Infiltration Gallery b) Intake Pump c) Transmission Pipe d) Ground Reservoir e) Distribution Pump D. Nangalisan I/G a) Infiltration Gallery b) Intake Pump c) Transmission Pipe d) Ground Reservoir e) Ground Reservoir f) Distribution Pump g) Elevated Reservoir E. Distribution Pipe F. Valve G. Fire Hydrant H. Bulk Meter I. Service Meter J. Stored Material K. Vehicle


VINTAR I/G
- Phase I : 800m³/d
- Phase II : 1,180m³/d
- Phase III : 2,200m³/d
GROUND RESERVOIR
- Existing : 140m³
- Phase I : 130m³
- Phase II : 130m³
- Phase III : 340m³
LAOAG DEEP WELLS
- Phase I : 2,160m³/d
- Phase II : 2,040m³/d
- Phase III : 2,000m³/d
TRANSMISSION PIPE
- Phase III : Ø200mm x 3,000m
TRANSMISSION PIPE
- Phase I : Ø200mm x 3,000m
Ø150mm x 1,500m
TRANSMISSION PIPE
- Phase II : Ø200mm x 1,500m
- Phase III : Ø200mm x 1,500m
RESERVOIR
- Phase I : Ground (620m³)
Elevated (100m³)
BACARRA I/G II
- Phase II : 2,190m³/d
- Phase III : 5,570m³/d
GROUND RESERVOIR
- Phase II : 500m³
- Phase III : 1,130m³
BACARRA I/G
- 2,020m³/d
LIGAO GROUND RESERVOIR
- 2,270m³
TRANSMISSION PIPE
- Phase I : Ø150mm x 2,000m
ELEVATED RESERVOIR
- Phase I : 230m³
TRANSMISSION PIPE
- Phase I : Ø150mm x 1,000m
RESERVOIR
- Phase I : Ground (570m³)
Elevated (100m³)
DILUMOT SPRING
- 1,820m³/d
BREAK PRESSURE CHAMBERS
- Phase I : 15m³ x 3
GROUND RESERVOIR
- Phase I : 610m³
TRANSMISSION PIPE
- Phase I : Ø150mm x 2,900m

VINTAR I/G
- Phase I : 800m^3/d
- Phase II : 1,180m^3/d
- Phase III : 2,200m^3/d

GROUND RESERVOIR
- Existing : 140m^3
- Phase I : 130m^3
- Phase II : 130m^3
- Phase III : 340m^3

LAOAG DEEP WELLS
- Phase I : 2,160m^3/d
- Phase II : 2,040m^3/d
- Phase III : 2,000m^3/d

TRANSMISSION PIPE
- Phase III : Ø200mm x 3,000m

TRANSMISSION PIPE
- Phase I : Ø200mm x 3,000m
  Ø150mm x 1,500m

RESERVOIR
- Phase I : Ground (620m^3)
  Elevated (100m^3)

TRANSMISSION PIPE
- Phase II : Ø200mm x 1,500m
- Phase III : Ø200mm x 1,500m

BACARRA I/G II
- Phase II : 2,190m^3/d
- Phase III : 5,570m^3/d

GROUND RESERVOIR
- Phase II : 500m^3
- Phase III : 1,130m^3

BACARRA I/G
- 2,020m^3/d

LIGAO GROUND RESERVOIR
- 2,270m^3

TRANSMISSION PIPE
- Phase I : Ø150mm x 2,000m

ELEVATED RESERVOIR
- Phase I : 230m^3

TRANSMISSION PIPE
- Phase I : Ø150mm x 1,000m

RESERVOIR
- Phase I : Ground (570m^3)
  Elevated (100m^3)

SAN MATEO I/G
- Phase II : 1,450m^3/d
- Phase III : 5,944m^3/d

TRANSMISSION PIPE
- Phase II : Ø200mm x 4,500m
- Phase III : Ø300mm x 4,500m

GROUND RESERVOIR
- Phase II : 490m^3
- Phase III : 1,500m^3

ELEVATED RESERVOIR
- 380m^3

ERMITA I/G
- 860m^3/d

NANGALISAN I/G
- Phase I : 772m^3/d
- Phase II : 1,564m^3/d
- Phase III : 5,126m^3/d

TRANSMISSION PIPE
- Phase II : Ø150mm x 1,000m

RESERVOIR
- Phase II : Elevated (190m^3)
- Phase III : Ground (160m^3)

WEST RIVERSIDE I/G
- 2,000m^3/d

RESERVOIR
- Phase III : Ground (490m^3)
  Elevated (100m^3)

TRANSMISSION PIPE
- Phase I : Ø200mm x 8,000m
- Phase III : Ø300mm x 8,000m

TRANSMISSION PIPE
- Phase I : Ø200mm x 5,100m
- Phase III : Ø200mm x 5,100m

SAN MATEO I/G
- Phase II : 1,450m^3/d
- Phase III : 5,944m^3/d

TRANSMISSION PIPE
- Phase II : Ø200mm x 4,500m
- Phase III : Ø300mm x 4,500m

WELLS
2,160m^3/d
: 2,040m^3/d
: 2,000m^3/d

GROUND RESERVOIR
- Phase II : 490m^3
- Phase III : 1,500m^3

ELEVATED RESERVOIR
- 380m^3

ERMITA I/G
- 860m^3/d

NANGALISAN I/G
- Phase I : 772m^3/d
- Phase II : 1,564m^3/d
- Phase III : 5,126m^3/d

TRANSMISSION PIPE
- Phase II : Ø150mm x 1,000m

ELEVATED RESERVOIR
- 40m^3

GROUND RESERVOIR
- Phase III : 270m^3

GROUND RESERVOIR
- Phase I : 160m^3
- Phase II : 90m^3
- Phase III : 260m^3

RESERVOIR
- Phase II : Elevated (190m^3)
- Phase III : Ground (160m^3)

RESERVOIR
- Phase III : Ground (490m^3)
Elevated (100m^3)

TRANSMISSION/DISTRIBUTION PIPE
- Phase I : Ø200mm x 7,400m
- Phase III : Ø300mm x 7,400m

WEST RIVERSIDE I/G
- 2,000m^3/d

TRANSMISSION PIPE
- Phase I : Ø200mm x 8,000m
- Phase III : Ø300mm x 8,000m

TRANSMISSION PIPE
- Phase I : Ø200mm x 5,100m
- Phase III : Ø200mm x 5,100m

Remarks
- Existing Water Source :
- Proposed Water Source :
- Existing Facility :
- Proposed Facility :
- Existing Pipeline :
- Proposed Pipeline :

WATER SUPPLY SCHEME FOR MASTER PLAN

S = 1 : 50,000

III. Feasibility Study

Feasibility study was carried out for two cases: Case 1 study was made on the initial project, namely, Phase I, as is generally made in the feasibility study of a project, and Case 2 study was made on the combined project of Phases I and II, as this is deemed more beneficial for the development of the municipalities concerned.

The results of both Case studies indicate that the two cases are feasible. The only difference is that the Case 2 project is to given a government subsidy of 25% of the total investment cost.

(1) Implementation Schedule:

Phase I	:	1982 - 1987
Phase I + II	:	1982 - 1988

(2) Project Costs:

	Phase I	Phase I + II
Foreign	$4.82 M	$10.40 M
Local	$3.43 M	$ 6.22 M
Total	$8.25 M	$16.62 M

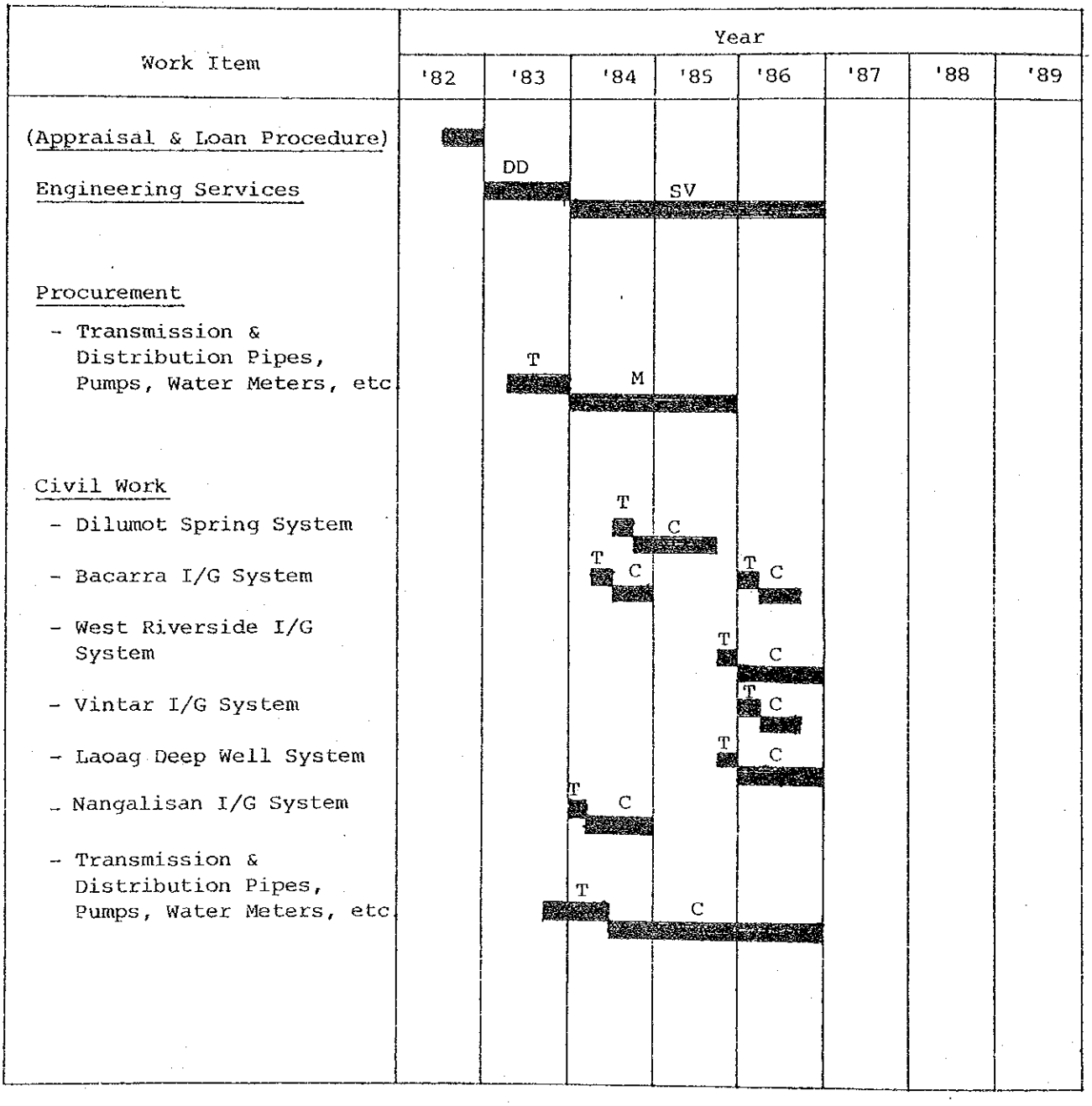
(Costs including price escalation according to implementation schedule)

(3) Financial Feasibility:

Phase I	:	Feasible
Phase I + II	:	Feasible with government subsidy of 25% of total investment cost

Construction Schedule for Phase I

(Target Year: 1987)



Note: DD = Detailed Design
SV = Supervision of Construction
T = Tendering Procedure (Advertisement/Tendering/Evaluation/Award)
M = Manufacturing & Shipping
C = Construction/Installation

Project Cost for Phase I (Target Year: 1987)

Note: - Unit = One Thousand Pesos = '000 Pesos
- Prices as of 1st July 1981
- Foreign Exchange Rate: US $ 1.00 = Peso 7.80

Work Items	Cost		
	Total Cost	Foreign Currency Component	Local Currency Component
A. Dilumot Spring System	2,258	1,069	1,189
B. Bacarra I/G System	2,520	1,159	1,361
C. West Riverside I/G System	2,388	1,064	1,324
D. Vintar I/G System	502	252	250
E. Laoag Deep Wells System	5,389	2,882	2,507
F. Nangalisan I/G System	8,950	5,737	3,213
G. Distribution Pipe	4,693	3,145	1,548
H. Valve	386	282	104
I. Fire Hydrant	858	566	292
J. Bulk Meter	185	148	37
K. Chlorinator	120	108	12
L. Service Meter	2,080	1,602	478
M. Stored Material	305	238	67
N. Vehicle	140	70	70
Sub Total	30,774	18,322	12,452
Detailed Design Cost (10.5%)	3,231	1,939	1,292
Supervision Cost (3.5 %)	1,077	646	431
Land Cost	200	-	200
Total	35,282	20,907	14,375
Physical Contingency (10 %)	3,529	2,091	1,438
Total	38,811	22,998	15,813
Price Contingency	25,541	14,603	10,938
Grand Total (Project Cost)	64,352 (Equivalent to US$8.25 M)	37,601 (Equivalent to US$4.82 M)	26,751 (Equivalent to US$3.43 M)

Water Rate Schedule

(Phase I)

DOMESTIC AND GOVERNMENTAL SERVICE CONNECTIONS, 1/2"

Year	First 10 m^3 1/	Charge for Each Added m^3 2/			Charge 3/ per Revenue Unit
		11-20	21-45	over 45	
1981	20.00	o.96	1.12	1.36	0.80
1982	20.00	0.96	1.12	1.36	0.80
1983	30.00	1.44	1.68	2.04	1.20
1984	47.50	2.28	2.66	3.23	1.90
1985	52.50	2.52	2.74	3.57	2.10
1986	60.00	2.88	3.36	4.08	2.40
1987	62.50	3.00	3.50	4.25	2.50
1988	70.00	3.36	3.92	4.76	2.80
1989	77.50	3.72	4.34	5.27	3.10
1990	86.25	4.14	4.83	5.87	3.45
1991	95.00	4.56	5.32	6.46	3.80
1992	104.50	5.02	5.85	7.11	4.18
1993	115.00	5.52	6.44	7.82	4.60

Note: 1/ To obtain charge per m^3 for the first 10 m^3 classified by connection size, multiply R.U. charge shown in 3/ above by the following connection size factors.

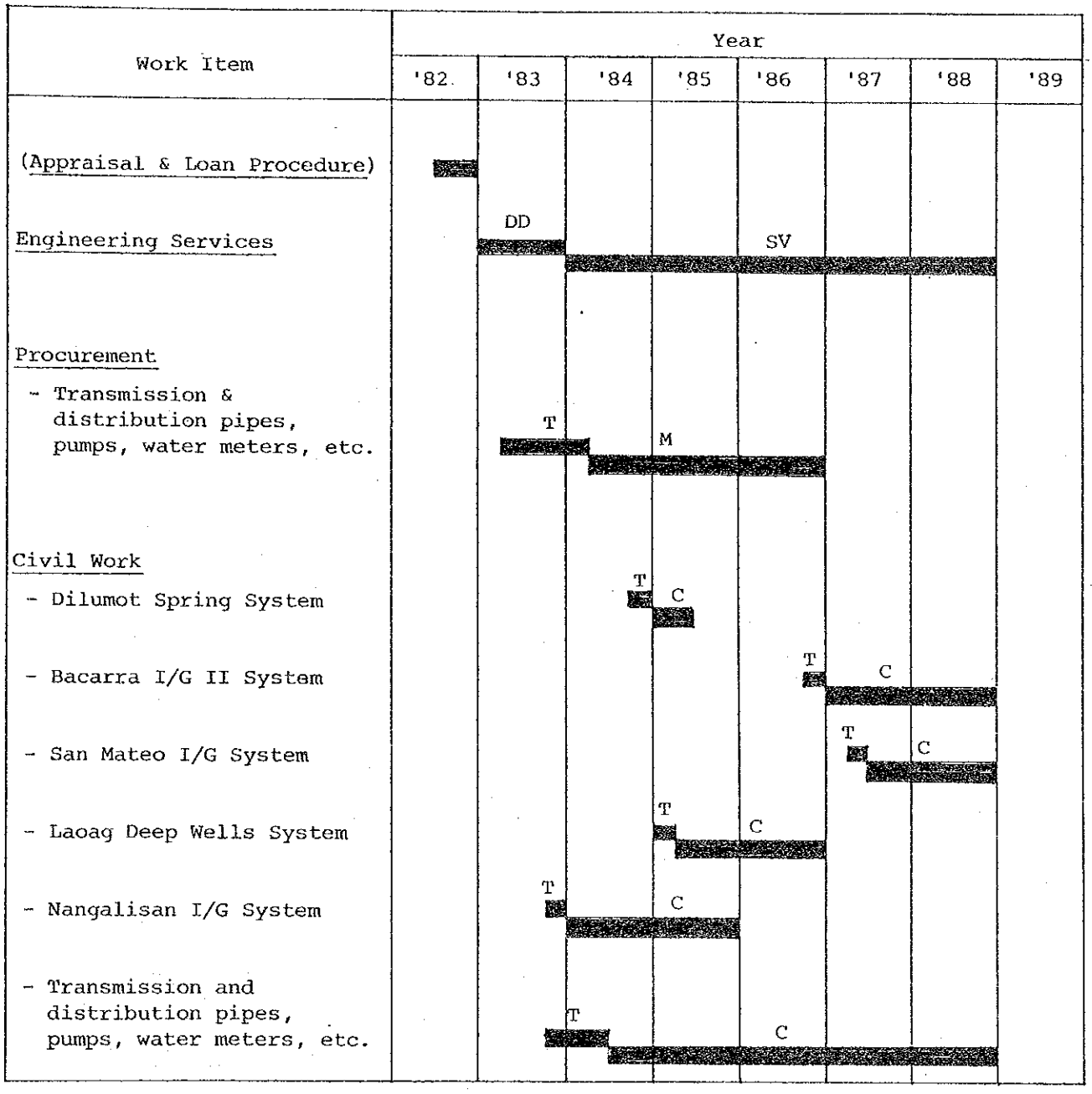
Domestic : 1.0 for 3/8"; 2.5 for 1/2"; 4.0 for 3/4"; 8 for 1"
Commerical: 5.0 for 1/2"; 8.0 for 3/4"; 16.0 for 1"; 40.0 for 1 1/2"

2/ To obtain charge for each added m^3, multiply R.U. charges shown in 3/ by the following block factors.

Domestic : 1.2 for 11-20 m^3; 1.4 for 21-45 m^3; 1.7 for over 45 m^3
Commercial: 2.4 for 21-45 m^3; 2.8 for 45-100 m^3; 2.4 for over 100 m^3

Construction Schedule for Phase I + II

(Target Year: 1993)



Note: DD = Detailed Design
SV = Supervision of Construction
T = Tendering Procedure (Advertisement/Tendering/Evaluation/Award)
M = Manufacturing & Shipping
C = Construction/Installation

Ilocos

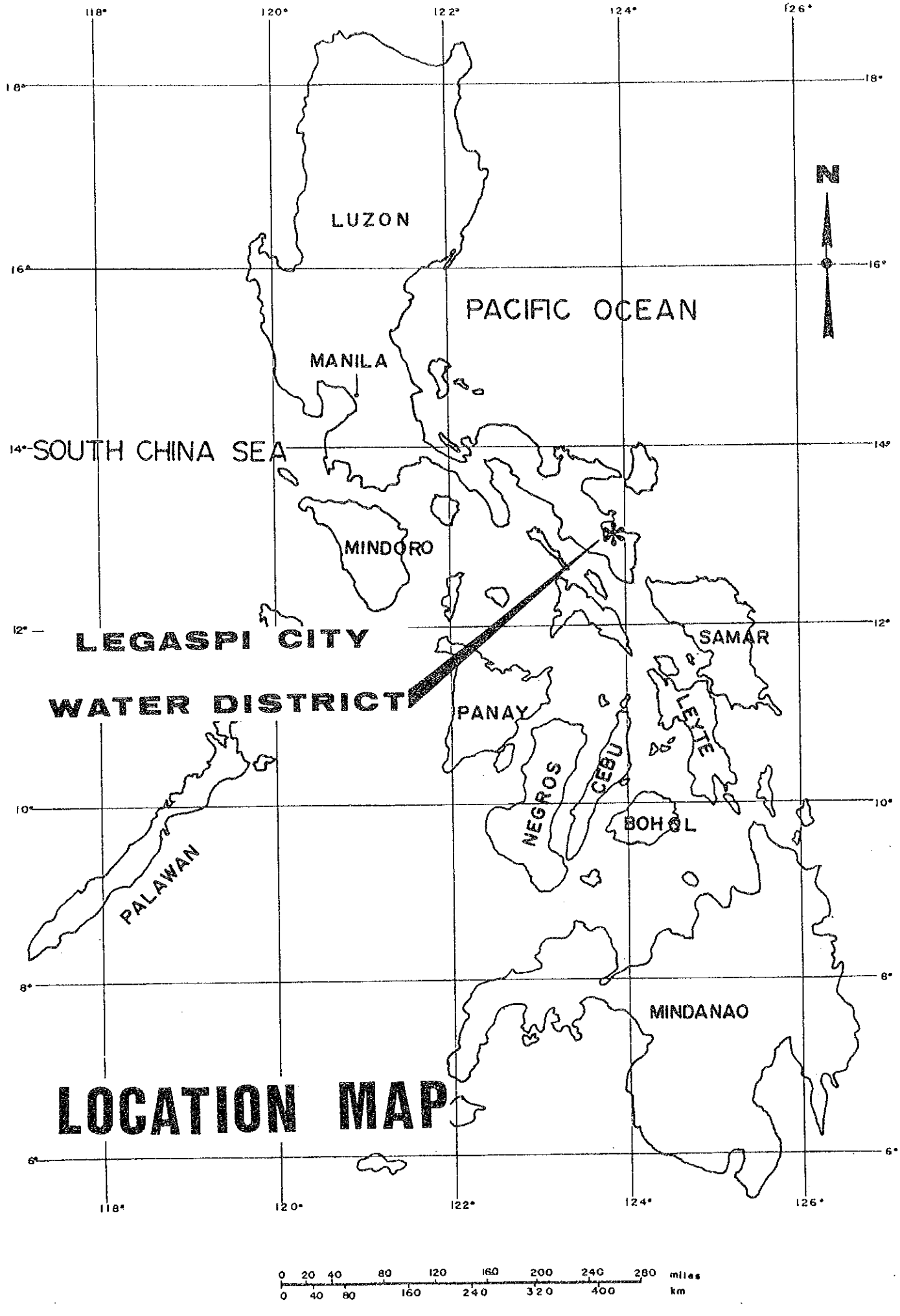
Project Cost for Phase I + II

(Target Year: 1993)

