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The World Bank

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LN 3124-PH

Report No. 7801-PH

STAFF APPRAISAL REPORT

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

August 23, 1989

Infrastructure Operations Division
Country Department II
Asia Regional Office

CURRENCY EQUIVALENTS

Currency Unit	=	Peso (P)
1 Peso	=	US$0.047
US$1	=	P 21 (April 1989)

WEIGHTS AND MEASURES

1 meter (m)	=	39.37 inches (in)
1 square meter (sq m)	=	10.8 square feet
1 kilometer (km)	=	0.62 mile
1 hectare (ha)	=	10,000 square meters (sq m) or 2.47 acres
1 cubic meter (cu m)	=	264 US gallons, approximately 1 metric ton
1 cubic meter per second (cums)	=	22.82 million US gallons per day
Gigawatt hour (GWH)	=	1 million kilowatt hours (kwh)
liter (l)	=	0.26 US gallons
liter per capita per day (lcd)	=	0.26 US gallons per capita per day
metric ton (ton)	=	2,205 lbs or 1 cubic meter of water

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
COA	Commission on Audit
DBM	Department of Budget and Management
DOF	Department of Finance
DOH	Department of Health
DPWH	Department of Public Works and Highways
EA	Engineering Area (MWSS's Engineering and Design Department)
ERR	Economic Rate of Return
GC	Government Corporation
LWUA	Local Water Utilities Administration
MIS	Management Information System
MSA	MWSS Service Area
MWSS	Metropolitan Waterworks and Sewerage System
NCR	National Capital Region
NEDA	National Economic and Development Authority
NPC	National Power Corporation
NRW	Non-Revenue Water
NWRC	National Water Resources Council
OECF	Overseas Economic Cooperation Fund of Japan
PMO	Project Management Office
PNB/UB	Philippine National Bank and Union Bank
RWDC	Rural Waterworks Development Corporation
RWSA	Rural Water Supply and Sanitation Association
WD	Water District

FISCAL YEAR

January 1 to December 31

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

Loan and Project Summary

Borrower: Metropolitan Waterworks and Sewerage System (MWSS).

Guarantor: Republic of the Philippines.

Beneficiaries: The City of Manila and 36 neighboring municipalities.

Amount: US$40 million equivalent.

Terms: 20 years, including 5 years of grace, at the Bank's standard variable interest rate.

Project Description: The proposed project would supply water to meet the expected water demand in MWSS service area (MSA) until the year 2000. The project has been designed to: (a) increase MWSS's water production capacity; (b) provide 15 cubic meters per second of water for an additional population of 3 million persons; (c) expand the distribution system to increase service coverage to 75% of the MSA by 1994, particularly in poor neighborhoods; (d) improve the efficiency of MWSS's operations; and (e) strengthen MWSS's finances as well as its planning and management information systems. The project would be cofinanced by the Asian Development Bank (ADB) and the Overseas Economic Cooperation Fund of Japan (OECF), and includes the construction of water transmission, treatment and distribution facilities, i.e. a 6 km tunnel, 18 km of aqueducts, 35 km of water mains, 520 km of distribution pipelines, a water treatment plant for 10.6 cubic meters per second, and a water reservoir (260,000 cubic meters). During the project period, MWSS would continue to develop its institutional capabilities by carrying out a satisfactory Development Program aimed at improving the corporations's financial performance, planning and operating efficiency.

Benefits and Risks: The project would maximize benefits from existing investments, postponing alternative investments costing three times those of the proposed project. It would provide urgently needed water to the MSA, which has about half of the country's industrial base, its commercial center and a population of about 9 million people. The project would: (a) eliminate water rationing and low pressures for about 5 million people who are already served; (b) distribute water supply benefits to the entire MSA; (c) reduce the dependence of commercial and industrial consumers on deep wells and excessive use of underground water, which is damaging the aquifer; (d) restore normal pressures, decreasing the potential health risk posed by sewage infiltration into unpressurized distribution mains; and (e) strengthen one of the country's largest corporations, which would influence other water utilities in the Philippines. There are no unusual project risks. The major risk, i.e., delayed implementation of the various components which could postpone overall project completion by one or more years, is mitigated by MWSS's experience with similar works and the fact that the raw water transmission system, the critical component of the project, has already been contracted. When this component is completed, any other completed works would produce immediate benefits by using the existing facilities. Failure

to reduce non-revenue water would increase the cost of water and reduce the population benefited under the project. However, the results achieved in parts of the distribution already rehabilitated indicate that the proposed non-revenue water targets are achievable.

Project Cost:

	Local	Foreign	Total
	---- (US$ million) ----		
IBRD-Financed Works	27.7	22.7	50.4
ADB-Financed Works	31.2	54.1	85.3
OECF-Financed Works	33.6	42.7	76.3
Locally-Financed Works	19.4	4.6	24.0
Base Cost (December 1988)	111.9	124.1	236.0
Physical Contingencies	8.3	9.3	17.6
Price Contingencies	19.5	18.3	37.8
Total Project Cost a/	139.7	151.7	291.4
Interest During Construction	37.3	33.2	70.5
Total Financing Required	177.0	184.9	361.9

Financing Plan:

World Bank	12.9	27.1	40.0
Asian Development Bank	37.5	92.5	130.0
OECF Loan (Government's Equity to MWSS)	29.3	50.7	80.0
Bonds-Local Banks	46.3	8.9	55.2
Internal Cash Generation	28.8	5.7	34.5
Other Local Funds	22.2	-	22.2
TOTAL	177.0	184.9	361.9

Estimated Disbursement:

Bank Fiscal Year	FY90	FY91	FY92	FY93	FY94	FY95
		----------	(US$ million)	----------		
Annual	5.2	6.8	8.4	10.0	8.0	1.6
Cumulative	5.2	12.0	20.4	30.4	38.4	40.0

Economic Rate of Return: 15%

Map: IBRD-21605

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a/ Including taxes and duties equivalent to US$7.6 million.

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

Table of Content

This report is based on the finding of an appraisal mission consisting of C. Fernandez (financial analyst), J. Kozel (sanitary engineer), and consultants F. Nielsen (municipal engineer) and K. Waterhouse (sanitary engineer) who visited Manila in April 1989. The report was edited by P. Brereton.

ANNEXES:

1. THE SECTOR

Sector Background

1.1 The provision of water supply and sanitation services in the Philippines has improved considerably over the past two decades. Following a major sector review in 1972, the current sector institutions were established and sector objectives, strategies and development plans defined. Between 1972 and 1980, water supply services were extended to an additional three million people, bringing the total population with access to safe water to around 22 million or about 45% of the population. By end-1987, about 63% of the population had access to safe water, including 31% which was served by piped systems. The rest of the population (about 21.2 million) relied on open dug wells, rainwater cisterns, lakes, ponds and streams of often doubtful quality. Although absolute service levels are improving, the quality of service in the areas covered is often poor, with low water pressures throughout and rationed service in some areas.

1.2 Sanitation services have also been expanding. Although the 1980 census estimated that only about 56% of the population had access to water-borne sewerage (either sanitary sewers or combined sewer/storm drain systems), septic tanks or pits for excreta disposal, a survey by the Department of Health (DOH) at end-1986 showed that about 69% of all households had safe excreta disposal facilities, about 15% had unsafe facilities and about 16% had none at all. In terms of population served, about 62% of the rural and 80% of the urban populations had access to sanitary facilities, with Metropolitan Manila having the highest service level at 93%. Pit or pour-flush latrines predominate throughout the country. In Metropolitan Manila, the dominant disposal facilities are septic tanks, many of which are not well maintained and are inefficient in treating the wastes which they discharge to surface water drainage systems. The only areas with sanitary sewerage systems are Metropolitan Manila, where only about 750,000 people or 9% of the metropolitan population are served, and three other cities where service is provided to the central areas. Because of the limited sewerage systems and inefficient private sanitary waste disposal facilities, untreated or poorly treated domestic sewage is a major source of water pollution.

1.3 The Philippines has abundant water resources for domestic water supply, irrigation and industrial use. Average annual rainfall is about 2,300 mm, and there are 18 major and over 400 principal rivers, about 60 natural lakes, and a significant, well-documented quantity of groundwater. However, most of the rain is concentrated in four months, the monsoon season, when floods and typhoon damage are major problems. During the remainder of the year, the rivers dry up, necessitating expensive dams and water regulation. With rapid population growth, the most accessible water sources, and the least costly to develop for community use, are already exploited, and many are now inadequate to support the present service areas. Development of water sources to serve the larger urban areas in the future will thus need to exploit more distant rivers, at a higher development cost. Similarly, the supply of rural communities increasingly requires development of deeper groundwater, at increased costs. Water pollution is also a growing problem, and in 1986 the National Pollution Control Commission identified 37 major and principal rivers as seriously polluted due to discharges from domestic sewage, municipal solid wastes and industrial wastes. Health statistics reflect this situation, indicating the nationwide prevalence of water-borne and sanitation-related diseases. Substantial improvement of the country's water supply and sanitation systems must therefore have high priority, to reduce the incidence of these diseases and to improve the general living standard of the population.

Sector Organization

1.4 The National Water Resources Council (NWRC), which includes representatives of the various sector institutions, is responsible for coordination and integration of all activities related to development and management of water resources. The Metropolitan Waterworks and Sewerage System (MWSS), established in 1972, is responsible for the development, operation and maintenance of water supply and sewerage systems in or around Metropolitan Manila. The MWSS Service Area (MSA) of about 150,000 ha includes Manila City, four neighboring cities and 32 municipalities. The Local Water Utilities Administration (LWUA), established in 1973, is responsible for providing technical and financial assistance for water supply and sanitation development to about 730 provincial cities with populations above 20,000 and, since 1987, to rural communities. Both MWSS and LWUA are semi-autonomous corporations under the Department of Public Works and Highways (DPWH). The Department of Health (DOH) implements the rural sanitation program and monitors drinking water quality.

1.5 The operation and maintenance of provincial water supply systems is the responsibility of locally-established Water Districts (WDs), which are also semi-autonomous public utilities, serving one or more municipalities. Rural Water Supply and Sanitation Associations (RWSAs) are responsible for the rural systems. By end-1988, some 290 WDs and more than 200 RWSAs had been established.

Sector Financing

1.6 Sector development in Metropolitan Manila is financed through funds self-generated by MWSS, government equity contributions, and foreign or local loans. LWUA, which is a financial intermediary for the remaining cities, is also funded through government contributions and loans, and on-lends these funds to WDs for system development. The municipalities served by the WDs normally make some equity contribution to self-finance part of the cost of development, while the financially weaker WDs receive some government grants. The RWSAs also receive government equity contributions and benefit from grants provided through bilateral assistance. The Government's general policy is to develop systems on the basis of a community's financial ability and willingness to pay for them. Accordingly, individual house connections are usually provided in the larger metropolitan and provincial urban areas, standpipe systems on the basis of the community's financial ability and willingness to pay for them, and wells with hand pumps in the rural areas. Tariffs in Metropolitan Manila have allowed MWSS to earn a financial rate of return of 8% on its revalued net fixed assets in operation. For provincial water supply (WDs), tariffs are supposed to generate adequate levels of revenue to meet operation and maintenance costs and cover debt servicing costs or depreciation, whichever is greater. In rural areas, tariffs are expected to meet operation and maintenance costs and the capital costs of distribution works related to individual connections; the Government usually finances the remaining capital costs. However, because of extensive poverty, and political reluctance by some local governments to increase tariffs, water tariffs in the WDs are usually inadequate, resulting in financial deficits and delayed payments to LWUA, jeopardizing the financial viability of the sector. For water entities with excessive debt burden, some grant financing may be needed to strengthen their finances and provide a reasonable debt to equity ratio.

1.7 Due to the depressed economic conditions and political changes that occurred during 1984-86, investment in water and sanitation services the sector declined. However, in 1987, the Government confirmed its commitment to sector development by adopting a Water Supply and Sanitation Master Plan which provides a well-integrated, but overly ambitious package of policies, programs and projects to be implemented in two stages, from 1988 to 1993 and from 1994 to the year 2000. Initiation of LWUA's part of the program was delayed due to management and staff conflicts, but the recent approval of a new LWUA Administrator ensures that implementation will now proceed.

Sectoral Issues and Constraints

1.8 Despite the progress made, a number of issues and constraints still impede sector development and performance, including problems related to funding, planning, the sector institutions, and operating efficiency.

1.9 Funding. The availability of local funds for system financing has been generally inadequate. Government counterpart funds have not been available

when needed, largely due to economic crises and competing demands, but also as a result of unrealistic planning and budgeting. Furthermore, funds which should have been generated by the WDs, LWUA and MWSS have not materialized because of inadequate tariffs, high levels of unaccounted-for water (para. 1.16), debt revaluation both in dollars and in pesos, and poor collection efficiency.

1.10 Billing and Collection. Poor billing and collection efficiency need to be addressed. Excessive accounts receivable and illegal connections reduce sector revenues and result in higher tariffs for the population paying their bills. LWUA has a serious problem due to the poor collection performance of the WDs; its collection efficiency declined from 76% of billings in 1981 to 51% in 1987, and has been as low as 25% to 30% for RWSA-operated systems. MWSS has improved its collection rate, but further efforts are needed to reduce its accounts receivable, which are approaching six months of billing, particularly for other government agencies (para. 4.12).

1.11 Planning. Development in the sector tends to be adversely effected by optimistic planning and goals. Historical information on implementation capacity and expenditure rates is overlooked in the planning process, as is the availability of local counterpart funds. The lack of pragmatic plans is a constraint to sector development since investment plans must often be reduced during project implementation, causing loans and budgets to be underutilized. Similarly, water demand projections are often unrealistic, resulting in overinvestment, low water sales, underutilized capacity and financial deficits. Consequently, under the proposed project, emphasis has been given to improving water demand forecasts and financial planning, and establishing improved monitoring and management information systems during implementation (para. 5.13).

1.12 Institutional Arrangements. The overall organization of the sector is basically sound, with one major exception. NWRC coordinates water resources development, but no institution exists to coordinate sewerage and sanitation activities. Therefore, sewage disposal, sanitation and pollution control receive less attention than water supply.

1.13 Several organizational changes are also needed within LWUA. First, it should decentralize its operations to the 12 regions, as DOH and DPWH have already done, in order to better serve the provincial population and improve collections. Furthermore, since LWUA is moving progressively to serve the smaller municipalities, which may not have sufficient customers to pay for adequate accounting, engineering and management, it may need to create larger districts or even provincial water systems, allowing economies of scale and cross-subsidization which would ensure the provision of water services to all municipalities in each region. Finally, LWUA (and to a lesser extent MWSS) management and labor need to improve their relationship to prevent operational disruptions like those which slowed and impaired LWUA operations from 1987 to 1989.

1.14 Institutional development in the WDs and the RWSAs in the regions has been limited, causing institutional, operational and financial problems, particularly in the smaller and poorer RWSAs. Since the provision of services in the rural areas relies mainly on community participation, the success of such programs will largely depend on mobilizing community support for the development and maintenance of water supply and sanitation facilities.