Note: - Unit = One Thousand Pesos = '000 Pesos
- Prices as of 1st July 1981
- Foreign Exchange Rate: US $ 1.00 = Peso 7.80

Work Items	Cost		
	Total Cost	Foreign Currency Component	Local Currency Component
A. Dilumot Spring System	826	207	619
B. West Riverside I/G System	243	219	24
C. Vintar I/G System	194	175	19
D. Bacarra I/G II System	2,844	1,290	1,554
E. San Mateo I/G System	3,422	2,125	1,297
F. Laoag Deep Wells System	5,949	3,088	2,861
G. Nangalisan I/G System	10,154	6,080	4,074
H. Distribution Pipe	24,844	16,645	8,199
I. Valve	1,666	1,215	451
J. Fire Hydrant	2,801	1,849	952
K. Bulk Meter	173	138	35
L. Chlorinator	130	117	13
M. Service Meter	7,771	5,984	1,787
N. Vehicle	210	105	105
Sub Total	61,227	39,237	21,990
Detailed Design Cost (10.5%)	6,429	3,857	2,572
Supervision Cost (3.5 %)	2,143	1,286	857
Land Cost	200	-	200
Total	69,999	44,380	25,619
Physical Contingency (10 %)	7,000	4,438	2,562
Total	76,999	48,818	28,181
Price Contingency	52,610	32,251	20,359
Grand Total (Project Cost)	129,609 (Equivalent to US$16.62 M)	81,069 (Equivalent to US$10.40 M)	48,540 (Equivalent to US$6.22 M)

LEGASPI CITY WATER DISTRICT



LOCATION MAP

SUMMARY

I. General

1.1 Physical and Socioeconomic Conditions

The Water District consists of Legaspi City, where are two poblacions, Old Albay and Legaspi Port. The poblacions have developed on the alluvial plain along the Yawa River, which divides the area to the mountain foot of Volcano Mayon and the densely inhabited plain. Major features are as follows.

(1)	Location:	Southeast of the Luzon Island in the Philippines; 500 km away from Manila
(2)	Topography:	Alluvial plain, sea coast and Mt. Mayon (2,462 m)
(3)	Climate:	Tropical climate with plentiful precipitation and high temperature Rainfall = 3,260 mm/year Not much variable temperature throughout the day and the year (Average = 27.0°C)
(4)	Population	98,790 in 1980, with 2.3 % of annual growth rate
(5)	Socio-Economic Conditions:	Identified as a commercial, trading center and educational center Dialect: Bicol (98%) Religion: Roman Catholic (98%) Public Water Supply: Existing, however poorly supplying Sewerage System: Not existing Electricity: 39 % in electrification Transportation: One airport, one seaport, one railway and highways

1.2 Existing Water Supply

Until the formation of the Water District in October, 1981, this District had been served by the waterworks of the Provincial Government including Daraga Municipality. Main water sources of the said waterworks are located in the municipal area of Daraga. Therefore, the District is situated on the farthest part from the water sources. Water supply conditions are most deplorable with extremely low water pressure; some places have no water at all during daytime. Features of the water supply of the District are as follows.

(1)	System:	Started in 1920's with Banadero Spring and in 1930's with Budiao Spring. Presently managed by Legaspi City Water District.
(2)	Water Source:	Two major springs of Budiao and Banadero
(3)	Distribution System:	28,310 m of distribution pipelines (200 mm - 50 mm in diameter) No regulating reservoirs
(4)	Present Water Use:	Maximum supply = 2,320 cu m/day Served Population = 18,600 Service Connections = Total 1,405 including 1,184 domestic connections
(5)	Water Rate:	Peso 11.0 per month for domestic (Minimum charge for the first 20 cu m)

II. Master Plan

A period from the present up to the year 2010 was taken for the design period of the master plan of Legaspi City Water District water supply. Percentage of served population to total population was planned to gradually rise from the present 19% to 64% at the end of the design period. Based on the served population, future water demand was projected.

All potential water sources to meet the projected water demand were investigated in and around the project area, including springs, groundwater and riverbed water. Selected water sources are Buyoan spring and riverbed water of the Yawa River.

The whole master plan period was divided into three Phases I, II and III. Phase I covers a period up to the year 1987 and plans to develop the spring water at Buyoan, together with improvement works of the existing water supply facilities. Phase II covers a period up to the year 1993 after Phase I. The rest period in Phase III, which will be subdivided into a few subphases, as required.

Major figures and work items are tabulated below.

(1)	Target Year:	Phase I = 1987 Phase II = 1993 Phase III = 2010
(2)	Service Area:	Present : 790 ha 1987 : 1,130 ha 1993 : 2,100 ha 2010 : 3,450 ha
(3)	Population Projection:	Present : 98,790 1987 : 111,930 1993 : 122,390 2010 : 149,900

(4) Served Population:

Present	:	18,600 (19%)
1987	:	24,520 (22%)
1993	:	55,030 (45%)
2010	:	95,260 (64%)

(5) Water Demand:

Present	:	2,320 cu m/day
1987	:	6,410 cu m/day
1993	:	13,220 cu m/day
2010	:	25,880 cu m/day

(6) Water Source:

1987	:	Buyoan Spring
1993	:	Plus Yawa Riverbed water
2010	:	Additional Yawa Riverbed water

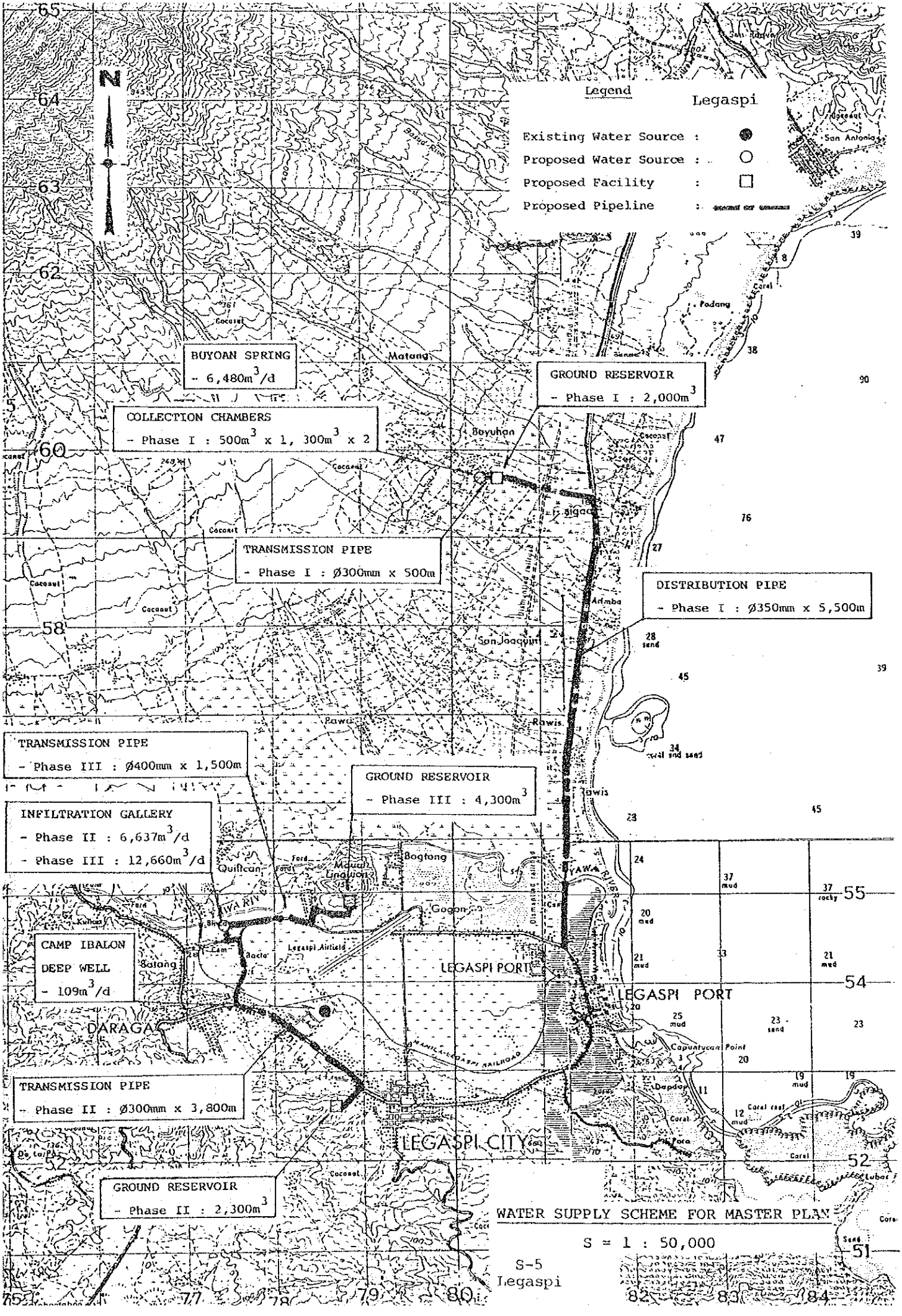
(7) Facilities to be Constructed:

See page 6 .

(8) Project Cost:

	Phase I	Phase II	Phase III
Foreign	$1.04 M	$ 2.49 M	$ 3.67 M
Local	$0.85 M	$ 1.61 M	$ 2.28 M
Total	$1.89 M	$ 4.10 M	$ 5.95 M

(Costs as of July 1981: Not including price escalation)


Legend
Legaspi
Existing Water Source :
Proposed Water Source :
Proposed Facility :
Proposed Pipeline :
BUYOAN SPRING
- 6,480m3/d
COLLECTION CHAMBERS
- Phase I : 500m3 x 1, 300m3 x 2
GROUND RESERVOIR
- Phase I : 2,000m3
TRANSMISSION PIPE
- Phase I : Ø300mm x 500m
DISTRIBUTION PIPE
- Phase I : Ø350mm x 5,500m
TRANSMISSION PIPE
- Phase III : Ø400mm x 1,500m
GROUND RESERVOIR
- Phase III : 4,300m3
INFILTRATION GALLERY
- Phase II : 6,637m3/d
- Phase III : 12,660m3/d
CAMP IBALON
DEEP WELL
- 109m3/d
TRANSMISSION PIPE
- Phase II : Ø300mm x 3,800m
GROUND RESERVOIR
- Phase II : 2,300m3
LEGASPI PORT
LEGASPI CITY
DARAGA
Matang
Buyuhan
Sigaa
San Joaquin
Rawis
Bagtang
Gogon
Quiltican
Mauraro
Linglingay
Legaspi Airfield
Satang
Dapdap
Capuntucan Point
Arimba
Padang
San Antonio
WATER SUPPLY SCHEME FOR MASTER PLAN
S = 1 : 50,000

S-5
Legaspi

Facilities to be Constructed

Phase I	Phase II	Phase III
i) Buyoan Spring System	i) Infiltration Gallery, System I	i) Infiltration Gallery, System II
a. Collection chambers	a. Infiltration gallery	a. Infiltration gallery
b. Reservoir	b. Reservoir	b. Reservoir
c. Transmission pipeline from the intake to the reservoir	c. Transmission pipeline from the gallery to the reservoir	c. Transmission pipeline from the gallery to the reservoir
d. Bulk meters	d. Bulk meters	d. Bulk meters
e. Chlorinators	e. Chlorinators	e. Chlorinators
ii) Others	ii) Others	ii) Others
a. Distribution pipelines	a. Expansion of distribution pipelines	a. Expansion of distribution pipelines
b. Water meters	b. Water meters	b. Water meters
c. Fire hydrants	c. Fire hydrants	c. Fire hydrants

III. Feasibility Study

Feasibility study was carried out for two potential cases: Case 1 study was made on the Phase I project, and Case 2 study on the combined project of Phases I and II. Case 1 study includes the development of Buyoan spring, and Case 2 study includes, in addition, the development of riverbed water of the Yawa River.