1.15 Groundwater Use. Excessive use of groundwater in the Manila Metropolitan Region is depleting the aquifer and resulting in intrusion of salinity in the areas near Manila Bay. However, there is little that can done until MWSS can provide additional water, end shortages and ensure a more reliable supply. Curtailing the use of groundwater for existing industrial users, when they cannot be supplied by MWSS, would have a negative impact on industrial production and employment. The largest users of groundwater in depleted zones have been identified by MWSS, and adequate transmission and distribution facilities would be provided under the proposed project to supply them reliably and reduce excessive water abstraction in these zones. If these problems persist after adequate supply capacities are provided by 1994, it would be necessary to enact legislation establishing more rigorous controls on water use, and allowing MWSS to charge for the use of underground water, to reduce its excessive use and contribute to the financing of expanded water supply facilities in the MSA.

1.16 Operational Efficiency. The water supply agencies currently receive no revenue for a large

portion of the water distributed. MWSS, for example, has had non-revenue water (NRW) of almost 60%, but is now carrying out a large-scale program to gradually reduce NRW to below 40% by 1994 (see paras. 2.14 and 2.15). LWUA has also begun to focus on NRW problems in the WDs, which will require leak detection programs as well as the implementation of measures to prevent such problems, including improved specifications for pipe materials and meters, and rigorous inspection of pipeline installation.

Previous Bank Lending

1.17 Except for a loan in 1964 for development of the Metropolitan Manila water supply system, the Bank's involvement in the sector essentially started in 1977 with the First Provincial Cities Water Supply Project (Loan 1415-PH, US$23 million, Project Performance Audit Report No. 6422) to improve water supply to five provincial towns. Since then, five additional loans have been made providing for: (a) expansion of water supply and sewerage in Metropolitan Manila (Loan 1615-PH, US$35.5 million in 1978 (Project Completion Report No. 7153); Loan 1814-PH, US$63.0 million in 1980; and Loan 2676-PH, US$69.09 million in 1986); (b) water supply in provincial towns (Loan 1710/Credit 920-PH, US$38.0 million in 1979); and (c) a national program of rural water supply and sanitation (Loan 2206-PH, US$35.5 million in 1982).

1.18 The above-mentioned projects have substantially met or are expected to meet their physical and institutional objectives, although they have suffered construction delays and fallen somewhat short of their financial goals. Institutionally, the projects have been important in helping to establish and set satisfactory organization structures and bylaws, implement extensive training programs, improve the technology used, establish billing and accounting systems, and provide the capacity to implement investments resulting in a large expansion of water and sewerage services (paras. 1.1 and 1.2).

1.19 Project implementation has normally been slow, with delays of two or more years, largely due to macroeconomic problems related to the country's difficult economic and political situation culminating in the 1986 revolution. These problems resulted in high inflation, large currency devaluations, shortages of counterpart funds, business failures by contractors, a major reorganization of sector institutions and changes in sector management and key staff in all institutions.

1.20 Recognizing these constraints, the Bank, under its Special Action Program, attempted to facilitate implementation by, among other things, increasing disbursement percentages, establishing special accounts, and working with the project entities to amend project scope. These measures, combined with actions taken by the implementing agencies to adjust to the new circumstances, helped ameliorate the situation somewhat. However, changes in the scope of some projects meant that about US$60 million equivalent (about 20% of the Bank loans outstanding) could not be utilized before loan closing and had to be cancelled. Some institutional achievements were also diminished, due to discontinuity in top management positions and uneven professional interest.

Sector Strategy

1.21 The Bank's role in the sector is to assist the Government in implementing its sectoral program through the provision of needed financial resources and in gradually solving the sector issues and constraints mentioned above. The Bank's past involvement in the sector has been instrumental in helping the Government to develop a well-conceived institutional framework and policies for the sector. In the future, given existing levels of service, Bank assistance will focus on the provision of service to the urban poor as well as continued improvement in institutional capabilities, particularly in planning and system operation and maintenance.

2. WATER DEMAND

The Project Area

2.1 The proposed project would assist MWSS to increase its water supply production capacity to serve 37 municipalities in the MWSS Service Area (MSA) and a total population of almost 9 million (see Map). This includes Metro Manila proper, also referred to as the National Capital Region (NCR), which is the country's most developed and fastest-growing area as well as its cultural, economic and political center. The NCR includes the cities of Manila, Caloocan, Pasay and Quezon City and another 13.5 municipalities, and has about 13% of the country's population and more than half of its large industries. However, 2.5 million persons live in blighted areas with minimum services and poor housing.

2.2 The MSA area of about 150,000 ha includes the NCR, Cavite City, another five municipalities in Cavite Province and 14 municipalities in Rizal Province. MWSS serves the entire metropolitan region, independently of local governments and city borders. This is an advanced organization for a metropolis, which allows the provision of equal levels of service, water quality and water charges across all municipalities, facilitating the planning and strengthening of all water and sewerage services. Water supply and sanitation facilities now available in the MSA are described in Annex 1.

Population

2.3 The MSA population increased by more than two million persons between 1980 and 1989, at an average annual growth rate of 4.1%. Detailed population estimates for each municipality based on forecasts by the National Statistics Office were prepared by MWSS, and assume that MSA's growth rate would decrease to 2.3% p.a. during the period 1990 to 2000, although several of the smaller municipalities would experience increases of up to 10% p.a. By the year 2000, the MSA population is expected to reach 11.6 million, growing to 13 million by 2010, with 85% of the total in the NCR.

Levels of Service

2.4 In the past, the population served by house connections in the MSA was estimated on the basis of 8.1 persons (about 1.4 households) per connection. However, a census of about 360,000 households in 54 zones in the NCR indicates that the population already served is larger than estimated, averaging about 9 persons per connection (1.5 households). This value was used for the water demand in this report, reducing the estimates of the population to be served and the reported per capita consumption.

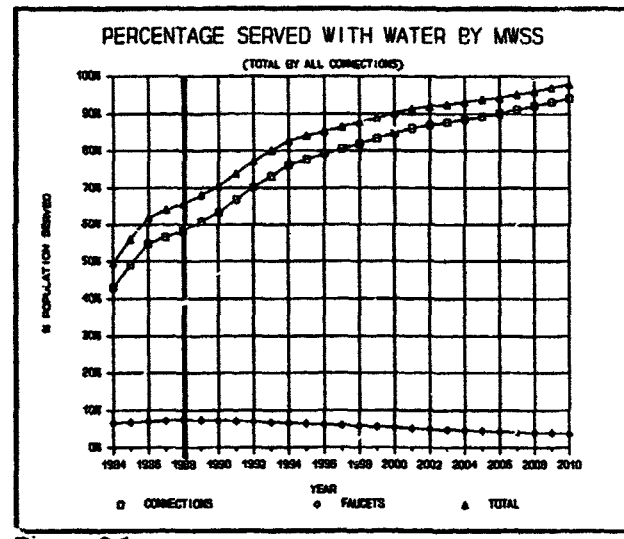

Figure 2.1

2.5 The population per connection is expected to decline slowly over time, as housing becomes less crowded, each house gains a separate connection, and population growth slows down. This would increase the number of connections but not the water consumption which is based on per capita estimates. The population served by domestic house connections is expected to increase from 58% in 1988 to 75% by 1994 and 85% by the year 2000. The total population with water supply, including commercial connections and about 1,400 public faucets, is expected to reach 82% by 1994 and 90% by the year 2000. Figure 2.1 shows actual values up to 1988 and the Bank forecast up to the year 2010 (the same applies to other figures in this report).

Water Demand

2.6 During 1984-86, per capita water consumption in the MSA fell considerably, with total consumption declining from about 250 liters per

capita per day (lcd) to about 200 lcd and domestic consumption declining from 160 lcd to 135 lcd. This reflected the economic downturn of the period as well as the effects of water rationing and shortages, the inadequate distribution system, and the lower water consumption of the additional, lower-income population connected in those years. Extensive areas still have no distribution network and the quality of service in many areas is inadequate, with low water pressures and rationing or intermittent supply.

2.7 Domestic Demand. About 20% of the population suffers from water rationing and intermittent supply. However, assuming the continuation of economic growth (at about 6% p.a.), higher per capita income and billing of part of the non-revenue water (NRW), domestic water consumption is expected to return to 160 lcd by 1994, with the total water consumption reaching about 250 lcd by 2005 (Figure 2.2).

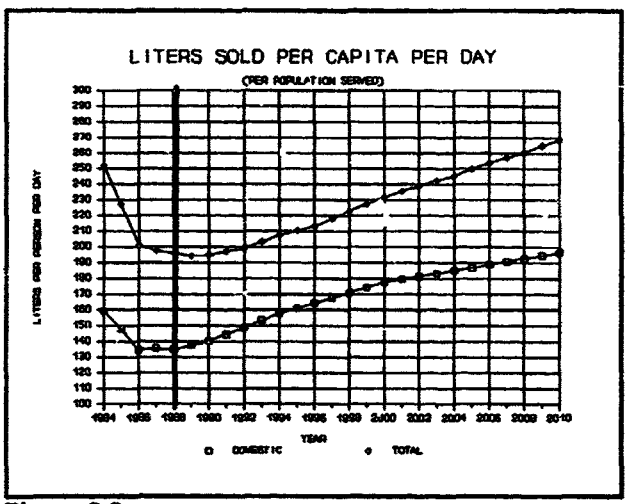

Figure 2.2

2.8 Under the above-mentioned assumptions, domestic water demand will increase from 617 million liters per day (MLD) in 1988 to 913 MLD by 1992 and 1,119 MLD by 1994. Annex 2 provides the assumptions used for this projection (Table 1) and yearly forecasts (Tables 2, 3 and 4).

2.9 Industrial and Commercial Demand. Total commercial and industrial usage of water is currently estimated at about 900 MLD, only 36% of which is supplied by MWSS. Previous estimates of MWSS demand have projected large increases in water sales, assuming that industrial consumers would switch from groundwater to the MWSS supply as a result of saline intrusion in the aquifer and lower groundwater levels due to overexploitation. These estimates appear overoptimistic, however, in view of continuing consumer concerns about the quality of MWSS's service and the higher cost of MWSS water. The low water distribution pressures and unreliability of the MWSS supply would continue in the next few years until the project is in operation. Furthermore, the cost of pumping underground water is only about P 2 per ton (excluding treatment cost, which is not needed by most industrial users), as compared to MWSS's charges to industrial customers. averaging P 9 per ton (including sewerage and environmental charges). Although groundwater exploitation has undoubtedly depleted resources in some areas, particularly adjacent to Manila Bay, the overall water resources in other areas are still substantial. Considering these and other factors that affect MWSS demand, the estimates of water demand used for the proposed project are lower than those used in the project feasibility report (see Annex 2).

2.10 Commercial and industrial connections are expected to increase at about 1.5%-2% and 0.5% p.a., respectively, less than the increase in population, in view of the availability of underground water, the lower water quality requirements for some applications and the poor service provided to the industrial zone, which is at the end of MWSS's distribution system. However, the water sold per connection is expected to increase rapidly (by about 3% p.a. for commercial and 8% p.a. for industrial connections), because of GNP growth and the diminishing underground supply in some areas. Under these assumptions, the water sold to commercial and industrial consumers is expected to increase from 353 MLD in 1988 to 400 MLD by 1992 and 445 MLD by 1994. Annex 2 provides detailed forecasts (Tables 5 and 6). As a proportion of total demand, commercial water demand is expected to decrease from 32% to 24% of total demand between 1988 and 1994 because of the rapid increase in domestic water demand. Industrial water demand is expected to remain at about 4.5% of total demand. These estimates depend, of course, on MWSS's pricing policies (which now cross-subsidize low-income consumers), the reliability of MWSS's service and the cost of extracting and/or treating underground water.

2.11 Bulacan Water Supply. On request of the Provincial Governor of the Bulacan Province

MWSS agreed to provide up to 1.1 cums of treated water in bulk to several municipalities neigboring MSA, in return from water taken from the Angat river, which provides 96% of MWSS's water supply and is located in this province. The pricing of bulk water supply is being studied by MWSS (para. 3.9).

New Water Connections

2.12 Under the above assumptions, the total number of connections is expected to increase substantially during the period 1989-92 (Figure 2.3). The targets for new connections would be almost twice those achieved in 1988, but below the number of connections installed in 1986 and 1987.

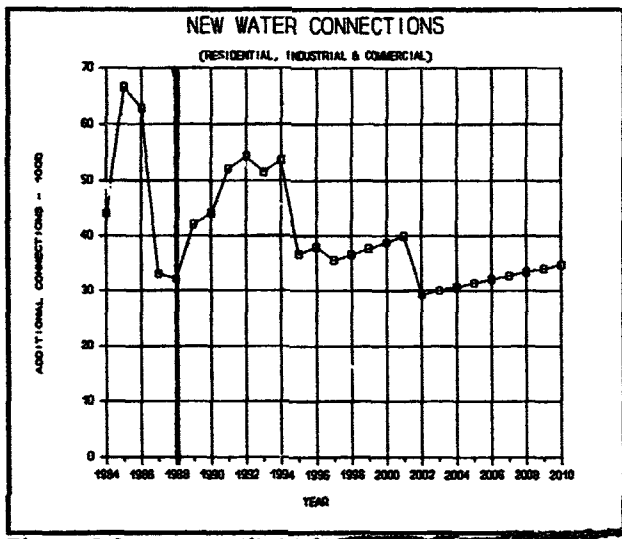

Figure 2.3

2.13 To ensure the reliability of MWSS's future financial projections (which depend on water sales) and thus the reliability of its planning and budgeting activities, MWSS intends to review and periodically update the water demand forecast using the computer model prepared for the project. Annual updates would be provided to the Bank (para. 5.13).

Non-Revenue Water

2.14 Non-revenue water (NRW) has been a major problem for MWSS. During the last ten years, NRW has been above 45%, and in 1985, when the La Mesa treatment plant entered into operation and normal pressures were restored, NRW peaked to about 66% of the water produced. As shown in Figure 2.4, some improvements have been made, but NRW still remains above 55%.

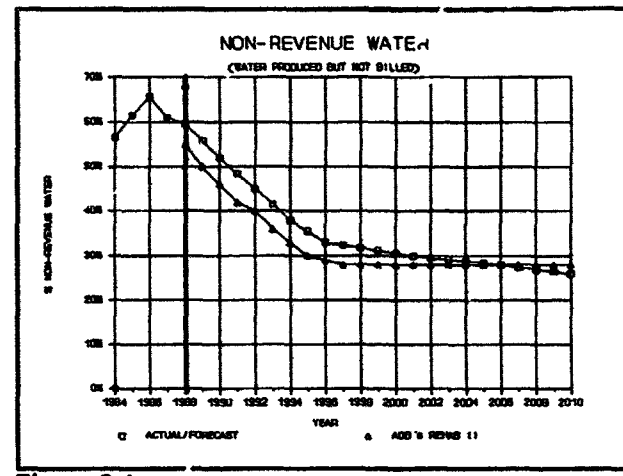

Figure 2.4

2.15 NRW significantly affects water sales by reducing effective delivery capacity of the system. With the final objective of reducing NRW below 30%, MWSS is undertaking a comprehensive leak detection and distribution system rehabilitation program. Financing for this program is being provided by two ADB loans totalling US$65.7 million. Results from eight rehabilitated areas show that, with these improvements, NRW can be reduced to less than 30%. These activities, in conjunction with other measures now being taken by MWSS, are expected to reduce NRW to 55% in 1989, and below 40% by 1994 (paras. 4.6-4.8).

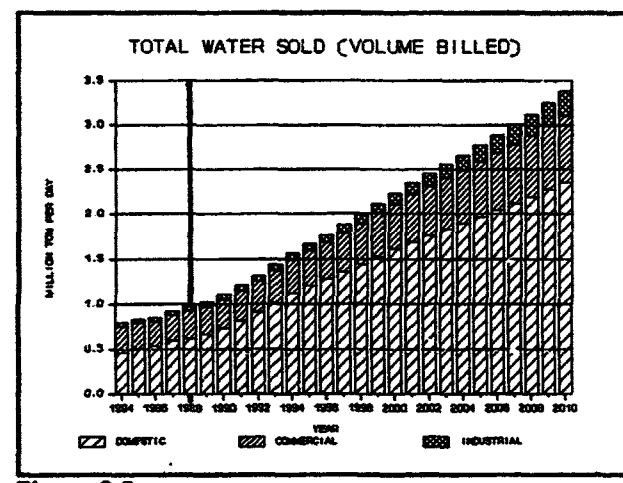

Figure 2.5

Forecasted Demand and Supply

2.16 Water demand in Manila is highly seasonal. While regression analysis of total and per capita water sold shows that water sales would reach about 38 million cu m per month by the year 1993, the existence of rationing in the past which pent up demand and the higher GNP growth rates expected in the future suggest that sales of 48 million cu m per month can be expected by 1994 (Annex 2, Table 3). The actual and forecasted water sales to domestic, commercial and industrial consumers between 1984 and 2006 are shown in Figure 2.5.

Production Capacity

2.17 MWSS's total water production capacity is about 2,590 MLD (2,500 MLD from the Angat Dam, treated at the Balara and La Mesa treatment plants, and 90 MLD from deep wells). Of its actual total production of about 869 million cu m in 1988, MWSS supplied about 359 million cu m (the remaining is NRW). The projections of future demand (Annex 2, Tables 2 and 3) indicate that MWSS's water production capacity would be exhausted by 1994, even if NRW were to be reduced to 38%. Total water consumption by that time will have grown to about 1,560 MLD and the maximum daily water production needed will be about 2,800 MLD. The proposed project would expand MWSS's water production capacity by 1,300 MLD in 1993, with the potential of supplying an additional 1,277 MLD by the year 2002. Groundwater sources providing water to some distant districts will be expanded 52%, but will supply only 133 MLD by 1994.

2.18 The total forecasted demand and supply of water from MWSS are shown in Figure 2.6, which indicates that, even if NRW is reduced below the targeted levels, the proposed investment in the Angat Dam would still be needed. Moreover, MWSS should also be able to supply the maximum daily demand, which peaks during the period January-June. The daily peak is generally estimated as 10% to 20% higher than the annual average demand. Using a peak factor of only 1.1 for maximum daily demand, the capacity of the project will be fully used about seven years after project completion, which previous Bank studies have shown as economically optimal for water treatment and transmission facilities. If NRW is not reduced to less than 30% by the year 2001, the additional capacity provided by the project would be exhausted much earlier.

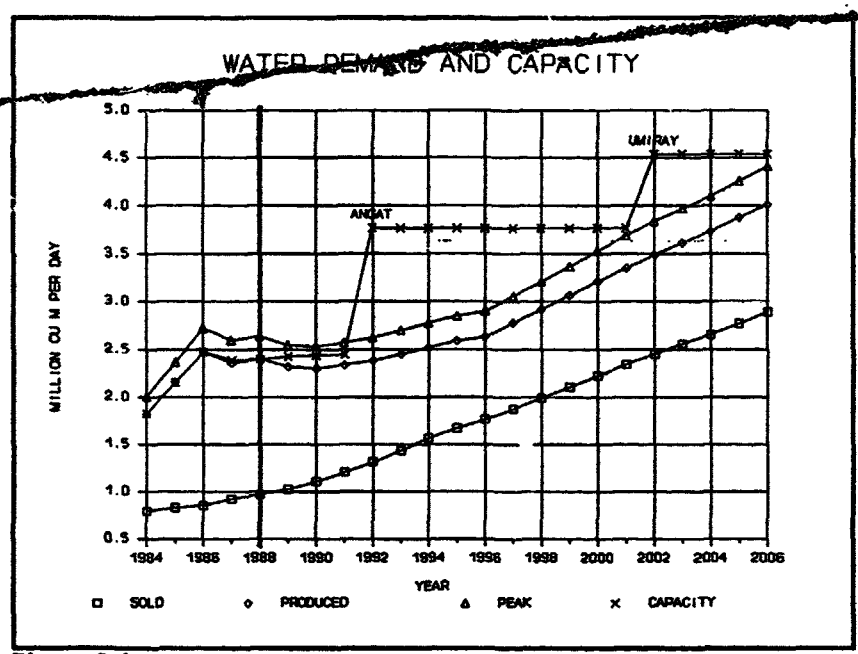

Figure 2.6

3. THE PROJECT

Project Origin

3.1 The proposed project is an important part of the Government's plan to upgrade and expand water services in the Metro Manila area and to provide an adequate base for the country's further commercial, industrial and social development. The project was identified in 1987, and the feasibility studies were completed in June 1988. In February 1989 the Government requested the Bank to cofinance the project with the Asian Development Bank (ADB) and in June 1989 an agreement in principle was reached between the Government and the Overseas Economic Cooperation Fund of Japan (OECF) for OECF to participate in cofinancing.

3.2 MWSS had initially intended to expand its production capacity by undertaking the Manila Water Supply III Project, comprising construction of a dam on the Kaliwa River, transmission mains and treatment facilities, costing about US$1.0 billion (in 1988 prices). However, budgetary constraints prompted it to postpone that project and to look for lower-cost solutions to improve water supply services in the Manila area. The alternative adopted optimizes use of water resources available from the Angat Reservoir in two stages: first, by reallocating water more effectively among the various beneficiaries, (water supply, power generation and irrigation) resulting in a 15 cums increase in MWSS's share for water supply, from 22 cums to 37 cums. In the second stage, which is expected to be operative by the year 2000, Angat resources will be enhanced by 9 cums through an interbasin transfer from the Umiray River, with the additional water allocated to power generation and MWSS. The capacity to convey this water is included in the power plant, the tunnel and aqueduct to be constructed under the proposed project. The optimization of the Angat Reservoir resources under the project provides optimal sharing of water for potable water supply, power generation, and irrigation, and is the least-cost alternative for MWSS.

Rationale for Bank Involvement

3.3 In accordance with Bank strategy, the proposed project supports Government efforts to improve the living conditions of the urban poor, promote economic and social development by eliminating major water shortages, and improve environmental conditions by providing safe water to in the MSA. The project would strengthen MWSS, through the implementation of a four-year institutional development program (paras. 3.10-3.11), with particular emphasis on improved planning and financial performance as well as better operation and maintenance of water production and distribution facilities. The cofinancing with ADB and OECF would also be important to ensure the achievement of common institutional and development objectives by MWSS.

Project Objectives

3.4 The main objective of the project would be to provide water supply for the expected water demand until the year 2000. The project has been designed to: (a) increase MWSS's water production capacity; (b) provide 15 cums of safe water to serve an additional population of about 3.0 million persons; (c) increase service coverage of the population in MSA to 75% by 1994, particularly in poor neighborhoods; (d) improve the efficiency of MWSS's operations; and (e) strengthen MWSS's finances as well as its planning and management information systems.

Project Description

3.5 The project is part of an overall investment program for which the Government has secured financing from different sources. The project includes construction of raw water transmission, water treatment and distribution facilities for an additional supply of 15 cums, including engineering, and consists of the following:

Part A: Transmission and Bulk Water Supply, comprising construction of (i) tunnel No.3 (about 6 km, 4.6 m diameter); (ii) aqueduct No.5 in three sections, 5A, 5B and 5C (about 16 km, 3.6 m diameter); (iii) the second La Mesa by-pass (about 2.5 km, 3.6 m diameter); and (iv) water mains (about 35 km) to provide treated water (1.1 cums) in bulk to eight municipalities in Bulacan Province.

Part B: Water Source, Treatment and Distribution Facilities, comprising construction of: (i) modification of the Angat power station; (ii) the La Mesa II treatment plant (10.4 cums); (iii) a water reservoir (260,000 cu m); (iv) expansion of the primary and secondary distribution system by about 420 km; (v) expansion of the tertiary distribution system by about 100 km, including provision of about 345,000 service connections; and (vi) telemetering.

Part C: Consultants' Services. Provision of engineering consultancy services for the project.

3.6 Cofinancing Arrangements. Part A of the project would be financed by the Bank, except for section 5A of aqueduct 5, which will be financed locally. Parts B and C would be cofinanced by ADB, except for items B (iii) and (iv), including respective consultancy services of Part C, which would be financed by OECF.

3.7 A detailed project description is presented in Annex 3. A summary description is as follows: The Angat auxiliary power station will be expanded by an additional turbogenerator, including construction of extension of the powerhouse and modification of the penstock of the main turbines. This will allow for release of 15 cums of water to the Ipo reservoir, about 7.5 km downstream. Tunnel No.3, followed by aqueduct No.5, will transfer raw water from Ipo dam to the La Mesa and Balara treatment plants and the Novaliches reservoir. The second La Mesa by-pass will connect all aqueducts with the Balara treatment plant and allow for complete elimination of the Novaliches reservoir from the system during dry periods when water levels in the reservoir are low and evaporation and leakage losses high.

3.8 The 15 cums of raw water will be directed partly to the underutilized La Mesa I treatment plant (about 4.6 cums) and partly to the new La Mesa II plant (about 10.4 cums). A new reservoir of 260,000 cu m will be constructed at Bagbag and connected with the La Mesa plants by a treated water aqueduct (about 0.5 km, 3.6 m diameter). The distribution system will be expanded by about 120 km of primary lines and 300 km of secondary lines, including construction of three new and rehabilitation of two pumping stations; and 100 km of tertiary lines, including about 345,000 service connections. The metering of flows in the entire distribution system will be improved and monitored centrally through a telemetering system. This will also provide for automatic water analyses and monitoring of key water quality parameters.

3.9 The bulk water supplied to Bulacan Province (about 90 MLD or 2% of MWSS's production capacity in 1992) will solve critical water shortages in eight municipalities bordering the MSA, and will be provided in return for the water taken by MWSS from the Angat River, which is located in Bulacan Province. The municipalities' Water Districts (WDs) will continue operations of existing systems and, jointly with LWUA, will arrange for expansions, which are currently being designed. The quantity of water to be supplied would be finalized on the basis of agreements between MWSS, LWUA and the WDs in the involved municipalities. Agreements have been concluded for two WDs' (Meycauayan, Obando) and discussions will follow shortly for the remaining six. Particularly important for reaching agreements is the price of bulk water, which should be much lower than the MWSS average price, since it should exclude the cost of distribution, billing and collection and assume a low level of NRW (about 10%) in bulk transmission mains. MWSS has agreed to provide the study of the price of this bulk supply for Bank review by December 1989.

3.10 MWSS's Development Program. During the project period, MWSS would continue to develop its institutional capabilities. MWSS's Administrator and Board of Directors have given high priority to streamlining the corporation's procedures and increasing the efficiency of operations, planning, and financial management. For this purpose, MWSS has

prepared a Development Program which outlines the main thrusts of such improvements. MWSS has also established a Management Group to periodically review and update the Program. The Development Program, approved by the Administrator in August 1989, is satisfactory to the Bank and is provided in Annex 8.

3.11 MWSS's Development Program for water supply sets the following objectives to be achieved by end-1992: (a) increase to 70% the population served by house connections; (b) reduce non-revenue water to less than 46%; (c) prevent further leakage by improved specifications for meters, pipelines and pressure-reducing valves; (d) improve staff efficiency; (e) provide training to about one third of all staff; (f) improve billing and collection; (g) improve the tariff structure to make tariffs more affordable to the urban poor; (h) maintain a satisfactory financial condition; (i) provide more uniform water pressures throughout the MSA; (j) improve the Management Information System by including delinquency reports, pending connections and other financial indicators; and (k) improve operation and maintenance of the water system. For sewerage and drainage, MWSS intends to: (a) improve services; (b) reduce pollution in the MSA; and (c) assist the population living in areas without sewerage services to gain access to adequate alternative sanitation. Further discussion of MWSS's institutional objectives is presented in Chapter 4.

Project Cost

3.12 The project is in an advanced stage of preparation, and cost estimates for the raw water transmission component are based on bid prices. Estimates for most of the remaining components are based on preliminary designs and the costs of recently awarded contracts for similar works.

3.13 The estimated cost of the project, including physical and price contingencies but excluding interest during construction, is P 6,523 million (US$291.4 million), of which P 3,416 million (US$151.7 million) or 52% of the total represents foreign exchange. The project cost includes taxes and duties estimated at about US$7.6 million equivalent. The base cost is expressed in December 1988 prices.

3.14 Physical contingencies average 8%, including 8% for civil works, 10% for the power station, 12% for the second La Mesa by-pass and the Bulacan bulk water supply, 25% for telemetering and 5% for materials and equipment. Estimated price increases over the project period amount to about 22% of base costs plus physical contingencies. Price increases for foreign costs are estimated at 5.3% for 1989, and 4.1% thereafter, and for local costs at 9% for 1989 to 1991, and 8% thereafter. It is estimated that exchange rate adjustments would, on average, maintain "purchasing power parity" during the project implementation period.

3.15 The estimated cost of Bank-financed components included in Part A of the project (except for aqueduct 5A), including physical and price contingencies but excluding interest during construction, is P 1,348 million (US$61.3 million). This includes taxes estimated at about US$1.4 million equivalent and a foreign exchange component of US$27.1 million, 44.2% of the total. For Part B of the project, the estimated cost of the ADB-financed component, including physical and price contingencies but excluding interest during construction, is P 2,485 million (US$108.7 million). This includes taxes estimated at about US$3.4 million equivalent and a foreign exchange component of US$68.3 million, 62.8% of the total. The estimated cost of the OECF-financed component, including physical and price contingencies but excluding interest during construction, is P 2,050 million (US$92.2 million). This includes taxes estimated at about US$2.[illegible] million equivalent and a foreign exchange component of US$50.7 million, 55% of the total. The project cost summary is shown in Table 3.1 and detailed project cost estimates in Annex 4.