The results of both Case study indicate that both projects are feasible. The only difference is that the Case 2 project is to given a government subsidy of 20% of the total project cost.

(1) Implementation Schedule:

Phase I	:	1982 - 1986
Phase I + II	:	1982 - 1988

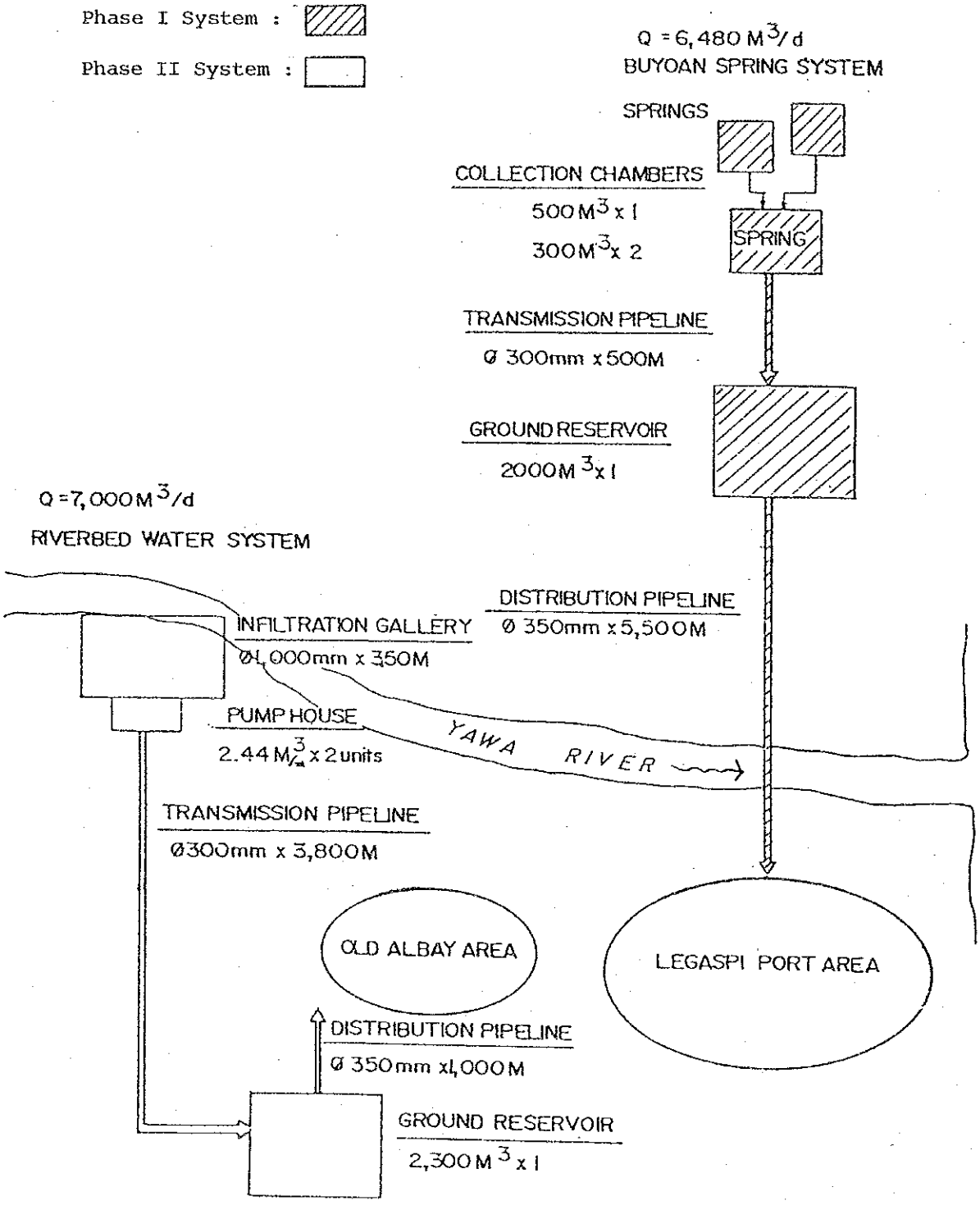
(2) Project Costs:

	Phase I	Phase I + II
Foreign	$1.64 M	$4.92 M
Local	$1.37 M	$3.72 M
Total	$3.01 M	$8.64 M

(Costs including price escalation according to implementation schedule)

(3) Financial Feasibility:

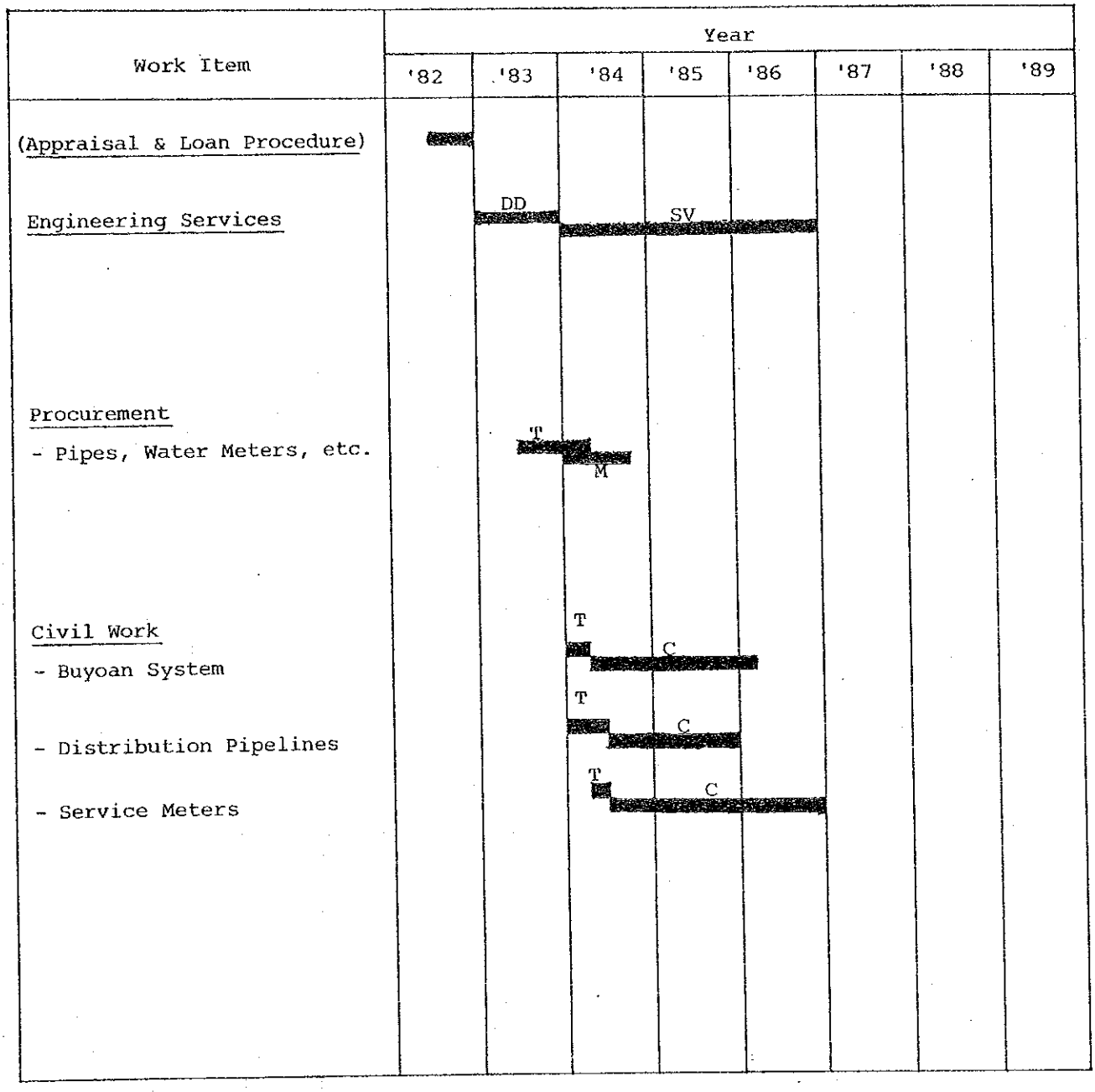
Phase I	:	Feasible
Phase I + II	:	Feasible with government subsidy of 20% of total investment cost



Proposed Water Supply System for Phase I and Phase II

Construction Schedule

(Phase I, Target Year: 1987)



Note: DD = Detailed Design
SV = Supervision of Construction
T = Tendering Procedure (Advertisement/Tendering/Evaluation/Award)
M = Manufacturing & Shipping
C = Construction/Installation

Legaspi Project Cost for Phase I (Target Year: 1987)

Note: - Unit = One Thousand Pesos = '000 Pesos
- Prices as of 1st July 1981
- Foreign Exchange Rate: US $ 1.00 = Peso 7.80

Work Items	Cost		
	Total Cost	Foreign Currency Component	Local Currency Component
A. Buyoan System	8,413	4,133	4,280
B. Reinforcement/Expansion of Distribution Pipelines	1,773	1,188	585
C. Other Equipment	1,513	1,102	411
Sub Total	11,699	6,423	5,276
Detailed Design Cost (10.5%)	1,228	737	491
Supervision Cost (3.5 %)	409	246	163
Land Cost	78	-	78
Total	13,414	7,406	6,008
Physical Contingency (10 %)	1,342	741	601
Total	14,756	8,147	6,609
Price Contingency	8,681	4,626	4,055
Grand Total (Project Cost)	23,437 (Equivalent to US$3.01 M)	12,773 (Equivalent to US$1.64 M)	10,664 (Equivalent to US$1.37 M)

Water Rate Schedule

(Phase I)

DOMESTIC AND GOVERNMENTAL SERVICE CONNECTIONS, 1/2"