Financing Plan

3.16 The proposed Bank loan of US$40 million would finance 13.7% of the project cost (14.1% excluding taxes), or about 11.1% of the total financing requirement of US$361.9 million (Table 3.2). The ADB loan would finance US$130 million of project costs or 35.9% of the total financing requirement. The effectiveness of the Bank loan is conditional upon the effectiveness of the ADB loan. Assurances were obtained during negotiations that the Government would provide equity contributions to capitalize MWSS, for the equivalent of US$80 million equivalent or 22.1% of the total financing requirements.[7] This is expected to be funded by an OECF loan, appraised in June 1989, cofinancing the

project. The remaining financing would be provided by bonds (US$55.2 million, 15.3%), MWSS's internal cash generation (US$34.5 million, 9.5%), and local loans or equity contributions (US$22.2 million, 6.1%).

3.17 The proposed Bank loan would finance 65% of expenditures related to Part A of the project (construction of the transmission, by-pass and bulk water supply works, except for aqueduct 5A, for which the contract has already been approved for local financing). This would include US$12.9 million of local currency financing, which is justified in view of the low foreign exchange requirements of this component (about 44%) and the high proportion of low-income beneficiaries. The proposed ADB loan and OECF funds would finance the foreign exchange as well as some local cost requirements of Part B of the project (distribution and treatment works) and project-related engineering. ADB would also finance the interest during construction. The financing plan is shown in Table 3.2. Further details are presented in Table 2 of Annex 10.

TABLE 3.1 TOTAL PROJECT COST

WORKS	MILLION PESOS Local	MILLION PESOS Foreign	MILLION PESOS Total	% OF BASE COST	MILLION US$ Local	MILLION US$ Foreign	MILLION US$ Total	% Foreign
IBRD-FINANCED WORKS	580.7	477.1	1057.8	21.3%	27.65	22.72	50.37	45.1%
ADB-FINANCED WORKS	655.5	1136.1	1791.5	36.1%	31.21	54.10	85.31	63.4%
OECF-FINANCED WORKS	706.2	896.1	1602.3	32.3%	33.63	42.67	76.30	55.9%
LOCALLY-FINANCED WORKS	407.5	97.1	504.6	10.2%	19.40	4.63	24.03	19.2%
BASIC COST, PRICES OF DEC. 1988	2349.8	2606.4	4956.2	100.0%	111.9	124.1	236.0	52.6%
PHYSICAL CONTINGENCIES	185.4	209.1	394.5	8.0%	8.4	9.3	17.6	53.0%
PRICE CONTINGENCIES	571.1	600.7	1171.7	23.6%	19.4	18.4	37.8	51.3%
TOTAL COST 1]	3106.3	3416.1	6522.5	131.6%	139.7	151.7	291.4	52.4%

TABLE 3.2 PROJECT FINANCING PLAN

	TOTAL MILLION PESOS	TOTAL MILLION US$	% OF TOTAL	MILLION PESOS 1989	1990	1991	1992	1993	1994
PROJECT COST 1]	6522.5	291.4	80.5%	546.6	1742.8	1907.2	1238.7	839.0	248.2
(A) IBRD-Financed Works	1348.4	61.3	16.9%	191.3	426.9	463.2	210.8	56.2	0.0
(B) ADB-Financed Works	2484.7	108.7	30.0%	9.4	465.3	707.5	622.1	432.2	248.2
(C) OECF-Financed Work	2050.4	92.2	25.5%	183.2	609.3	648.9	326.7	282.3	0.0
(D) Locally-Financed	638.9	29.2	8.1%	162.7	241.3	87.5	79.1	68.3	0.0
INTEREST CAPITALIZED	1659.2	70.5	19.5%	27.5	120.4	260.4	367.5	426.3	457.0
World Bank	212.3	8.9	2.5%	2.4	9.0	27.1	43.1	58.2	72.4
ADB	576.0	24.2	6.7%	3.5	25.1	71.3	120.8	162.9	192.5
PNB/UB	870.9	37.3	10.3%	21.6	86.4	162.0	203.7	205.2	192.1
TOTAL TO BE FINANCED	8181.7	361.9	100.0%	574.1	1863.2	2167.6	1606.2	1265.3	705.2
FINANCED BY:									
World Bank Loan	920.3	40.0	11.1%	63.0	106.9	187.0	213.4	252.7	97.4
Asian Development Bank Loan	2991.8	130.0	35.9%	12.7	481.1	764.7	730.4	586.5	416.5
Government Equity (OECF Loan)	1794.7	80.0	22.1%	96.0	528.7	563.1	237.1	244.9	124.8
Local Banks	1200.0	55.2	15.3%	240.0	480.0	360.0	120.0	0.0	0.0
Internal Cash Generation	801.0	34.5	9.5%	0.0	0.0	247.9	305.3	181.3	66.5
Other Local Funds	473.8	22.2	6.1%	162.5	266.5	44.9	0.0	0.0	0.0
TOTAL FINANCING	8181.7	361.9	100.0%	574.1	1863.2	2167.6	1606.2	1265.3	705.2

1] Includes taxes equivalent to about US$7.6 million. Due to rounding, the last digits in totals may not add up as shown in the tables.

Project Implementation

3.18 The project would be implemented from 1989 to 1994 (Annex 5). Overall project planning and supervision of construction would be carried out by MWSS staff, who have acquired considerable experience through several previous projects. Consultant assistance will also be provided, particularly for all preliminary and a majority of detailed designs as well as construction supervision. Civil works and installation of equipment will be carried out by contractors. The contracts for the tunnel and the aqueduct were awarded in May/June 1989. Based on the awarded contracts and the agreed schedule, the completion of the power station, tunnel, aqueduct and part of the distribution system is scheduled for February 1992. The initial water supplied by this system would be treated using available capacity (about 4.6 cums) at the existing La Mesa I treatment plant. The remaining 10.4 cums would be treated at the La Mesa II treatment plant, to be completed in December 1992 together with the La Mesa by-pass and about 30% of the distribution system. The Bulacan bulk system will be completed in early 1993 and the remaining part of the distribution system, mainly secondary and tertiary pipelines, as well as the telemetering in December 1994. The implementation schedule is realistic given the advanced status of engineering and contracting, improvements introduced in MWSS's contracting and awards procedures, and its experience with implementing foreign-assisted projects. MWSS will closely monitor the progress of implementation to avoid delays which might affect the somewhat rapid implementation schedule envisioned.

3.19 MWSS's Engineering Area (EA), under the Deputy Administrator for Engineering, is responsible for all matters related to project planning and design. For preliminary and detailed designs of the power plant, the treatment works, primary and secondary distribution network, and the telemetering system as well as for the preliminary designs of the tertiary distribution network, EA is assisted by the project consultants (para. 3.23). Detailed designs of the tertiary network and all designs of the second La Mesa by-pass and the Bulacan bulk supply will be undertaken by EA's staff. All designs will be completed by December 1990.

3.20 The construction phase of the project, including bidding, evaluation of bids and supervision of construction, will be the responsibility of the Project Management Office (PMO) established under the Deputy Administrator for Construction Management. PMO is headed by a Project Director, who is the Deputy Administrator for Construction Management, assisted by three Project Managers and their staff, who are separately responsible for (a) the power plant and tunnel; (b) aqueducts, treatment plant and reservoir; and (c) the distribution system, telemetering, second La Mesa by-pass and the Bulacan system. The Project Managers for (a) and (b) above have already been appointed. The third Project Manager will assume his duties in February 1990 upon completion of designs for the distribution system and bulk water supply. The PMO will closely coordinate with EA on engineering aspects during project implementation.

3.21 Coordination of the design and construction of the Bulacan bulk system will be provided by a Joint Committee, established in July 1989 and comprising representatives of MWSS, LWUA and Bulacan Province (including the WDs of the benefited municipalities). It will also make recommendations on actions to be taken to successfully implement this component.

3.22 Land Acquisition and Compensation. Land acquisition is minor since the land is either already in MWSS's possession or under the right-of-way owned by MWSS, and will be completed in 1989. During modification of the power station and installation of the new turbine in 1991, power generation from Angat Dam will be suspended for two to three months. MWSS has agreed to compensate the National Power Corporation (NPC) for this revenue loss, and the estimated amount of compensation is included in the project cost. NPC will also lose some peaking and average energy generation capacity after the project is in operation, since the hydraulic head for 15 cums will be reduced by about 30 m. The compensation to NPC for such losses which may result from the project is a complex issue due to the interaction of weather variations, MWSS's forecasted water demand, NPC's overall peaking generation requirements, etc. This requires preparation of a study by a third party, independent of NPC and MWSS, which would serve as a common basis for negotiations on compensation. A tentative estimate of such annual

cost is included in the financial and economic evaluation of the project. Assurances were obtained from the Government and MWSS that an agreement between NPC and MWSS for compensation of power losses, will be concluded by December 31, 1990 and, additionally, an understanding was reached with the Government that while these matters are studied and resolved, project construction will proceed as scheduled.

Technical Assistance

3.23 Technical assistance required for designs and construction supervision comprises about 230 person-months of foreign consultant services and about 1,650 person-months of local consultants. In May 1989 a joint venture of local and foreign consultants was awarded the contract for completion of a major part of the detailed design. Contracts for the remaining designs and construction supervision are planned to be concluded before December 1989. These consulting services will be financed by ADB and OECF loans. In addition, ADB plans to provide MWSS a technical assistance grant (US$300,000) for institutional development and training of MWSS staff in financial management and in various aspects of the management and operation of a water supply project (e.g., tunneling technology, aqueduct and pipe laying, water quality control, training of trainers, etc.). ADB is also appraising a technical assistance grant (US$990,000) for preparation of a feasibility study for the proposed Umiray-Angat transbasin water conveyance system (about 9 cums). This grant has been approved in principle by the Japanese Government to be financed by ADB's Japanese Special Fund.

Procurement

3.24 Procurement of Bank-financed components. To accelerate project start-up, MWSS applied advanced contracting for the tunnel and aqueduct following international competitive bidding (ICB). The Bank reviewed relevant documents and procedures employed for advertisement, prequalification, bidding and evaluation of bids for these contracts and found contract awards for the tunnel and sections 5B and 5C of aqueduct No.5 (US$41.8 million) acceptable. The contract for section 5A of aqueduct No.5 (US$13 million) was awarded in accordance with Government procedures requiring that bids 30% below the average be automatically disqualified, which is not acceptable to the Bank. This contract will be financed locally. Procurement of the remaining civil works, equipment and materials will be divided into about five contracts (US$19.5 million) which will be awarded following ICB or local competitive bidding (LCB) in accordance with procedures satisfactory to the Bank.

3.25 Procurement under ICB will include civil works for the second La Mesa by-pass as well as pipe materials, including accessories for the Bulacan component (US$6 million), and part of the equipment and materials for the second La Mesa by-pass (US$3 million). The remaining civil works contracts, under US$2 million each and together totalling about US$3.8 million, as well as minor equipment and materials, under US$0.1 million each and about US$0.9 million in aggregate, will be procured through LCB. Although LCB procedures are generally acceptable to the Bank, a review of recent legislation identified some potential issues which are being discussed with the Government and are expected to be resolved prior to scheduled LCB under the project. Prior Bank review would be required for civil works contracts costing over US$2 million and goods contracts over US$0.5 million. In total, these represent about 90% of the value of all contracts, which is adequate. Details on procurement of Bank-financed components are shown in the Table 3.3.

3.26 Procurement of other components. The procurement of components financed by ADB and OECF, including consultancy services, will proceed in accordance with guidelines and arrangements satisfactory to the financing agencies. The Bank has reviewed terms of reference for consultancy services for the supervision of Bank-financed construction and found them satisfactory.

Disbursements

3.27 The proceeds of the Bank loan would be disbursed for eligible expenditures under Part A of the project as follows: (a) civil works at 70%; and (b) equipment and materials at 100% of foreign expenditures, 100% of local expenditures (ex-factory), and 65% of local expenditures for other items procured locally.

3.28 A Special Account of US$3 million would be established to facilitate Bank disbursements. Retroactive financing up to US$4 million (10% of the proposed loan) is recommended for project expenditures incurred after May 1, 1989. This would accelerate project start-up and the elimination of water rationing in MWSS. MWSS is aware that procurement action taken in expectation of retroactive financing is at its own risk and does not commit the Bank in any way to approve a loan for the project.

3.29 The project is expected to be completed by December 31, 1994 and the loan to be closed by December 31, 1995. Disbursement of the Bank loan is expected to take six years, faster than the country disbursement profile, but considered reasonable since contracts for the main components to be financed have already been awarded and should be completed in February 1992. The estimated disbursement schedule is shown in Annex 7.

Project Supervision

3.30 Project supervision by ADB, OECF and the Bank will be coordinated through a Supervision Plan, which would be agreed during the Project Launching mission, scheduled for November 1989. Bank supervision of the project would require about 60 staff-weeks, of which about 30 would be needed during the first two years for project start-up, procurement, and specifications review. During the first two years, in addition to general engineering and financial staff, specialists would be needed to review designs of the Bulacan bulk water supply and the second La Mesa by-pass, specifications for water meters, implementation of leak detection and control, water tariffs, water demand, and corporate planning. Supervision in subsequent years would focus on financial, management and construction administration requirements.

TABLE 3.3 PROCUREMENT OF BANK-FINANCED COMPONENTS

(MILLION US$) 1]

Project Component	ICB	LCB	OTHER	TOTAL
Civil Works	46.90 (31.60)	3.76 (2.50)		50.66 (34.10)
Materials & Equipment	9.00 (5.40)	0.84 (0.50)		9.84 (5.90)
Engineering			0.65 (0.00)	0.65 (0.00)
Land Acquisition			0.16 (0.00)	0.16 (0.00)
SUBTOTAL	55.90	4.60	0.81	61.31
IBRD FINANCING	(37.00)	(3.00)	(0.00)	(40.00)

1] Figures in parentheses are amounts financed by the Bank.

4. THE BORROWER

The Borrower and Executing Agency

4.1 The Borrower and executing agency for the proposed project will be MWSS, which is a government-owned, autonomous public utility responsible for the provision of water, sewerage and drainage services to the City of Manila and another 36 municipalities in and around Manila. MWSS is headed by a Board of Trustees which formulates policy, determines staffing levels and remuneration, considers and approves budgets, approves large contracts, appoints MWSS's Deputy Administrators, and recommends tariff adjustments for the President's approval. MWSS is attached to and supervised by the Department of Public Works and Highways, whose Secretary is Chairman of the MWSS Board. Day-to-day management of the corporation is carried out by MWSS's Administrator, who is appointed by the President. The Administrator is supported by a Senior Deputy Administrator and six Deputy Administrators for Administration, Construction, Customer Services, Engineering, Finance and Operations (see Chart 1). To promote specialization and decentralization of operations, six MWSS Branch Offices have been established, with each office responsible for meter reading, billing and collection, general customer services, and the reduction of NRW.