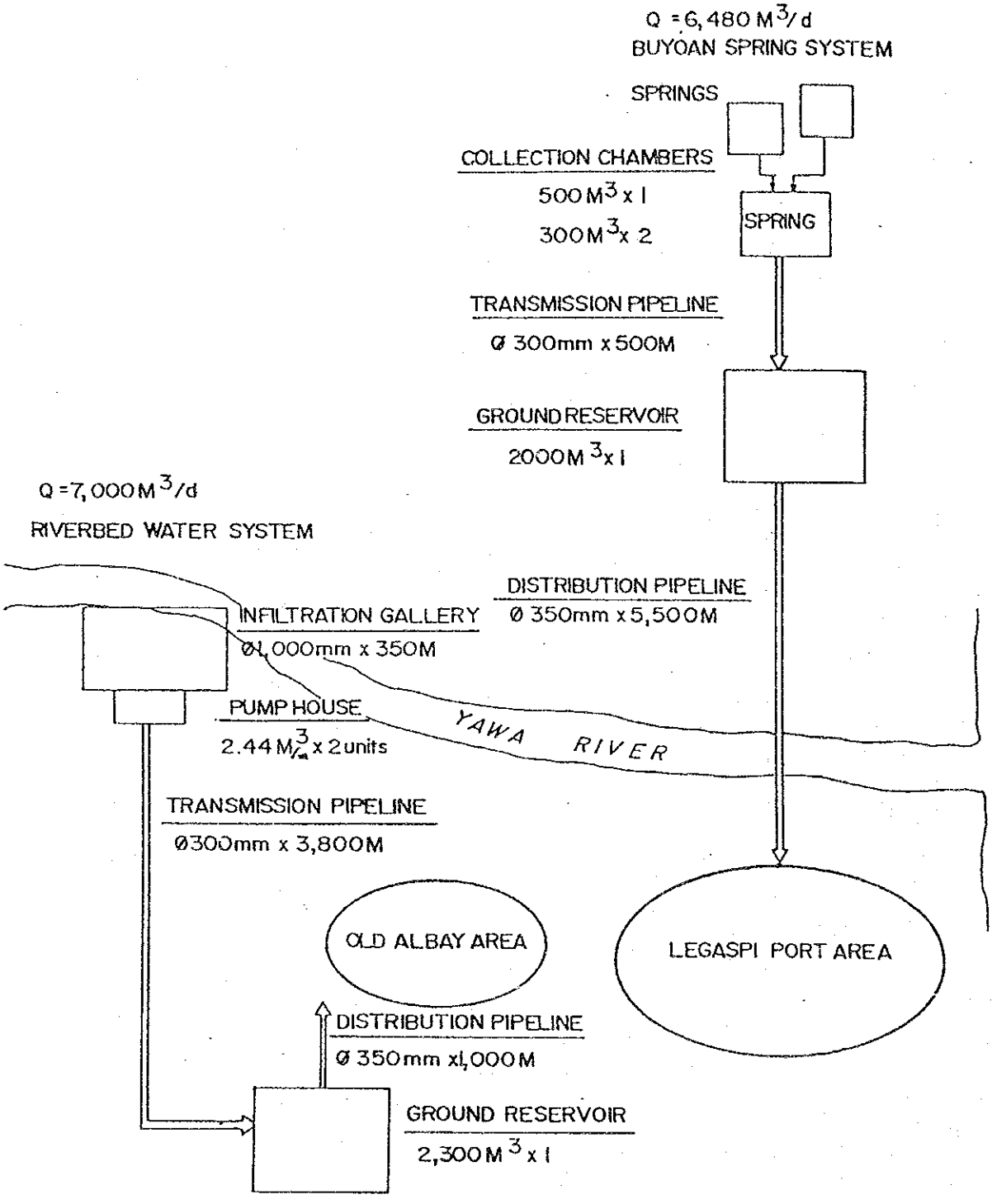
Year	First 10 m^3 1/	Charge for Each Added m^3 2/			Charge 3/ per Revenue Unit
		11-20	21-45	over 45	
1981	15.00	0.72	0.84	1.02	0.60
1982	15.00	0.72	0.84	1.02	0.60
1983	22.50	1.08	1.26	1.53	0.90
1984	36.25	1.74	2.03	2.47	1.45
1985	36.25	1.74	2.03	2.47	1.45
1986	36.25	1.74	2.03	2.47	1.45
1987	37.50	1.80	2.10	2.55	1.50
1988	42.50	2.04	2.38	2.89	1.70
1989	42.50	2.04	2.38	2.89	1.70
1990	42.50	2.04	2.38	2.89	1.70
1991	57.50	2.76	3.22	3.91	2.30
1992	62.50	3.00	3.50	4.25	2.50
1993	70.00	3.36	3.92	4.76	2.80

Note: 1/ To obtain charge per m^3 for the first 10 m^3 classified by connection size, multiply R.U. charge shown in 3/ above by the following connection size factors.

Domestic : 1.0 for 3/8"; 2.5 for 1/2"; 4.0 for 3/4"; 8 for 1"
Commerical: 5.0 for 1/2"; 8.0 for 3/4"; 16.0 for 1"; 40.0 for 1 1/2"

2/ To obtain charge for each added m^3, multiply R.U. charges shown in 3/ by the following block factors.

Domestic : 1.2 for 11-20 m^3; 1.4 for 21-45 m^3; 1.7 for over 45 m^3
Commercial: 2.4 for 21-45 m^3; 2.8 for 45-100 m^3; 2.4 for over 100 m^3

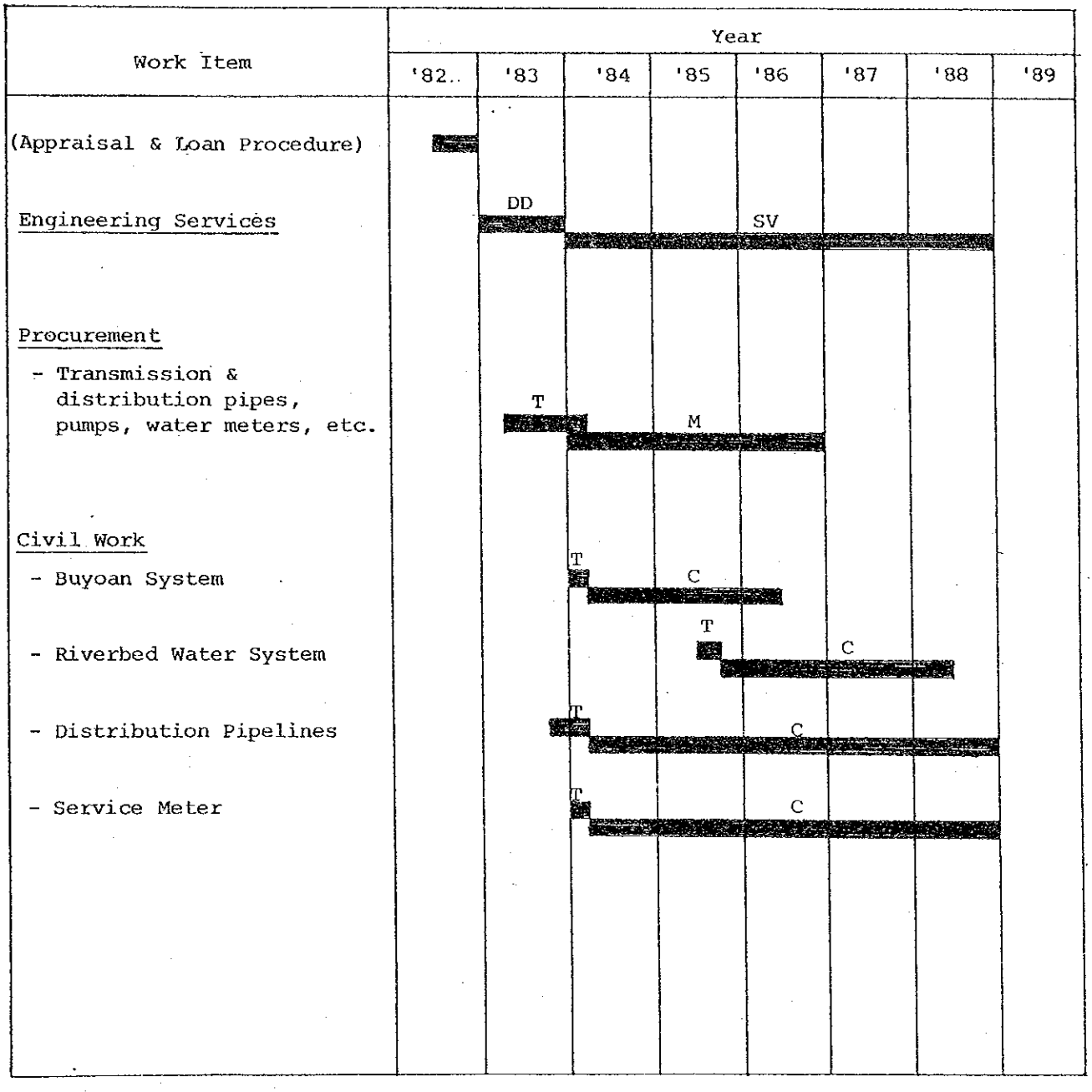


Proposed Water Supply System

(Target Year : 1993) Phase I + II

Construction Schedule (Phase I + II)

(Target Year : 1993)



Note: DD = Detailed Design
SV = Supervision of Construction
T = Tendering Procedure (Advertisement/Tendering/Evaluation/Award)
M = Manufacturing & Shipping
C = Construction/Installation