4.2 Although the performance of MWSS's management during 1986-87 was uneven, reforms introduced since then have improved overall management appreciably. MWSS has particularly benefitted from improvements introduced under the Reform Program for Government Corporations (partly assisted under Loan 2956-PH) and the appointment of qualified professionals for MWSS's top management and Board of Directors.

Personnel and Training

4.3 MWSS's staff are generally competent and motivated, and many of the technical staff have been in their positions for several years, providing valuable continuity and in-depth knowledge of the system. Staff levels are, however, too high in relation to the number of connections and services provided. Although MWSS has been increasing its staff efficiency during 1987-88 and even reduced its staff by some 320 persons during this period, further improvements will be necessary. At end-1988, MWSS had 8,790 staff, about 25% of whom were involved in engineering, construction supervision, system rehabilitation and leak detection. The remainder were operational staff, largely working in water supply or general administration.

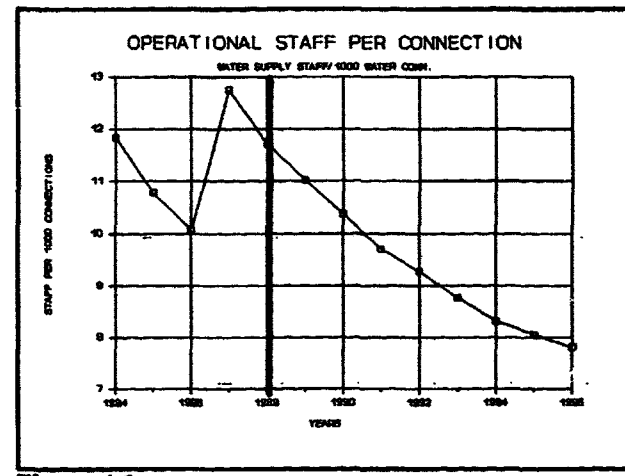

Figure 4.1

4.4 During 1986-87, MWSS's staff efficiency, as indicated by the ratio of operational staff per thousand water connections, sharply deteriorated, and increased from 10.1 to 12.7 (Figure 4.1). Recent management efforts have been able to reduce this ratio to about 11.0, but this is still much higher than the ratio of 4 staff per thousand connections achieved in very efficient water utilities. Although the MWSS staff/connection ratio is not expected to be as low (given the lower cost of labor in the Philippines and high unemployment levels), the staff/connection ratio should be reduced to decrease the cost of water to the population. MWSS aims at increasing its efficiency and reach 9 staff per thousand connections by 1992, by reducing new recruitment and staff increases, while increasing the number of new connections by about 6% p.a. (see Annex 11, Monitoring Indicators).

4.5 MWSS's Human Resources Development Division (HRDD) has one of the most successful staff training programs in the Region. HRDD is currently

carrying out a very extensive program, designed for all staff levels, from laborers to top management, and even including contractors' staff. The program for 1989 includes 128 different training activities for about 3,200 persons (one third of the total staff). HRDD has also prepared a Five-Year Plan for 1990-94 (available in the project file), with four major components: (a) management development, which includes about 70 training activities per year in planning, supervision, team building, use of computers, budgeting and accounting, etc.; (b) technical and skill development, including about 20 training activities per year in pipe laying, leak detection, preventive maintenance, plant operations, water treatment, meter repairs, etc.; (c) overseas training for about 20 staff a year in various technical courses of 2 to 20 months' duration; and (d) a reciprocal training and exchange program with the Metropolitan Waterworks Authority in Thailand.

Operations and Maintenance

4.6 MWSS operation and maintenance practices require improvement. In the past, maintenance of the distribution system, about half of which is about 30 years old, received low priority, and efforts were focused on the expansion programs. The Bank-assisted Metropolitan Manila Water Distribution Project (Loan 2676-PH) highlighted the problem of leakage in the system and the need to give priority to maintenance and rehabilitation of the existing infrastructure. An accelerated program was therefore prepared and is now being implemented to rehabilitate the distribution systems in more than 90% of the MWSS service zones and thus reduce NRW to less than 40% by 1994 and to 30% by the year 2000 (para. 2.14 and Figure 2.4).

4.7 Results from the rehabilitation projects indicate that about 80% of NRW is due to leakage, with the remaining 20% attributed to metering errors and to unregistered or illegal connections. Extensive surveys have detected less than 2% illegal connections (other than in Pasay, a low-income area where the survey detected 15% illegal connections). Further investigations indicate that part of the NRW problem may result from the use of inaccurate and, more important, overly large water meters since many of the meters used are too large to register the low flows used by most consumers (particularly under low pressures or when domestic storage tanks are used). Currently, about 80% of the meters are 1/2 inch and the rest are larger. However, with about 70% of MWSS's domestic consumers using less than 40 tons of water per month per connection (see Figure 4.2) and 95% of them using less than 100 tons per month per connection, smaller meters would be more appropriate. Consequently, the suitability of many of the meters is being studied by a consultant appointed by the Bank.

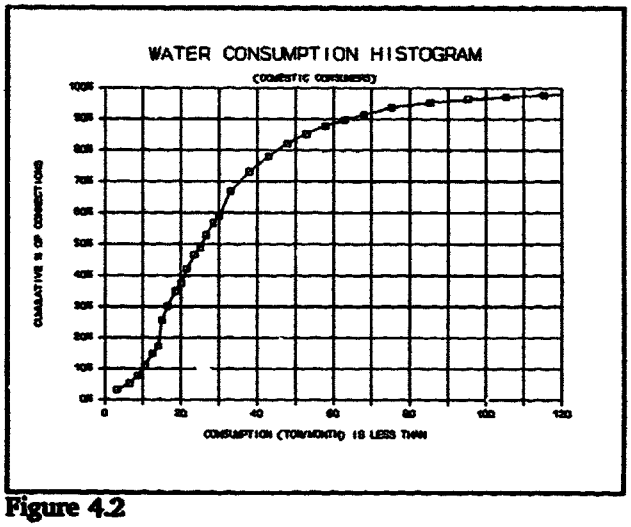

Figure 4.2

4.8 Standards for pipes and installations have also been changed to prevent future leakage by replacing easily-corroded galvanized pipe with PVC pipe, and measures have also been introduced to help prevent meter tampering and illegal connections. The rehabilitation program is expected to be completed in 1993. To complement the distribution works, the La Mesa I and Balara treatment plants are expected to be rehabilitated with assistance from the Government of Japan. Assurances were obtained at negotiations that MWSS would study and improve its specifications for water meters by December 31, 1990 and in accordance with its Development Program it would take all measures to reduce NRW to below 49% in 1991, 46% in 1992, 43% in 1993 and 40% in 1994. Moreover, MWSS is aiming to reduce NRW to about three percentage points below these levels.

4.9 There is also a need to upgrade consumer services to reduce to less than ten days the time required for normal house connections and to improve connection monitoring by: (a) issuing monthly reports on the number of connections requested and completed; (b) monitoring to ensure

that connections closed for non-payment are not reopened; and (c) carrying out special monitoring and auditing of the water used by large commercial and industrial consumers. Assurances were obtained at negotiations that MWSS would upgrade its customer services and connection monitoring by December 31, 1990.

4.10 Under the project, remote metering of the main pipelines will be installed to facilitate control of the extensive distribution system. Assurances were obtained at negotiations that by December 31, 1993 MWSS will improve its operational systems by: (a) establishing a central control operating room, including remote metering devices; (b) making operational the computer simulation of the transmission and distribution networks; and (c) installing pressure-reducing valves in zones with excessive pressures.

Billing and Collection

4.11 Billing is computerized, but the program requires several improvements, including a more timely production of statistics. This would be achieved in 1990 with the use of a larger computer.

4.12 Gross accounts receivable are about six months' sales, which is excessive (Figure 4.3). MWSS is now starting to use successfully the Government's inter-agency clearing office for the settlement of these overdue accounts. In addition, agreement has been reached with the Commission on Audit (COA) to eliminate accounts receivable pending for many years, which are clearly uncollectible. Since about 30% of accounts receivable are due from government agencies, assurances were obtained during negotiations that to reduce MWSS's accounts receivable for water and sewerage services, the Government will: (a) include adequate amounts in the budgetary appropriations of national government agencies and the operating budgets of government corporations for the payment of their water and sewerage bills; (b) ensure the settlement by December 31, 1990 of a substantial portion (60%) of the past due accounts receivable of MWSS from local government units and government corporations; and (c) ensure that by December 31, 1990, and thereafter, the accounts receivable of MWSS from national government agencies will not exceed the aggregate amount of four months of their billing. Assurances were also obtained from MWSS that starting December 31, 1990, its overall accounts receivable will not exceed four months of billing.

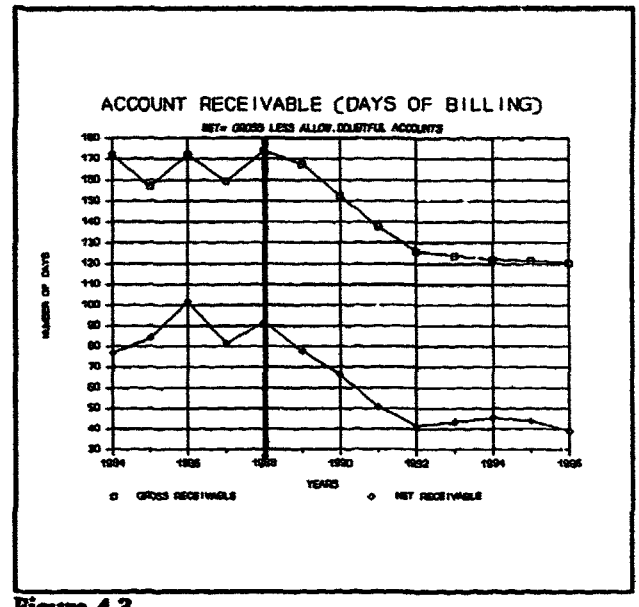

Figure 4.3

Accounting and Auditing

4.13 MWSS's accounting procedures are generally satisfactory. MWSS is in the process of changing its systems to a larger computer. The computerized accounting requires improvements mainly to provide: (a) more timely reports; (b) better management summaries; and (c) in-line information to all deputy administrators. Under the Reform Program for Government Corporations (Loan 2956-PH), consultants in late 1989 will review the computer accounting programs used by 10 major government corporations (including MWSS) to improve or replace existing programs, set compatible information for all government agencies, and provide better information to management. Financial statements up to and including 1988 have been satisfactorily audited by COA. Assurances were obtained during negotiations that MWSS's financial statements, project expenditures, Special Account and Statements of Expenditure would continue to be audited by independent auditors acceptable to the Bank and that the Auditor's Report would be sent to the Bank not later than six months after the end of each financial year.

5. FINANCIAL ANALYSIS

Past and Current Financial Performance

5.1 MWSS's financial performance has been satisfactory. Its net income steadily improved from P 54 million in 1978 to P 346 million in 1984 and P 538 million in 1988. Similarly, its rate of return on revalued net fixed assets in operation increased from 4% in 1980 to 9% in 1986, reflecting large increases in current charges per ton of water, from P 0.66 in 1978, to P 2.1 in 1984 and P 4.0 in 1986.

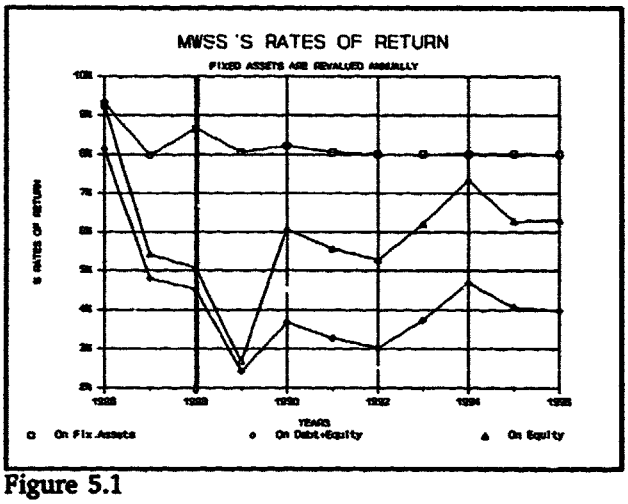

Figure 5.1

5.2 Even during the recession and turbulence of the period 1986-87, MWSS was able to achieve rates of return of about 8% p.a. on its revalued fixed assets in operation (Figure 5.1). Furthermore, while there were few tariff increases during 1986-88, MWSS was able to maintain a satisfactory financial position by increasing its efficiency and sales. Thus, between 1985 and 1988 MWSS increased its customers by 30% and the volume of water sold by 17%.

5.3 Investment levels throughout this period have fluctuated, first increasing from a modest P 90 million in 1978 to P 2.6 billion in 1984, then, under monetary controls applied by the Government, decreasing to about P 1 billion (US$50 million) p.a. in recent years (Figure 5.2).

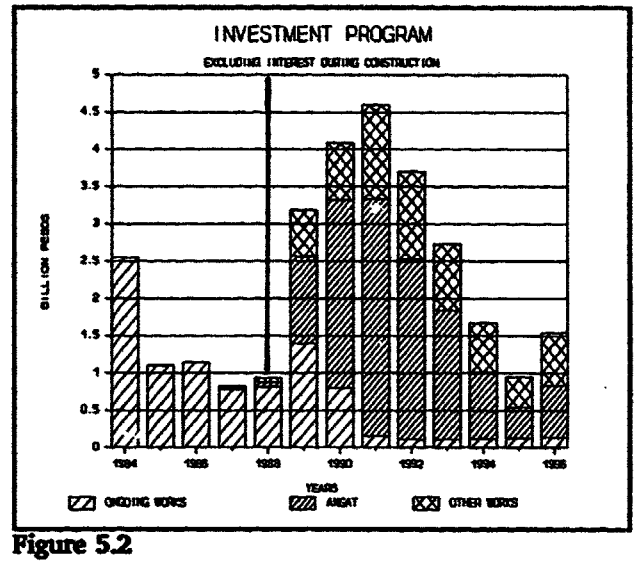

Figure 5.2

5.4 MWSS's financial ratios similarly indicate a satisfactory performance: the working ratio is about 39%, the operating ratio is about 51% 1/ (endnotes appear at the end of the chapter) and the debt/equity ratio is 46%. Cash flow, however, has been a problem due to large debt service increases in recent years (about 95% of MWSS's debt is with the ADB and the Bank). In 1988 MWSS's total debt was P 4.6 billion. MWSS's debt service ratio has been below 1.2 in some years and is expected to be below 1.0 in 1989, requiring equity contributions (including the waiving of franchise and income taxes). This is partially due to the revaluation of loans in strong currencies, which increased MWSS's debt balance and payments in dollars by about 40%. This was compounded by a 100% devaluation of the peso vis-a-vis the dollar. Therefore, during 1983-88, while local consumer prices doubled, MWSS's debt service obligations more than tripled, forcing MWSS to allocate more than half of its revenues for debt service payments.