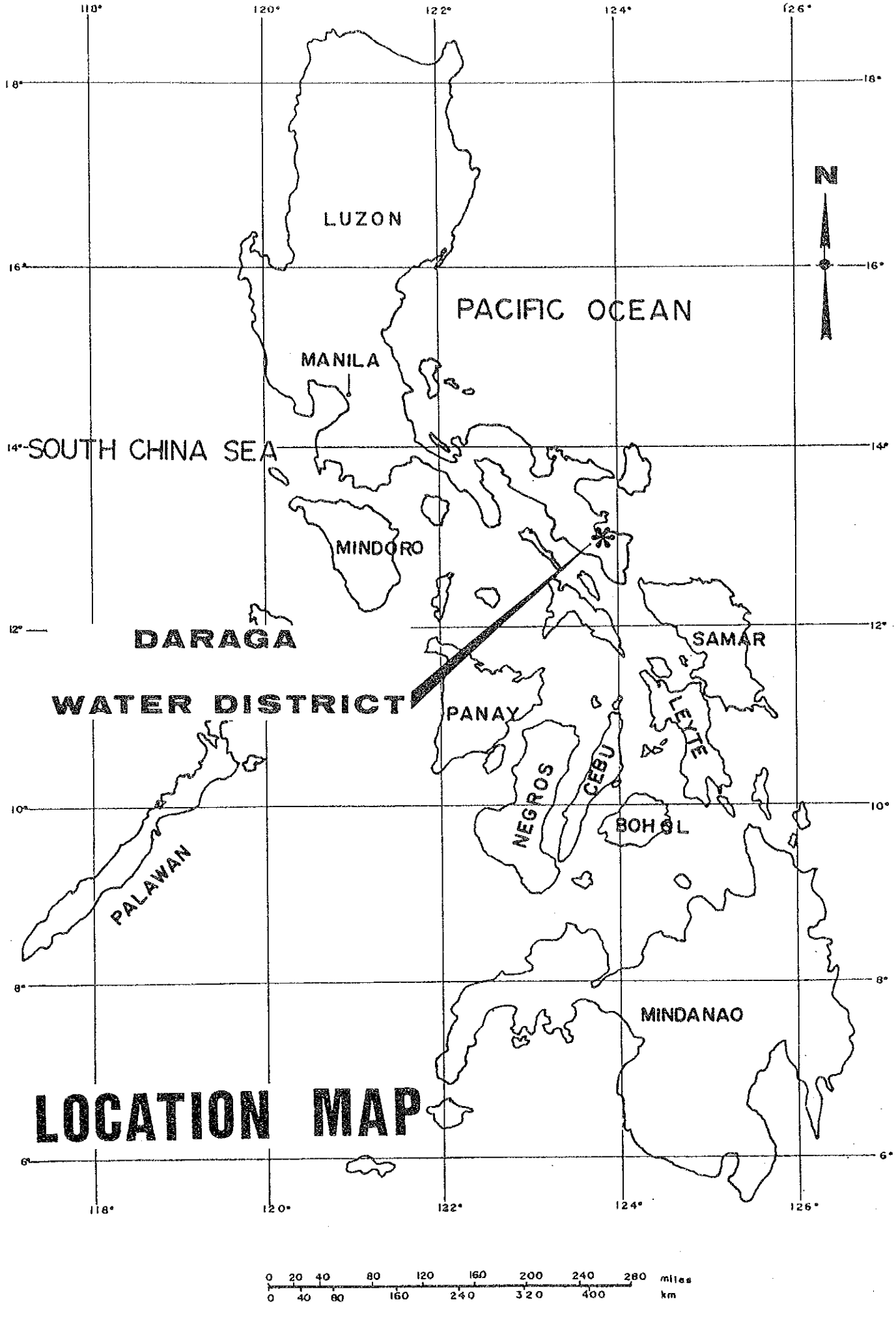
Legaspi

Project Cost for Phase I + II (Target Year: 1993)

Note: - Unit = One Thousand Pesos = '000 Pesos
- Prices as of 1st July 1981
- Foreign Exchange Rate: US $ 1.00 = Peso 7.80

Work Items	Cost		
	Total Cost	Foreign Currency Component	Local Currency Component
A. Buyoan System	8,413	4,133	4,280
B. Riverbed Water System	9,670	4,903	4,767
C. Reinforcement/Expansion of Distribution Pipelines	4,663	3,124	1,539
D. Other Equipment	7,880	5,939	1,941
Sub Total	30,626	18,099	12,527
Detailed Design Cost (10.5%)	3,216	1,901	1,315
Supervision Cost (3.5 %)	1,072	634	438
Land Cost	143	-	143
Total	35,057	20,634	14,423
Physical Contingency (10 %)	3,506	2,064	1,442
Total	38,563	22,698	15,865
Price Contingency	28,839	15,659	13,180
Grand Total (Project Cost)	67,402 (Equivalent to US$8.64 M)	38,357 (Equivalent to US$4.92 M)	29,045 (Equivalent to US$3.72 M)

DARAGA WATER DISTRICT


LUZON
PACIFIC OCEAN
MANILA
SOUTH CHINA SEA
MINDORO
DARAGA
WATER DISTRICT
SAMAR
PANAY
LEYTE
CEBU
NEGROS
BOHOL
PALAWAN
MINDANAO
N
LOCATION MAP
miles
km

SUMMARY

I. General

1.1 Physical and Socioeconomic Conditions

The Water District consists of Daraga poblacion and surrounding barangays. The poblacion lies on the alluvial plain developed by the Yawa River, and the built-up area of the poblacion adjoins with Old Albay of Legaspi City. The barangays are scattered on the mountain foot of Volcano Mayon. Major features of the District are as follows.

(1)	Location:	Southeast of the Luzon Island in the Philippines; 500 km away from Manila
(2)	Topography:	Alluvial plain, sea coast and Mt. Mayon (2,462 m)
(3)	Climate:	Tropical climate with plentiful precipitation and high temperature Rainfall: 3,260 mm/year Not much variable temperature throughout the day and the year (Average = 27.0°C)
(4)	Population:	73,213 in 1980, with 3.0% annual growth rate
(5)	Socio-Economic Conditions:	Identified as a commercial, trading center and educational center Dialect: Bicol (98%) Religion: Roman Catholic (98%) Public Water Supply: Existing, however poorly supplying Sewerage System: Not existing Electricity: 40% in electrification Transportation: One airport, one railway and highways

1.2 Existing Water Supply

Until the formation of the Water District in October, 1981, this District had been served by the waterworks of the Provincial Government including Legaspi City. Main water sources of the said waterworks are located in the District. Therefore, the District is to supply water in bulk to the Legaspi City Water District until the completion of the project of the latter. Water supply conditions are far from satisfactory because of overall deterioration of the existing facilities and some damages thereof by the mudflow caused by the heavy rain in 1981. Features of the water supply of the District are as follows.

(1)	System:	Started in 1920's with Banadero Spring and in 1930's with Budiao Spring. Presently managed by Daraga Water District.
(2)	Water Source:	Two major springs of Budiao and Sanadero
(3)	Distribution System:	19,865 m of distribution mains with diameters of 200 - 50 mm No regulating reservoirs
(4)	Present Water Use:	Maximum supply = 2,080 cu m/day from Budiao Spring Served Population = 17,900 Service Connections = Total 1,229 including 1,125 domestic connections
(5)	Water Rate	Peso 11.00 per month for domestic (Minimum charge for the first 20 cu m)

II. Master Plan

A period from the present up to the year 2010 was taken for the design period of the master plan of Daraga Water District water supply. Served population was planned to gradually increase from the present served population 17,900 (24% of total population) to 67,806 (55%) at the end of the design period. Based on the served population, future water demand was projected.

Potential water sources to meet the projected water demand were investigated in and around the project area, including springs and riverbed water. Riverbed water of the Yawa River in addition to the existing spring was selected for future use.

The whole master plan period was divided into three Phases I, II and III. Phase I covers a period up to the year 1987 and plans to increase the supply capacity by rehabilitation of the water sources and some improvement of transmission facilities. Phase II covers a period up to the year 1993 after Phase I, and plans to increase the supply capacity by improvement of the transmission facilities. The rest period is Phase III.

Major figures and work items are tabulated below.

(1)	Target Year:	Phase I	= 1987
		Phase II	= 1993
		Phase III	= 2010
(2)	Service Area:	Present	: 400 ha
		1987	: 680 ha
		1993	: 1,480 ha
		2010	: 1,850 ha
(3)	Population Projection:	Present	: 73,210
		1987	: 85,850
		1993	: 94,980
		2010	: 122,340

(4) Served Population:

Present	:	17,900 (24%)
1987	:	23,270 (27%)
1993	:	39,240 (41%)
2010	:	67,806 (55%)

(5) Water Demand:

Present	:	1,720 cu m/day
1987	:	5,203 cu m/day
1993	:	7,608 cu m/day
2010	:	15,811 cu m/day

(6) Water Sources:

Present	:	4 springs
1987	:	"
1993	:	"
2010	:	4 springs + Riverbed water

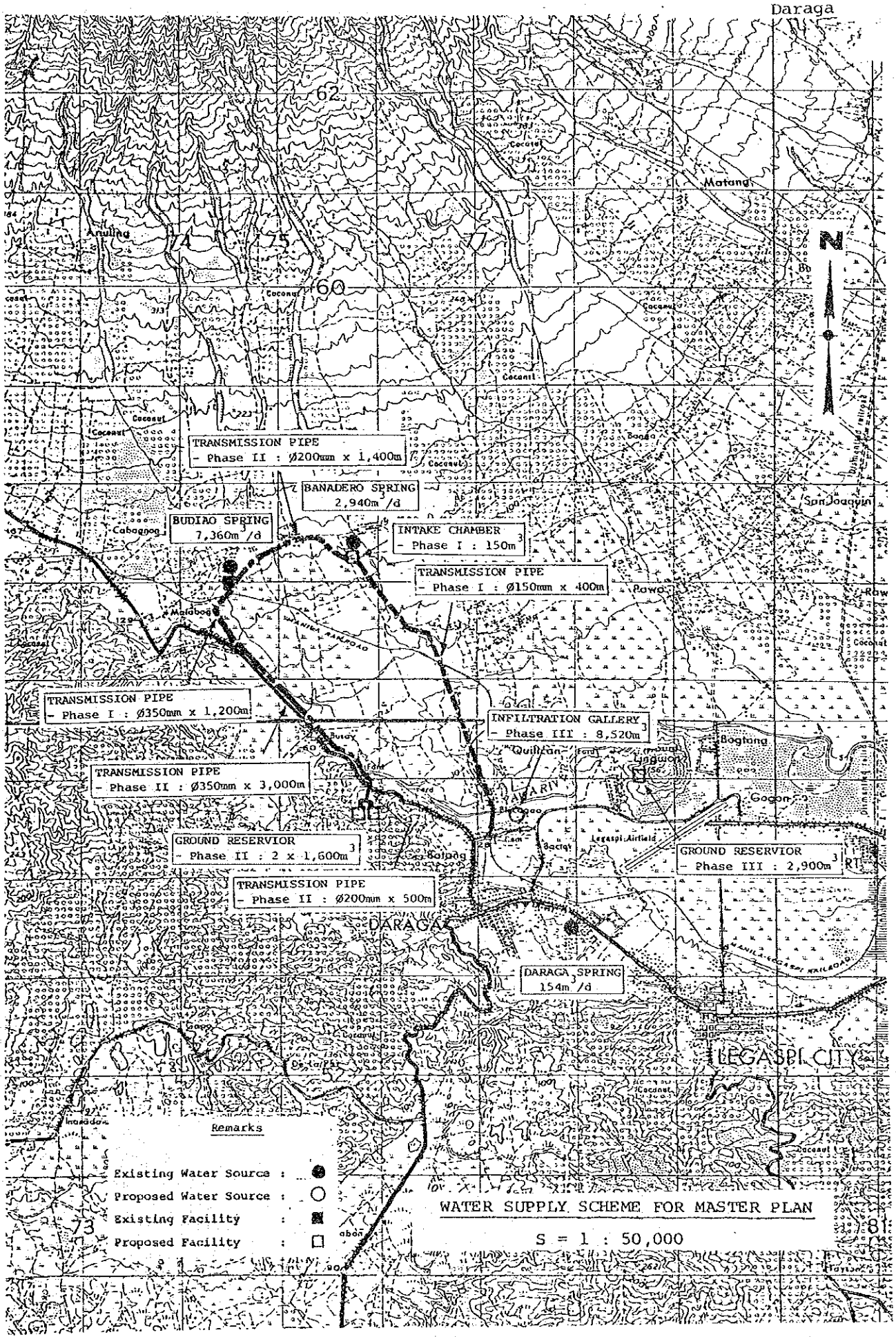
(7) Facilities to be Constructed:

See page 6.

(8) Project Cost:

	Phase I	Phase II	Phase III
Foreign	$0.58 M	$ 2.12M	$ 2.77M
Local	$0.38 M	$1.40 M	$ 1.72M
Total	$0.96 M	$ 3.52M	$ 4.49M

(Costs as of July 1981: Not including price escalation)


Daraga
TRANSMISSION PIPE
- Phase II : Ø200mm x 1,400m
BANADERO SPRING
2,940m³/d
BUDIAO SPRING
7,360m³/d
INTAKE CHAMBER
- Phase I : 150m³
TRANSMISSION PIPE
- Phase I : Ø150mm x 400m
TRANSMISSION PIPE
- Phase I : Ø350mm x 1,200m
INFILTRATION GALLERY
- Phase III : 8,520m³
TRANSMISSION PIPE
- Phase II : Ø350mm x 3,000m
GROUND RESERVIOR
- Phase II : 2 x 1,600m³
TRANSMISSION PIPE
- Phase II : Ø200mm x 500m
GROUND RESERVIOR
- Phase III : 2,900m³
DARAGA SPRING
154m³/d
DARAGA
LEGASPI CITY
Remarks
Existing Water Source :
Proposed Water Source :
Existing Facility :
Proposed Facility :
WATER SUPPLY SCHEME FOR MASTER PLAN
S = 1 : 50,000

Facilities to be Constructed

Phase I	Phase II	Phase III
i) Budiao/Banadero System a. Transmission pipeline of a part of Budiao System b. Bulk meters c. Chlorinators d. Daraga Spring System ii) Others a. Expansion of distribution pipelines b. Water meters c. Fire hydrants	i) Budiao/Bunadero System a. Transmission pipeline from Banadero Spring to Budiao Spring b. Transmission pipeline from Budiao to new reservoir c. Reservoir d. Pumps at Banadero Spring e. Chlorinators ii) Others a. Expansion of distribution pipelines b. Water meters c. Fire hydrants	i) Infiltration Gallery System a. Infiltration gallery b. Reservoir c. Transmission pipeline from the gallery to the reservoir d. Bulk meters e. Chlorinators ii) Others a. Expansion of distribution pipelines b. Water meters c. Fire hydrants

III. Feasibility Study

Feasibility study was carried out for two potential cases: Case 1 study was made on the Phase I project, and Case 2 study on the combined project of Phases I and II. The Phase I project places emphasis on rehabilitation of the existing water sources and partial replacement of the transmission line. The Phase II project intends to lay a connection line from Banadero to Budiao and replace part of the existing transmission line, in addition to construction of a reservoir.

The results of the above study indicate that both projects are feasible. The only difference is that the Case 2 is to given a government subsidy of 20% of the total project cost.

(1) Implementation Schedule:

Phase I : 1982 - 1985
Phase II : 1982 - 1988

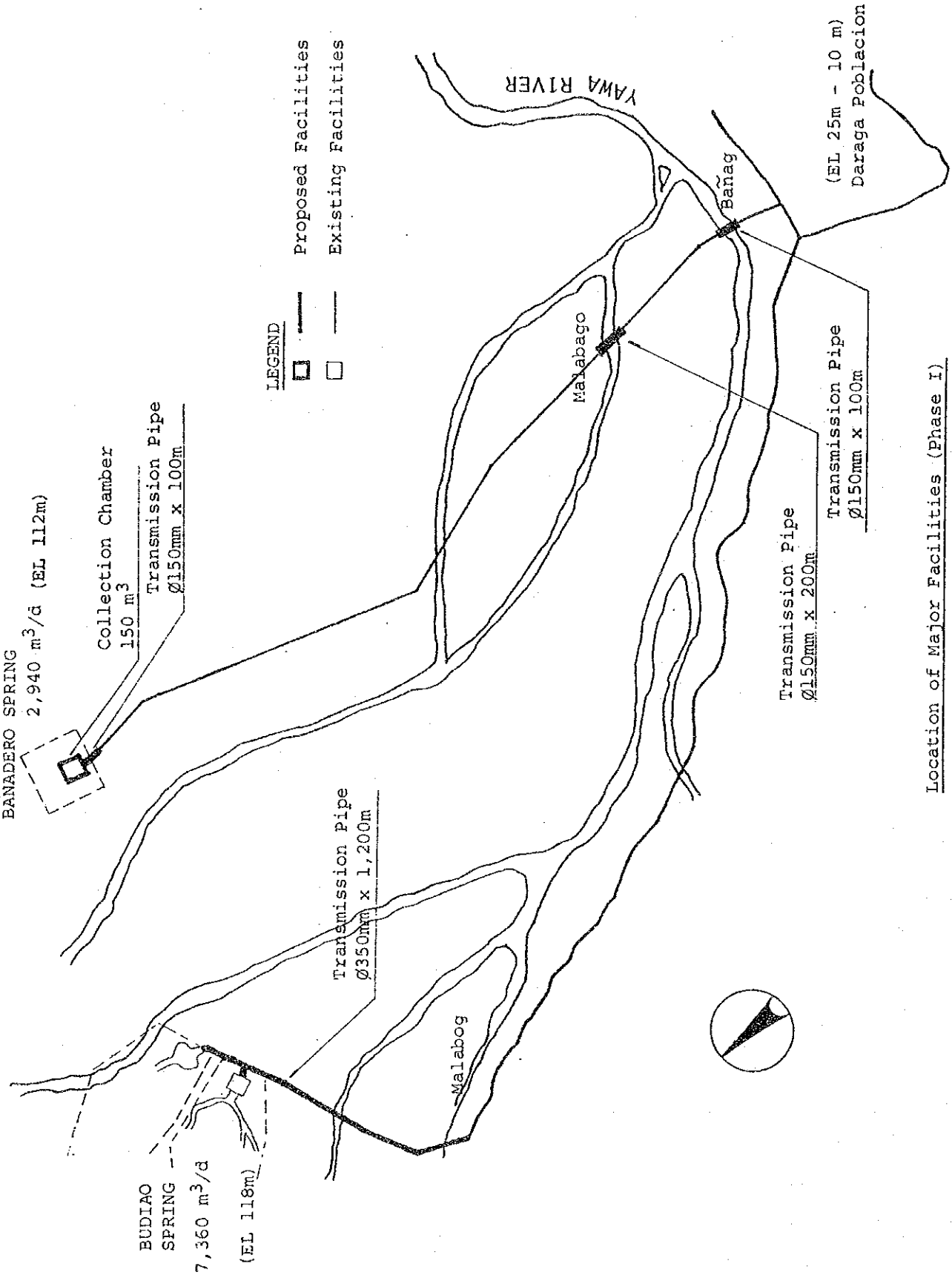
(2) Project Costs:

	Phase I	Phase I + II
Foreign	$0.91 M	$3.84 M
Local	$0.60 M	$2.67 M
Total	$1.51 M	$6.51 M

(Costs including price escalation according to implementation schedule)

(3) Financial Feasibility:

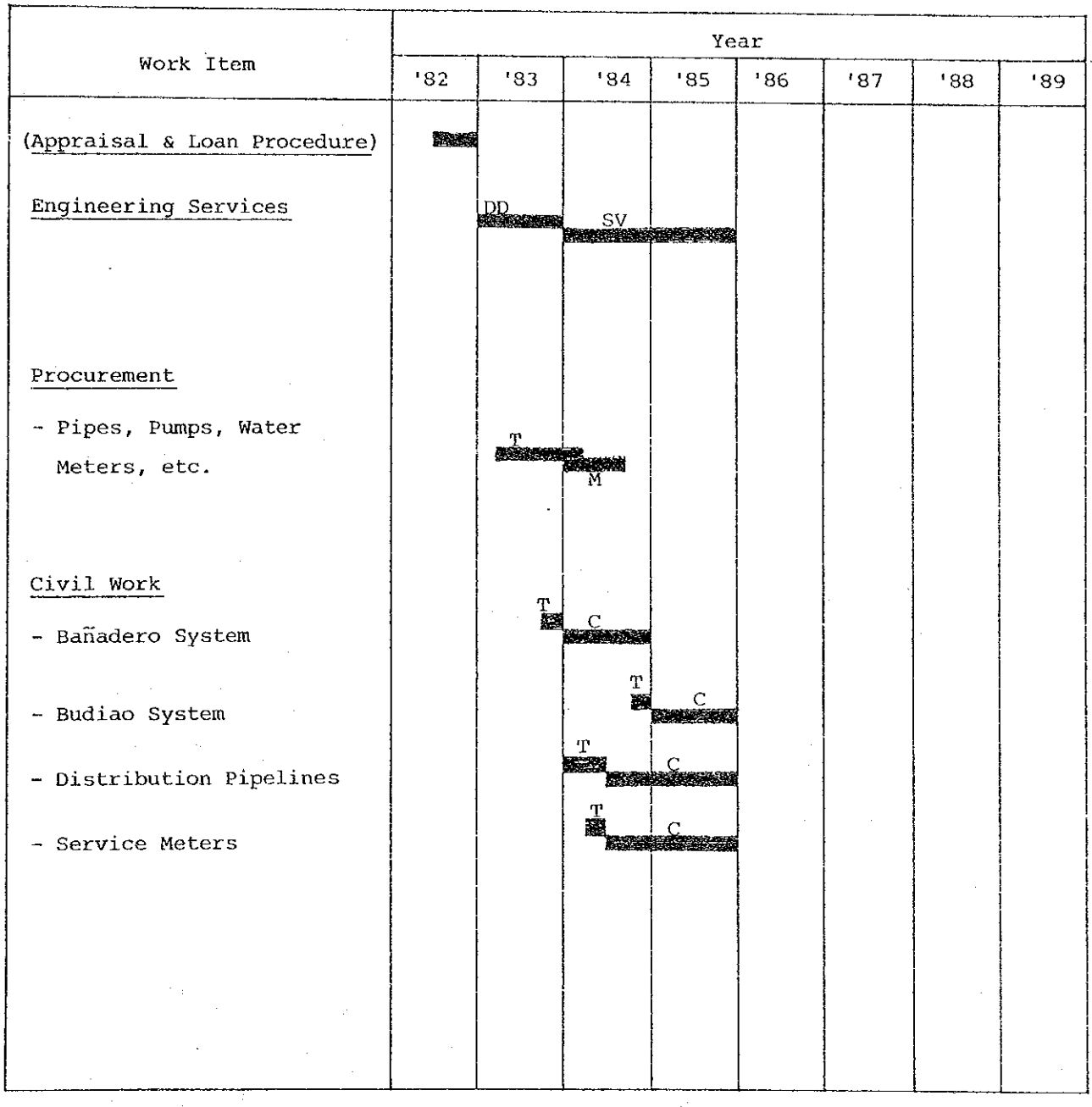
Phase I : Feasible
Phase I + II : Feasible with government subsidy of 20% of total investment cost



Location of Major Facilities (Phase I)

Construction Schedule for Phase I

(Target Year: 1987)



Note: DD = Detailed Design
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T = Tendering Procedure (Advertisement/Tendering/Evaluation/Award)
M = Manufacturing & Shipping
C = Construction/Installation

Construction Cost for Phase I

(Target Year: 1987)

Note: - Unit = One Thousand Pesos = '000 Pesos
- Prices as of 1st July 1981
- Foreign Exchange Rate: US $ 1.00 = Peso 7.80

Work Items	Cost		
	Total Cost	Foreign Currency Component	Local Currency Component
A. Banadero System	1,030	396	634
B. Budiao System	1,723	1,028	695
C. Reinforcement/Expansion of Distribution Pipelines	1,665	1,115	550
D. Equipment	1,457	1,063	394
Sub Total	5,875	3,602	2,273
Detailed Design Cost (10.5%)	617	378	239
Supervision Cost (3.5 %)	206	126	80
Land Cost	100	-	100
Total	6,798	4,106	2,692
Physical Contingency (10 %)	680	411	269
Total	7,478	4,517	2,961
Price Contingency	4,311	2,592	1,719
Grand Total (Project Cost)	11,789 (Equivalent to US$1.51 M)	7,109 (Equivalent to US$0.91 M)	4,680 (Equivalent to US$ 0.60M)