Water and Sewerage Tariffs

5.5 MWSS's tariffs are progressive, with prices increasing as water use increases. This not only discourages wasteful use of water and encourages conservation but also cross-subsidizes low-income users and facilitates their access to safe water. Tariff levels are adequate, and water rates for large consumers are higher than the estimated marginal cost of P 3.3 per ton. To compensate for debt revaluation, MWSS has introduced an automatic compensation for exchange rate adjustments (CERA) which increases automatically if the foreign debt service per ton of water sold increases in relation to the reference values for 1984. Because the volume of water sold increased considerably during the last three years, CERA increases have been modest; the CERA surcharge is currently equivalent to 10% of the average water tariff. The average water rate in 1988, including the CERA, was about P 4.4 per ton, with domestic consumers paying charges about 20% lower than the average, and commercial and industrial consumers paying 32% and 76% more, respectively, than the average. In addition, there are minor charges for meter maintenance (equivalent to 0.7% of MWSS's revenues).

5.6 As a result of the tariff structure, in December 1988 domestic consumers accounted for about 86% of MWSS's customers, used about 62% of the water, but paid only about 48% of MWSS's revenues. Commercial consumers comprised about 13% of the customers, but used about 22% of the water and provided 28% of the revenues. The few (0.6%) industrial consumers used about 7% of the water and provided about 12% of the revenues. Government services comprised 0.8% of the accounts, used about 10% of the water and provided 12% of the revenues.

5.7 In July 1989, MWSS's Board of Trustees approved an improved tariff structure. Under the previous tariff structure, some tariff levels covered a wide range of consumption, resulting in relatively high unit charges for the lowest consumers within a range and comparatively low charges for those with the highest consumption. For domestic consumers, for example, a change in their water consumption from 24.9 tons to 25.0 tons per month increased their monthly payment by 53% (from P 30 to P 46). Details of the previous tariff structure and the improved tariff structure correcting this and other problems are provided in Annex 9. The new tariff also reduced the minimum price from P 18.6 to P 16.0 per month per connection (benefiting low consumers, mainly the urban poor), while increasing the price for excessive consumption. MWSS's Corporate Planning Department is considering additional improvements, particularly to reduce the number of rates and to apply the same unit charges to all residential consumption above 60 tons per month (which exceeds the actual water used by 90% of MWSS's residential consumers, Figure 4.2).

5.8 Sewerage charges levied on customers with house connections are 50% of the water charges, which is reasonable. The remaining population pay environmental charges equivalent to about 10% of the cost of water consumption. These charges are used to operate, maintain and contribute to the expansion of the sewerage system, clean septic tanks and implement other environmental protection measures. Including all charges, MWSS's revenues average P 5.3 per ton.

Overall Financial Plan and Investment Program

5.9 Although the proposed project is MWSS's largest and most important investment in the medium term, it represents only one third of MWSS's expected investments during 1989-94. As shown in Table 5.1, about P 2.7 billion (16% of total investments) are for ongoing projects (mainly the two rehabilitation projects). MWSS's total capital expenditures, including investments, as well as working capital and debt service, are high, averaging P 4 billion per year (Figure 5.3). Most of the new projects are relatively small, the largest being METROSS II, which would improve sewerage and sanitation services, and represents 14% of planned investment (Table 5.1). Since some of these projects have lower priority, MWSS can advance or delay them, providing flexibility to balance its cash flow. MWSS's gross internal cash generation during 1989-94 would be about 61% of its investments, and its net internal cash generation (after debt service) would be 26% of its total investments, which is satisfactory.

TABLE 5.1 - MWSS'S FINANCING PLAN (1989-94)
(Million Pesos)

	TOTAL	%	1989	1990	1991	1992	1993	1994
Income before depreciation	12544	72.7%	1258	1563	1819	2154	2587	3164
Other income (+) or Expenses	-1959	-11.3%	108	-286	-349	-389	-475	-568
GROSS INTERNAL SOURCES OF FUNDS	10585	61.3%	1366	1277	1469	1765	2112	2596
MINUS:								
Amortization	3496	20.3%	352	370	391	520	827	1036
Operational Interest	2988	17.3%	763	318	385	537	516	470
TOTAL DEBT SERVICE	6484	37.6%	1115	688	776	1057	1342	1506
WORKING CAPITAL NEEDS (+)	-283	-1.6%	174	-244	193	-150	-105	-150
OTHER ASSETS (+) OR LIAB.NEEDS	126	0.7%	7	42	32	24	12	9
CASH INCREASE (+) OR DECREASE	-218	-1.3%	-1385	-27	145	216	401	431
NET INTERNAL SOURCES OF FUNDS	4476	25.9%	1455	819	324	617	462	800
CAPITAL EXPENDITURES								
ONGOING PROJECT WORKS	2702	15.7%	1398	799	157	110	116	122
NEW PROJECT WORKS:	11899	68.9%	1165	2515	3175	2419	1726	898
ANGAT WATER SUPPLY	6523	37.8%	547	1743	1907	1239	839	248
Manila WS REHAB. II (MWSRP II)	1407	8.2%	503	356	385	163	0	0
Manila WS III (MWSP III)	228	1.3%	88	100	10	10	10	10
Fringe Areas WS (FAWSP)	201	1.2%	13	53	55	74	7	0
Rizal Province WS (RPWSP)	264	1.5%	14	40	66	106	39	0
Rehab. Balara & Train.(RBTP/NRTC	635	3.7%	0	225	410	0	0	0
METROSS II	2441	14.1%	0	0	342	828	831	440
Other Works	200	1.2%	0	0	0	0	0	200
Interest Capitalized	2662	15.4%	401	301	444	430	520	565
Other Assets (General)	0	0.0%	0	0	0	0	0	0
TOTAL CAPITAL EXPENDITURES	17262	100.0%	2964	3616	3776	2960	2362	1584
NET TO BE FINANCED:	12786	74.1%	1509	2797	3453	2343	1899	785
FINANCED BY:								
Foreign Borrowing:	7377	42.7%	913	1103	1526	1711	1530	594
IBRD-Angat Project	920	5.3%	63	107	187	213	253	97
ADB-Angat Project	2992	17.3%	10	481	764	730	586	421
Other Foreign Loans	3464	20.1%	840	515	575	768	691	76
Local Borrowing	1600	9.3%	280	580	470	270	0	0
PNB-UB Bonds	1200	7.0%	240	480	360	120	0	0
Other Local Loans	400	2.3%	40	100	110	150	0	0
TOTAL BORROWING	8977	52.0%	1193	1683	1996	1981	1530	594
EQUITY (TRANFER OF OECF'S LOAN)	1795	10.4%	96	529	563	237	245	125
OTHER GOVERN. EQUITY	1380	8.0%	220	361	483	124	125	66
FOREIGN GRANTS (Balara Rehab.)	635	3.7%	0	225	410	0	0	0
TOTAL FINANCED	12786	74.1%	1509	2797	3453	2343	1899	785

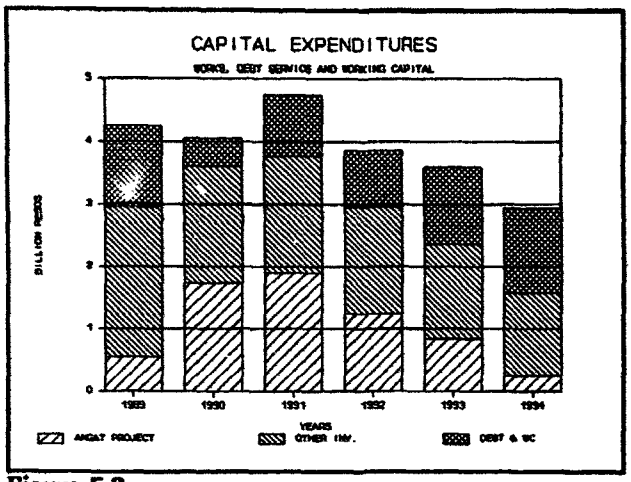

Figure 5.3

5.10 The proposed overall financing plan for MWSS's total investments assumes that in addition to ongoing loans and those proposed for the project, MWSS would take additional loans to finance about 60% to 70% of its new investments. Since local long-term financing is not available, MWSS assumes that most financing would be a combination of foreign loans (25 years term, 5 years grace) and a few local loans or bonds (7-year terms, 18% interest). Compensation for power losses due to the reduction in peak generating capacity and additional generating costs estimated at P 52 million for maximum capacity of 15 cums is included in the financial projections.

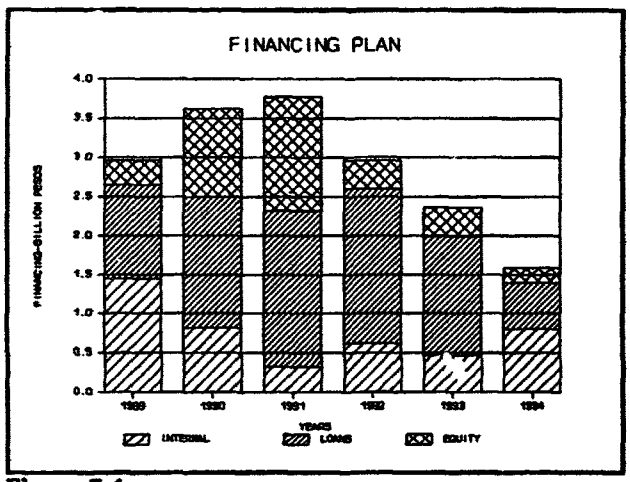

Figure 5.4

5.11 During the last three years the Government has been reducing budgetary contributions to government corporations. This is more difficult for corporations like MWSS where there are issues of poverty and basic needs, and a massive, concentrated investment. Because of this, and given MWSS's low debt service ratio, the Government has agreed to provide equity contributions for the proposed project as a way to capitalize MWSS. Government's equity contributions would total about P 3.2 billion, including: (a) P 1.8 billion (US$80 million) expected to be funded by an OECF loan being negotiated with the Government; (b) waiving until 1991 the payment by MWSS of franchise taxes (equivalent to about 2% of gross revenues) and income taxes (about 35% of net income); and (c) providing other cash contributions (P 0.6 billion) particularly for sewerage (METROSS II). The rehabilitation of the Balara treatment plant is contingent on the securing of a foreign grant, presently being arranged by MWSS. On the above basis (Figure 5.4), MWSS's financial plan is viable. However, cash resources would be constrained, particularly during 1990-91.

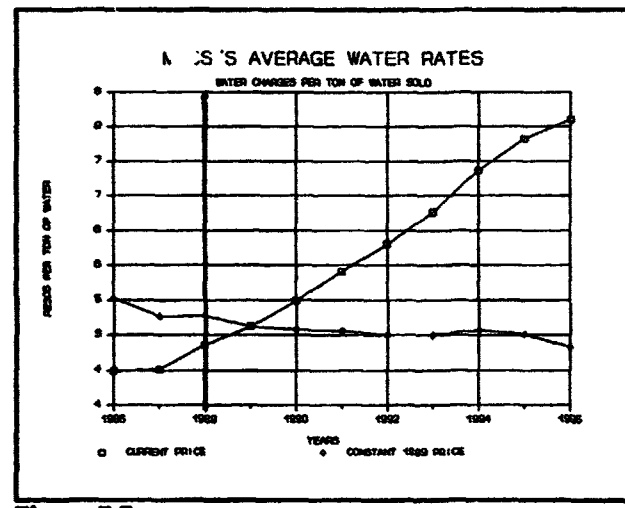

Figure 5.5

Financial Projections

5.12 MWSS's financial projections (Annex 10) show that an 8% financial rate of return could be maintained by keeping the present average tariff in constant prices (Figure 5.5), and implementing the proposed efficiency improvements in staffing and NRW (see Annex 11, Monitoring Indicators). This rate of return is based on net fixed assets in operation, revalued either by detailed valuation or using the

consumer price index during interim valuations. MWSS should also maintain a satisfactory financial performance as measured by its return on fixed assets and maximize internal cash generation for its development program. A minimum debt service ratio of 1.2 should also be achieved to ensure payment of its debt service obligations. 2/ Assurances were obtained at negotiations that MWSS will: (a) achieve an annual rate of return on its revalued net fixed assets in operation of not less than 8% per year; (b) maintain a debt service ratio of not less than 1.2; and (c) carry out annually, and provide to the Bank for comments by October 30 of each year, a review of the adequacy of its water supply and sewerage charges. Sensitivity analysis shows that the main financial variables are the NRW and the revaluation of the debt service. Even if only half of the reduction in NRW resulted in additional water sales, the decrease of NRW from 60% to 40% would increase MWSS's net income by almost 80%.

Monitoring and Evaluation

5.13 MWSS has considerably improved its planning and management information systems (MIS) during the last two years. The Bank has assisted MWSS in this task by helping it to develop computerized models for its MIS, long-term planning and water demand, all of which are now in operation. Given the magnitude of its investments and debt service obligations, these systems should be further improved to accurately forecast MWSS's finances. In addition, improvements are required in assessing water demand, which is critical to the corporation's physical planning and financial viability. The MWSS Planning Department is planning to carry out surveys of consumers to establish more accurately the population served as well as an analysis of the relatively high cost of water connections which may discourage low-income users or result in illegal connections. Assurances were obtained during negotiations that MWSS will provide the Bank, in April and October of each year, copies of the following reports: (a) financial projections, and monitoring indicators; (b) the Management Information System on water and sewerage services, revenues and operational costs; (c) project costs; and (d) status of project contracts. The April report would also include updated data for MWSS's long-term investment plans and water demand. MWSS would also prepare and provide to the Bank a project completion report, not later than six months after project completion.

1/ The working ratio is the ratio of the operating expenses excluding depreciation divided by operating revenues. The operating ratio is the ratio of the total operating expenses divided by total operational revenues.

2/ The debt service ratio is the ratio of gross internal cash generation to total debt service (amortization and principal). Since part of MWSS's interest expenditures are financed (e.g., under ADB's loans), the revenues of MWSS are stable through the year, and equity contributions or cash reserves are not considered in this ratio, the 1.2 debt service ratio is adequate.

6. ECONOMIC AND SOCIAL ANALYSIS

Project Benefits

6.1 The proposed project would provide urgently needed water to the Metropolitan Manila area, which has about half of the country's industrial base, its commercial center and a population of about 9 million people.

6.2 The project would improve water services in the area, so that by the time of project completion in 1994, about 5 million persons who are already served would be free of water rationing and low pressures. The project would also expand the water distribution system to areas now without water networks, where many of the poorest part of the population reside. By improving the reliability of water services to industrial and commercial consumers, it would allow them to gradually phase out their current dependence on deep wells and excessive pumping of underground water, which is depleting the aquifer and allowing saline intrusion. This would restore the use of water resources within the natural recharge capacity of the aquifer. In addition to this environmental benefit and the obvious improvements to sanitation permitted by an increased water supply, the normal water pressures restored by the project should decrease the potential health risk posed by sewage infiltration into the water supply system. The project thus represents a critical input to the continued resumption of economic and social development in the Philippines.