Water Rate Schedule
(Phase I)

DOMESTIC AND GOVERNMENTAL SERVICE CONNECTIONS, 1/2"

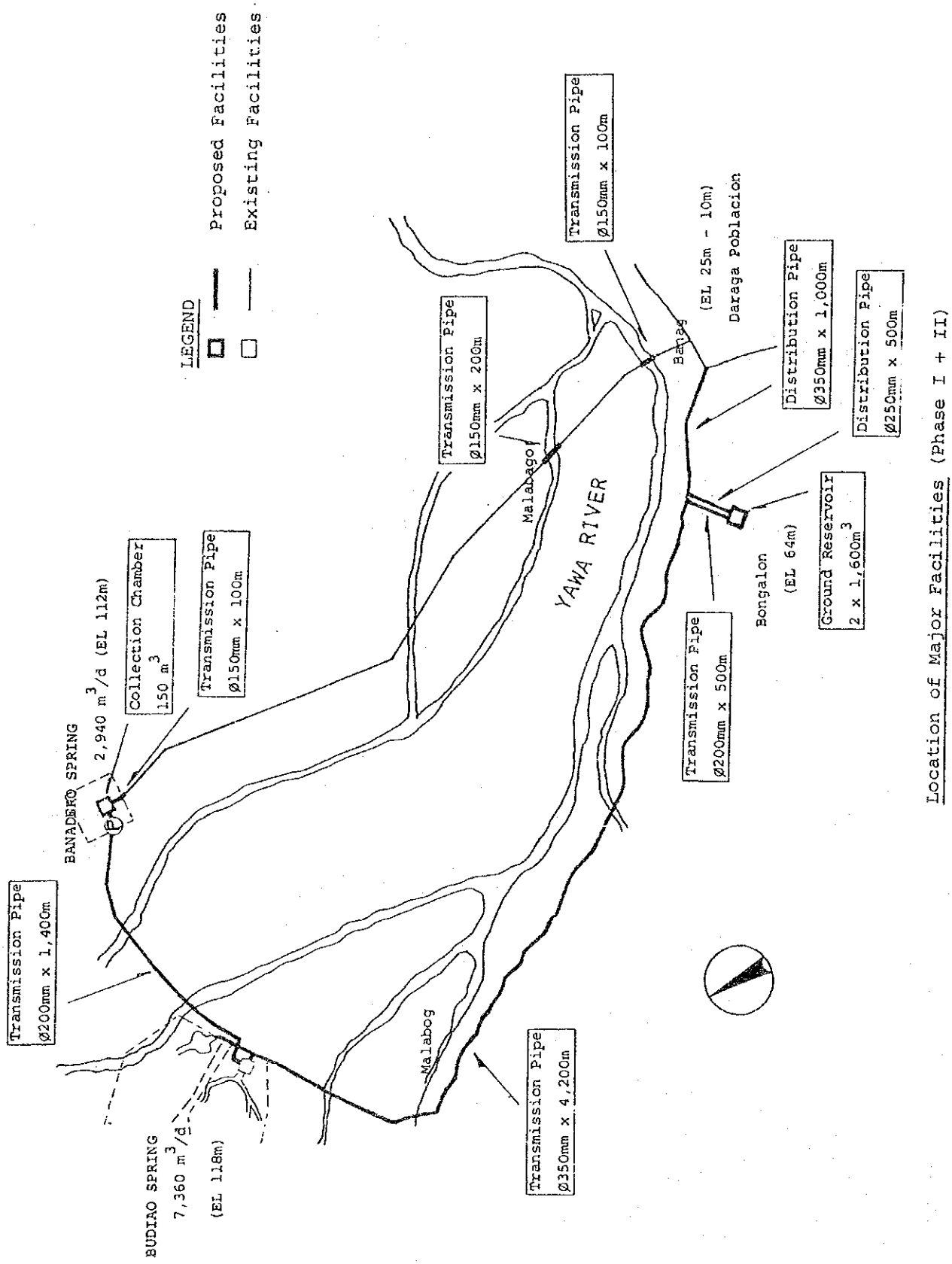
Year	First 10 m^3 1/	Charge for Each Added m^3 2/			Charge 3/ per Revenue Unit
		11-20	21-45	over 45	
1981	17.50	0.84	0.98	1.19	0.70
1982	17.50	0.84	0.98	1.19	0.70
1983	26.00	1.25	1.46	1.77	1.04
1984	26.00	1.25	1.46	1.77	1.04
1985	26.00	1.25	1.46	1.77	1.04
1986	28.50	1.37	1.60	1.94	1.14
1987	28.50	1.37	1.60	1.94	1.14
1988	34.00	1.63	1.90	2.31	1.36
1989	34.00	1.63	1.90	2.31	1.36
1990	42.00	2.02	2.35	2.86	1.68
1991	42.00	2.02	2.35	2.86	1.68
1992	50.75	2.44	2.84	3.45	2.03
1993	50.75	2.44	2.84	3.45	2.03

Note: 1/ To obtain charge per m^3 for the first 10 m^3 classified by connection size, multiply R.U. charge shown in 3/ above by the following connection size factors.

Domestic : 1.0 for 3/8"; 2.5 for 1/2"; 4.0 for 3/4"; 8 for 1"
Commerical: 5.0 for 1/2"; 8.0 for 3/4"; 16.0 for 1"; 40.0 for 1 1/2"

2/ To obtain charge for each added m^3, multiply R.U. charges shown in 3/ by the following block factors.

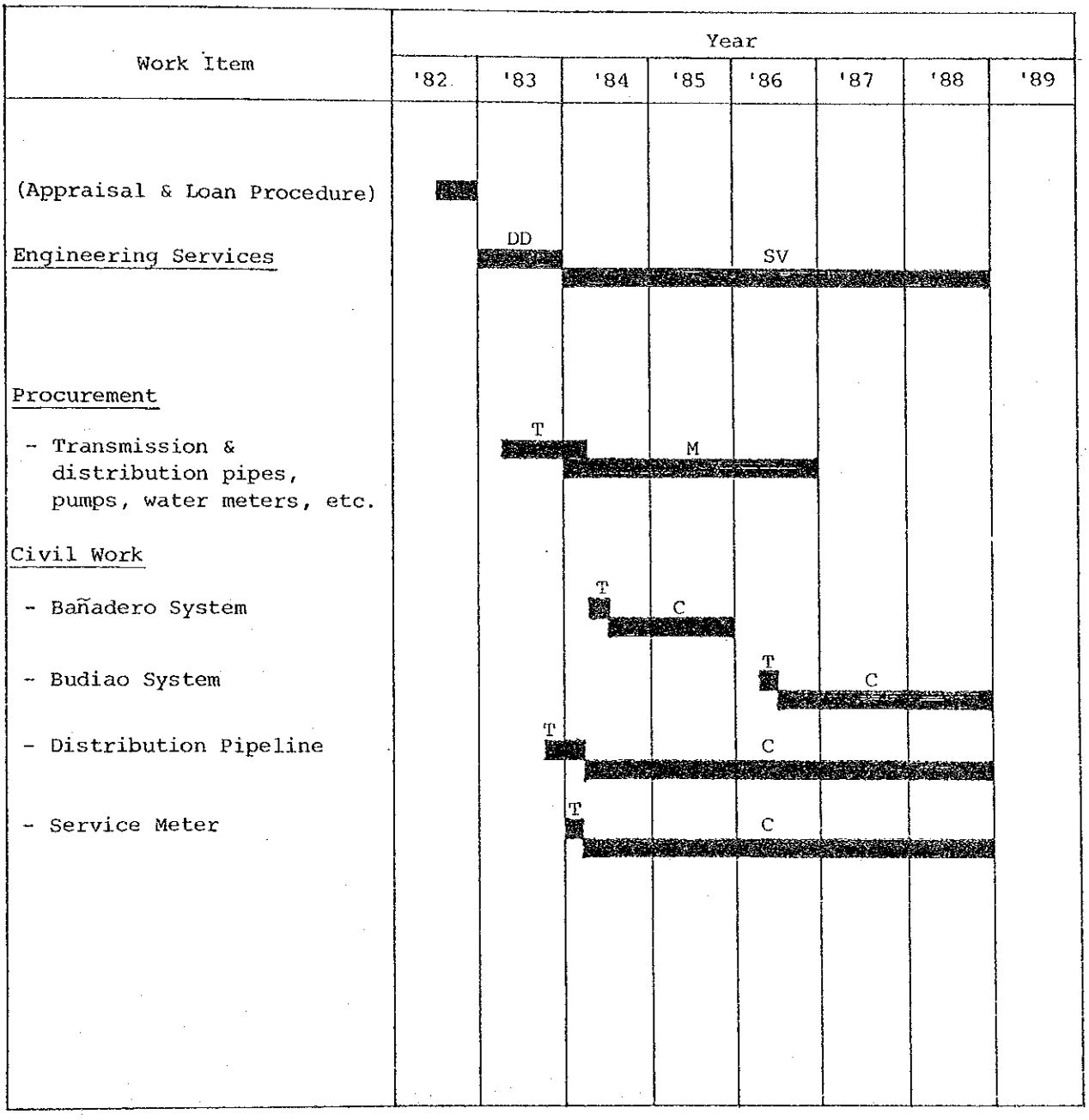
Domestic : 1.2 for 11-20 m^3; 1.4 for 21-45 m^3; 1.7 for over 45 m^3
Commercial: 2.4 for 21-45 m^3; 2.8 for 46-100 m^3; 3.4 for over 100 m^3



Location of Major Facilities (Phase I + II)

Construction Schedule for Phase I + II

(Target Year: 1993)



Note: DD = Detailed Design
SV = Supervision of Construction
T = Tendering Procedure (Advertisement/Tendering/Evaluation/Award)
M = Manufacturing & Shipping
C = Construction/Installation

Project Cost for Phase I + II

(Target Year: 1993)

Note: - Unit = One Thousand Pesos = '000 Pesos
- Prices as of 1st July 1981
- Foreign Exchange Rate: US $ 1.00 = Peso 7.80

Work Items	Cost		
	Total Cost	Foreign Currency Component	Local Currency Component
A. Banadero System	2,824	1,530	1,294
B. Budiao System	9,695	5,210	4,485
C. Reinforcement/Expansion of Distribution Pipelines	4,633	3,105	1,528
D. Equipment	5,662	4,249	1,413
Sub Total	22,814	14,094	8,720
Detailed Design Cost (10.5%)	2,396	1,480	916
Supervision Cost (3.5 %)	798	493	305
Land Cost	156	-	156
Total	26,164	16,067	10,097
Physical Contingency (10 %)	2,617	1,607	1,010
Total	28,781	17,674	11,107
Price Contingency	21,987	12,273	9,714
Grand Total (Project Cost)	50,768 (Equivalent to US$6.51 M)	29,947 (Equivalent to US$3.84 M)	20,821 (Equivalent to US$2.67 M)