6.3 In addition, the project would maximize benefits from existing headwork investments at the Angat Dam and postpone very large investments in other water sources. And, by institutional improvements and the implementation of MWSS's Development Program, it would strengthen one of the largest corporations in the country, which would influence other water utilities in the Philippines, which tend to follow MWSS's lead.

Least-Cost Solution

6.4 The least-cost solution to Manila's water supply problem was extensively investigated during project preparation. Studies were carried out which surveyed and evaluated all possible water sources for the MSA and their cost. Various alternatives to the proposed project were initially considered in order to avoid decreasing NPC's hydroelectric generation capability at a time when oil prices were expected to rise; however, lower oil prices and a subsequent study which indicated that the loss of generation capacity would be less than originally believed allowed serious consideration of the approach finally adopted.

6.5 The Angat Water Supply Optimization Project would also postpone for many years the Manila Water Supply III Project, the long-term solution for the supply of water to the MSA, which requires the construction of a large dam, transmission mains and tunnels, and treatment facilities at a total cost of about US$1.0 billion in 1988 prices. Hydrologic studies demonstrated that, by modifying the operating rules of the Angat Dam, MWSS's primary water source, and by allowing use of the Dam's full design capacity (down to elevation 160 m), MWSS could optimize the use of about 15 cums of water, except during the severest droughts, at a total cost, including distribution systems, equivalent to one third of the Manila III Project. The Angat Project would not affect existing irrigation users, but will reduce the peak and average power generation from Angat Dam.

6.6 Several alternatives for optimization of the Dam's capacity were studied. The final selection was between two alternatives: (a) continuing the release of water from the present turbines (therefore without power losses) and pumping water from a downstream location to MWSS's treatment plant; and (b) building a new turbine at a higher elevation. The latter alternative was selected, since its present value in terms of net revenues is 5% higher than that of the former alternative. The aqueduct and tunnels also follow the least-cost route, which is parallel to the four existing aqueducts, using land already owned by MWSS. The project would allow optimization of the La Mesa I treatment plant's unused capacity of about 5 cums.

6.7 Additional analysis was carried out to determine the correct staging of tunnel and pipeline construction, particularly for the additional 9 cums

which will be supplied to Angat from the Umiray Basin to meet future demand. The timing of this investment obviously depends on expected levels of water demand. The feasibility study for the project forecasts that the Umiray supply would be needed by 1995. However, the revised estimate of water demand made by Bank staff indicates that the Umiray water will not be needed until the year 2000.

6.8 Even under the lower estimated demand used for the proposed project, staging the construction of the aqueduct is not the least-cost solution, because of the need to purchase additional land and gain right of way over an area of about 15 m by 20 km. Therefore, it was decided to construct the tunnel and pipelines for the final capacity of 24 cums. Moreover, since the full capacity would not be needed immediately, there would be an opportunity to repair Aqueduct No. 1, which has been showing signs of deterioration, including a decline in capacity from 8 to 6 cums, even with higher pressures. Without extensive maintenance, this aqueduct may fail. Such repairs are not feasible now, because they require that the aqueduct be out of operation, reducing the already rationed water supply by 35% for several months. Thus, immediate construction of the aqueduct and tunnel for the total capacity is preferable, so that Aqueduct No. 1 can be shut down in 1992 for repair. The Bulacan bulk water supply would provide water by gravity, and is also the least-cost alternative for the municipalities contiguous to MSA (Annex 6, paras. 2 to 4).

Economic Rate of Return

6.9 The Economic Rate of Return (ERR) for the total project was calculated, taking into account: (a) as a proxy for benefits, the tariff revenues from MWSS's incremental water sales. This is appropriate because Angat/Umiray would be the only additional water sources during the next few years. Revenues were estimated using existing charges for water as of December 31, 1988; and (b) as costs, the capital costs relating to the project as well as other investments in rehabilitation of the distribution system and leak detection. These investments are essential to avoid water wastage, particularly when pressures and water supply are normalized upon project completion. The economic analysis also includes the annual cost for energy losses due to peak generation or lower hydraulic head. Investment costs were shadow priced for the economic cost of labor and foreign exchange (Annex 6, Table 1). On this basis, the ERR for the project is estimated at 15% (Annex 6, Table 2).

6.10 Sensitivity analysis indicates that the ERR would still be an acceptable 14% if project construction takes two additional years. The ERR would be 13% with a 10% increase in costs combined with a 10% decrease in benefits. The reduction of incremental water sales by 30% for ten years reduce the ERR to 13% (Table 6.1).

6.11 The above rates of return underestimate total project benefits, however, by excluding many important benefits which are difficult to quantify. These include improvement of the living standards of the population already connected, the increased economic rents in new land areas supplied with water, the consumer surplus, and the health and general welfare benefits brought about by a safe and reliable water supply. These benefits were estimated in Annex 6, Table 3, and indicate, although admittedly not very precisely, that the project's benefits estimated from water sales comprise only a minor fraction of the total benefits and the project's ERR (Table 6.1).

Marginal Cost

6.12 The long-term marginal cost of water was calculated at discount rates varying between 5% and 12% (Annex 6, Table 2). The marginal costs per ton of water vary between P 1.9 and P 3.3, which is lower than MWSS's present average charges. The marginal cost coincides with the average domestic tariff and about 30% lower than MWSS's average tariff, which is reasonable given MWSS's financial requirements.

6.13 The existing financial tariff is higher than the marginal cost for this project, because of MWSS's cash requirements for debt service and the need to contribute to a rapid expansion of water services. Moreover, present prices reflect the inefficiency in the use of water and of other facilities, which would be improved during project implementation. Average rates for commercial and industrial consumers as well as for large domestic consumers are well above the average marginal cost. These tariffs are justifiable to discourage excessive or wasteful consumption by the largest consumers (commercial, industrial and 20% of the domestic

TABLE 6.1 ECONOMIC RATE OF RETURN

	Base Case	Project Cost 10% Higher	Bene-fits 10% Lower	Project Cost +10% Benefits Minus 10%
Base Case (Existing Tariffs)	15%	14%	14%	13%
Benefits Reduced 30% for ten years	13%			11%
Including Compens. for Peak Capacity	15%			14%
Base Case plus Health & Fire Protect.	16%			13%
Project delayed for two Years	14%			13%
Base Case plus Consumer Surplus	24%			21%
Base Case plus Land Benefits	23%			19%
Including Health, Land and Consumer Surplus Benefits	34%			28%

consumers use 80% of the water sold), allowing postponement of construction of the costly Manila Water Supply III Project for about 12 years. Industrial tariffs should, however, be lowered when MWSS water supply is normalized.

Affordability

6.14 MWSS's present water rates are affordable. The average tariff is about US$0.22 per ton, which is in the low range for capital cities in developing countries. A major MWSS concern has been to maintain cross-subsidies which allow the low-income population to benefit from water services. The critical test of affordability is the low-income population. In this case, using the minimum wage of P 79 per day recently approved for the MSA, the average charge for a family of six persons, using 10 tons per month (55 lcd) would be only P 16 per month (US$0.80). Even including environmental charges and the CERA, this is less than 1% of their monthly income. Although most of the low-income population does not have sewerage services, even if sewerage charges are added, the total bill would still be less than 1.5% of monthly income. This is much lower than the 4% and 7% considered affordable for water and for water and sewerage services, respectively. Although there are individuals earning less than the minimum wage, this is expected to be reduced over time, with gradual increases in per capita income. Furthermore, in these cases there is usually more than one income-earner per family.

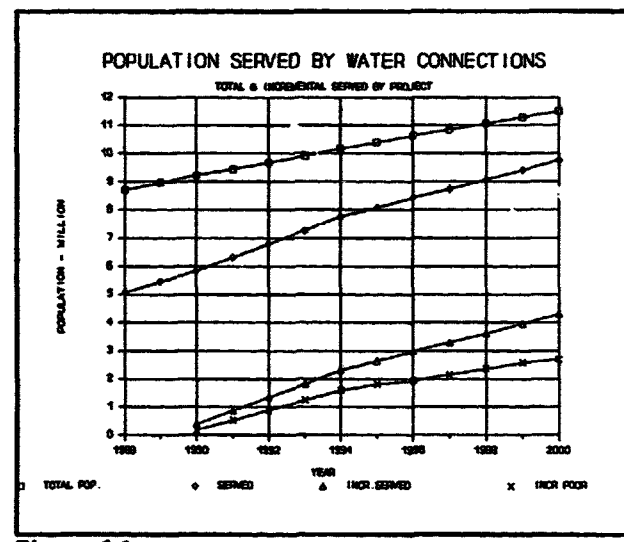

Figure 6.1

Impact on the Urban Poor

6.15 The project would provide water to unserved areas of the city and increase coverage by house connections from 58% in 1988 to 75% by 1994. The total additional population to be provided with water by house connections for the first time would be large, increasing from 2.3 million in 1994 to 4.3

million by the year 2000. This is mainly due to the project, but includes benefits which can not be identified separately for other complementary investments. It is estimated that about 45% of the population in Metro Manila is poor. As shown in Figure 6.1, almost 70% of the additional population served as a result of project investments will be the urban poor, an additional 3.7 million of whom would be served by the year 2000 (Annex 6, Table 4). MWSS is also expanding the number of public faucets to serve the population which has neither house connections nor wells. The provision of water by house connections would also have considerable impact on freeing the urban poor, particularly women, from the arduous task of carrying water from public faucets. For an average household family of 6 persons using 30 lcd, this requires the transport of 65 tons of water per year. This is normally carried in small 20 liter containers, over a distance of several blocks.

Environmental Impact

6.16 The project would provide reliable water supply to most of the population in MSA. It would also have a major positive environmental benefit by reducing the currently high level of groundwater use, thus helping in restoration of the natural regime and preventing excessive depletion and salinity intrusions, already experienced in the coastal areas. The augmented supply will also ensure that the entire network is continuously under pressure, thereby eliminating the serious health hazard of sewage infiltration in the distribution network.

6.17 The impact of the additional sewage and "grey" water resulting from the expanded water supply will be alleviated mainly by septic tanks, which are required by law for all houses, and partly by the existing sewerage system which has been designed to accommodate such augmented quantities of sewage. Combined drains are also expected to cope with the additional sewage, since they are sized for very large flows during the monsoon period. Although several creeks and the Pasig River would be further polluted, this does not affect any beneficial users of water for agriculture or water supply.

6.18 MWSS is making a significant effort to improve sanitation, within its financial means. A first sewerage project (METROSS I, paras. 1.17 and 1.18) is being completed successfully, expanding and rehabilitating sewers and constructing an ocean outfall. Design of a second sewerage project to further expand sewage collection and disposal facilities (METROSS II) has been completed, and is expected to start construction in 1990 (with ADB financing). Programs to improve sanitation in existing neighborhoods are also being carried out successfully under several other municipal programs (PROGRESS and Municipal Development) or housing rehabilitation projects under the National Housing Authority.

6.19 MWSS servicing of private septic tanks was discontinued for about one year because of problems in finding suitable disposal sites for the sludge, which have to be approved by the Department of Environment and Natural Resources. This problem has been solved and MWSS has now reactivated the program using private contractors. It is planned that each tank would be cleaned at least once every five years, which is within normal requirements.

Project Risks

6.20 There are no unusual project risks. The major risk, i.e., delayed implementation of the various components, which would postpone overall project completion by one or more years, is mitigated by MWSS's experience with similar works and because the raw water system, the critical component of the project, has already been contracted. When this component is completed, any other completed works would produce immediate benefits by using the existing facilities. It is estimated that even with a two-year delay in construction, the economic rate of return would still be 14%. A more likely problem is that improvements in the distribution system for cities in Bulacan would not be completed by 1993 since these works are still being prepared for loan processing. However, this component uses only 2% of the water production capacity, and bulk water supply would first be extended to two major municipalities in Bulacan which already have most of the distribution system required and a very serious water shortage. The other municipalities would be supplied only by 1993, giving adequate time to expand their small distribution systems. Failure to reduce NRW would increase the cost of water and reduce the population benefited. However, the results achieved in the areas already rehabilitated indicate that the proposed NRW targets are achievable.

7. AGREEMENTS REACHED AND RECOMMENDATION

7.1 The effectiveness of the Bank loan is conditional on the effectiveness of the ADB loan (para. 3.16).

7.2 Assurances were obtained from the Government at negotiations that:

(a) an agreement between NPC and MWSS for compensation of power losses will be concluded not later than December 31, 1990; while compensation to NPC is studied and resolved, project construction will proceed as scheduled (para. 3.22);

(b) adequate amounts would be included in the 1990 budget for payment to MWSS of the accounts receivable of all government entities. Adequate amounts for the payment of water and sewerage services would be budgeted thereafter by government corporations and national agencies, and the receivables from these agencies would not exceed four months of billing after December 31, 1990 (para. 4.12); and

(c) equity contributions for US$80 million equivalent would be provided to capitalize MWSS (para. 3.16).

7.3 Assurances were obtained at negotiations that MWSS would:

(a) reach an agreement with NPC for compensation of power losses not later than December 31, 1990 (para. 3.22);

(b) improve its specifications for water meters and pursue all measures to reduce NRW (para. 4.8);

(c) upgrade its customer services and connection monitoring by December 31, 1990 (para. 4.9);

(d) improve its operational systems by December 31, 1993 (para. 4.10);

(e) reduce by December 31, 1990 and thereafter maintain its accounts receivable below four months of billing (para. 4.12);

(f) achieve an annual rate of return of at least 8% per year (para. 5.12);

(g) maintain a debt service ratio not lower than 1.2 (para. 5.12);

(h) review annually the adequacy of its water supply and sewerage charges (para. 5.12); and

(i) prepare periodically updated reports on water demand, monitoring indicators, long-term plans and financial projections (para. 5.13).

7.4 Subject to the above condition and assurances, the proposed project would constitute a suitable basis for a Bank loan of US$40 million equivalent to MWSS. The loan would have a term of 20 years, including a grace period of 5 years, and carry the standard variable interest rate. The loan would be guaranteed by the Republic of the Philippines.

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

EXISTING WATER SUPPLY AND SANITATION SYSTEMS

WATER SUPPLY

1. MWSS'sservice area (MSA) of about 150,000 ha includes five cities and 32 municipalities with 1988 population of 8.7 million. The estimated average daily water supply at the end of 1988 is about 3,310 MLD serving about 7.6 million (87% of total). About 2,400 MLD (72%) is surface water drawn from outside the MSA and about 910 MLD (28%) is ground water extracted within MSA area of which private wells account for about 820 MLD (90%) and MWSS wells for 90 MLD (10%). Out of total water supply of 3,310 MLD, MWSS provides 2,490 MLD (75%) from both surface and ground water sources, and private wells provide 820 MLD (25%). MWSS serves a population of about 6.5 million of which about 5.0 million (58%) through house connections, about 0.7 million (8%) through public faucets, and about 0.7 million (8%) are served by MWSS indirectly through water vendors. Private wells served a population of about 1.1 million (13% of total population) as well as substantial part of industry and commerce.

Water Sources

2. MWSS's surface water originates from the following sources: (i) the Angat reservoir, which provides an annual average of 22 m^3/sec; (ii) the catchment area between the Angat and Ipo dams, which provides about 4 m^3/sec; and (iii) the Alat diversion weir, which provides about 4 m^3/sec to the Novaliches reservoir. This is a major buffer reservoir with a capacity of about 40 million m^3 providing a reserve of about 17 days of MWSS's average needs. Sources (ii) and (iii) are highly seasonal and normally dry up for several months. In those periods the Angat source provides about 29 m^3/sec. In dry periods the Novaliches reservoir has a very low water level and the operations depend almost entirely on the Angat source.

3. Ground water is extracted both inside and outside the areas serviced by MWSS's central distribution system (CDS). Inside CDS there are about 2,250 private deep wells, extracting some 780 MLD, and about 100 MWSS deep wells, extracting about 90 MLD. Outside CDS about 20,000 shallow wells are estimated to extract some 40 MLD. The ground water has been excessively exploited with the water level being about 50 m to 100 m below sea level and in the early eighties declining 4 m to 8 m annually resulting in saline water intrusion, along the coast in particular. MWSS has planned gradually to substitute private wells with water supplied by distribution system. However, the reduced level of services provided by MWSS during the last two years have counteracted these plans.

Transmission of Water

4. Water from the Angat reservoir for MWSS is released through the auxiliary power station at the base of the dam and is discharged to the Angat river to be impounded in the Ipo reservoir, about 7.5 km downstream. From Ipo reservoir water is diverted into the 6.4 km long tunnels No. 1 and 2, with capacities 8.6 m^3/s and 20.0 m^3/s, respectively, which convey it to the headwork at Bicti and by the following 17 km aqueducts 1, 2, 3 and 4, with capacities 5.3 m^3/s, 5.3 m^3/s, 9.0 m^3/s and 14.1 m^3/s, respectively, to La Mesa treatment plant, and, through the Novaliches reservoir, to Balara treatment plants, 7 km south of Novaliches reservoir.

Treatment of Water

5. There are three existing water treatment plants serving Manila: the Balara No. 1 and No. 2 plants, and the La Mesa plant, completed in March 1982. Balara No.1, with design capacities of 5.4 m^3/sec, and Balara No.2, with a capacity of 13.1 m^3/sec, obtain their raw water supply from the Novaliches reservoir and via a by-pass from aqueducts 1 & 2. They are traditional sand filter plants, No. 1 having simple sedimentation basins while Balara No. 2 has forced circulation with horizontal mechanical mixers. Accelerators installed in connection with plant Balara No. 1 is only partially in operation. Raw water for the La Mesa treatment plant (rated capacity of 17.4 m^3/s), is supplied from aqueduct No. 4. The plant has dual media sand filters and vertical mechanical mixers in the flocculation tanks. The output of the two Balara plants is currently about 1 m^3/s short of rated capacity due to operating and maintenance constraints and the La Mesa plant is restricted to a flow of about 11.5 m^3/s due to constraints imposed by the upstream transmission system which is delivering about 5 m3/sec less than rated capacity. Both plants are performing below their qualitative and quantitative capacities due to mechanical ailments and poor maintenance.

Distribution System and Reservoirs

6. The treated water from Balara treatment plants is delivered in the supply area through the San Juan reservoir, the Pasig reservoir and the Balara pumping station. Treated water from La Mesa treatment plant is supplied directly to the system through the Bagbag reservoir floating on the system. The main distribution system is divided into two supply zones due to the difference in the elevation of balancing reservoirs and the hydraulic gradients of about 20 meters at the upstream ends. The top water level (TWL) of San Juan reservoir is at 57.4 m while that of Bagbag reservoir is 71.0 m. Consequently, the two systems are interconnected only at their downstream ends where the hydraulic gradients have equalized. At the present time the operating pressure in both distribution zones is being controlled to minimize leakage, and at the end of the dry season to preserve the water level in the Novaliches reservoir. This is done by reducing the maximum operating levels in San Juan and Bagbag reservoirs and by throttling of valves in both the primary and secondary distribution systems. Dimensions in the approximately 3,000 km distribution system, of which 1,436 km was laid since 1981, ranges from 50 mm to 2,800 mm in diameter with more than 75% being 150 mm or smaller. The distribution system contains 16 smaller reservoirs with a combined capacity of 658 MLD or just over 21% of the rated capacity of the three treatment plants, and 15 pumping (booster) stations with a rated total output of 2,400 MLD. The delivery heads vary from 19 m to 50 m. A number of these pumping stations were shut down when the supply from La Mesa was introduced to the system as the additional head available made them redundant. Under the project about six will be rehabilitated and made operative.

Operation and Maintenance

7. Most of the systems are operated well, although the optimal operations are hampered by failures of measuring equipment and mechanical parts of the plants. The lack of a comprehensive model for the hydraulically very complex water transmission system between Ipo and Novaliches and La Mesa and the lack of flow meters in the system limits MWSS's possibilities of having full insight into its operational options. All three treatment plants suffer from failures of mechanical parts as well as measuring instruments. Staffing levels are ample but possibly due to the mechanical degradation the general maintenance level appears to have slipped. The poor state of mechanical repair does not appear to stem from lack of knowledge by the operator but to the low priority given to maintenance by MWSS's centralized financial and maintenance management. While much effort is going into the new activities, it appears that the general record level as to the performance by the distribution system has deteriorated with some records not having been maintained for the last four to five years. The absence of these records makes the daily operation crude and deprives the planners of pertinent information. This refers to as-made drawings and their up-dating, reports on bursts and major repairs of pipes, flow and pressure records, etc. Also, MWSS's practice of referring to each metered domestic connection as one household does not reflect the real situation as there are many cases of one meter branching off to several dwellings on the meter holder's plot, not least in the fringe areas where hoses are also used between dwellings. This difference in terminology makes handling and correlation of data difficult and holds potential for systematic errors.

SEWERAGE AND SANITATION

General

8. The sewerage system in Metropolitan Manila consists of separate systems in the City of Manila and in Makati and communal septic tanks in Quezon City; together these schemes are serving about 0.8 million or 9% of the Metropolitan population. Of the remaining 6.9 million people, 2.4 million or 29% of the total population have individual septic tanks with soak-away drains or are connected to open canals, creeks and rivers and another 2.3 million discharge the "grey" waste water directly to street gutters or nearest surface drain leaving about 2.2 million people with public/communal latrines or without any organized sanitation. Most of the latter live in blighted areas. Over half of the non-sewered plots have water sealed latrines, often pour-flush, discharging to individual septic tanks or pits. Most of the industries are located outside the sewered areas treating their waste on site and discharging into rivers and storm water drains.

Networks, Pumping Stations and Transmission

9. Within MWSS's entire service area only the City of Manila has a large water borne system consisting of 280 km of main sewers with diameters between 150 mm and 1425 mm collecting sewerage through the northern and the southern interceptors to the Tondo pumping station (capacity of 5 m^3/s), which discharges the untreated sewage through an 1800 mm outfall pipe 2.7 km into the Manila Bay at a depth of 11 m. The collection network is a gravity system, with two and four pumping stations on the northern and southern interceptors and one pumping station in the port area, lifting the sewage between 1.5 m and 2.8 m. MWSS is also responsible for 114 km of sewers with diameters of 200 mm to 600 mm in Quezon City discharging into 41 communal septic tanks. In Makati, a high-income residential and commercial area of 650 ha, the private developer constructed a separate sewerage system which the organization is still operating.

Sewage Disposal

10. The raw sewerage from the pumping station at Tondo is discharged untreated to Manila Bay about 2.7 km off-shore at a depth of 11 m through the outfall completed in late 1983. To monitor the performance of the quality of Manila Bay, a monitoring program was undertaken; albeit as it started late and data collected were inadequate the monitoring has been extended another two years to 1991. In addition MWSS is responsible for the desludging of septic tanks. To service the estimated 620,000 individual septic tanks in its service area MWSS had in 1980 embarked on a program aimed at desludging 60,000 tanks annually. About 18,000 tanks were desludged before the program was suspended late 1985 when the Department of the Environment and Natural Resources (DENR) disapproved the sludge dumping site. Presently, only about 50 septic tanks are being desludged monthly by MWSS. It plans to reactivate the program using contractors, who will, as part of the contract, have to provide adequate dumping sites, which should be approved by DENR. The first contract for desludging of 34,000 tanks was awarded in July 1989.

11. Sewerage from Makati is discharged through a 42" diameter main sewer to an activated sludge treatment plant with a rated capacity of 19,000 m^3/d and the treated effluence is lead to a contributory to Pasig River.

Operation and Maintenance

12. To finance the operation and maintenance of its sewerage and sanitation program MWSS bills all water consumers a 10% environmental charge and those connected to a sewerage system an additional 40% sewerage charge on the water consumed.

13. The responsibility for dealing with waste water discharges in open drains is shared between the Department of Public Works and Highways (DPWH), and the Metro Manila Commission (MMC). MWSS is responsible for the sewerage system and plans gradually to take over the systems constructed by estate developers. A number of improvement programs, such as ZIP, PROGRESS, and MMINUTE are either on-going or planned to be implemented by MWSS, MMC, MPWH and the National Housing Corporation (NHA). The coordination of these

agencies is organized through a shared Program Management Office within MMC.

WATER POLLUTION

14. All waterways in Manila are heavily polluted. About 70-80% of water pollution is caused by domestic water since only about 12-15% of the population has satisfactory treatment facilities and the rest depends on septic tanks which were not maintained during the last year because of problems in finding a suitable disposal site for the sludge. This problem has been resolved and MWSS has restarted the maintenance of septic tanks, using private contractors. About 20-30% of the pollution originates from industry namely tanneries, textile mills, food processing industries, distilleries, chemical plants and metal plants. In 1986 the National Pollution Control Commission surveyed 218 industrial establishments in Manila and found that 138 had waste water treatment plants and 80 establishments discharged untreated wastes. Since treatment of industrial wastes are dealt with on site by the individual establishment control, enforcement of compliance with standards is a major problem. Domestic pollution creates visual and smell deterioration of the environment near the rivers or channels, but no economic losses, since there are no further beneficial users of the water from the Pasig River or the creeks in the MSA, and these waters can be discharged safely to the ocean.

Previous Foreign-Financed Projects

15. Since 1974 ADB and the Bank have been involved in different water supply and sewerage projects implemented by MWSS, which are listed in Table 1.

Table 1 Water Supply and Sanitation Implemented by MWSS with ADB and IBRD Assistance 1/

		Loan No.	Date of Approval	Amount Loan mill $	Total Project mill $
World Bank.					
1	Water Supply and Sanitation in Metro Manila *	1615-PH	FY 78	88.0	394
2	Manila Sewerage and Sanitation Project *	1814-PH	FY 81	63.0	177.4
3	Urban III	1821-PH	FY 81	7.0	120.0
4	Manila Water Distribution Project	2676-PH	FY 87	69.0	96.3
Asian Development Bank.					
1	Manila Water Supply Project	190-PHI	28.Aug.74	51.3	
2	Second Manila Water Supply Project *	351-PHI	07.Sep.78	49	394
3	Manila Sewerage Project *	457-PHI	24.Jan.80	42.8	177.4
4	Water Supply Sector	545-PHI	25.Nov.81	46.0	
5	Manila Water Supply Rehabilitation Project	645-PHI	27.Oct.83	39.3	64.5
6	Second Manila Water Supply Rehabilitation Project			26.4	63.3
	Technical Assistance				
6	Manila Water Supply	87-PHI	05.May.73	0.5	
7	Bulacan Bulk Water Supply Scheme	433-PHI	81	0.2	
8	Water Supply and Sanitation Sector Project	779-PHI	20.Jun.86	0.1	
9	Angat Water Supply Optimization Project	1039-PHI	21.Sep.88	0.1	

1/ * Indicate projects financed by both Banks.

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

WATER DEMAND

The Project Area

1. The proposed project would assist MWSS to increase its water supply production capacity to serve the Metropolitan Manila area. Metro Manila, also referred to as the National Capital Region (NCR), is the country's most developed and fastest-growing area as well as its cultural, economic and political center. The NCR, which includes the cities of Manila, Caloocan, Pasay and Quezon City and another 13 municipalities, has about 13% of the country's population and more than half of its large industries.

2. MWSS's Service Area (MSA) includes a total population of almost 9 million, 16% more than the NCR (See Map). The MSA area of about 150,000 ha includes the NCR, Cavite City, another five municipalities in the province of Cavite and 14 municipalities in Rizal Province. MWSS serves the entire metropolitan region, independently of local governments and city borders.

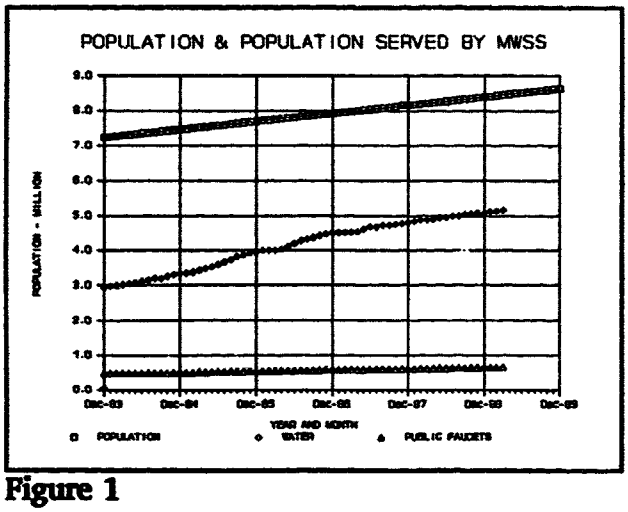

Figure 1

Population

3. The MSA population increased by more than two million persons between 1980 and 1989, at an average annual growth rate of 4.1%. Average growth rates are decreasing rapidly and were about 2.9% between 1985 and 1988. Detailed population estimates for each municipality based on forecasts by the National Statistic Office were prepared by MWSS, and assume that MSA's growth rate would decrease to 2.3% p.a. by the year 2000. If higher population growth rates were to continue, the water demand, economic rate of return, and MWSS's finances would be better. Within the MSA several of the smaller municipalities would experience increases of up to 10% p.a. By the year 2000, the MSA population is expected to reach 11.6 million, growing to 13 million by 2010, with 85% of the total in the NCR, about 6% in the municipalities in Cavite and the remainder in Rizal. A large part of the current population (about 2.5 million) live in blighted areas with minimum services and poor housing.

Levels of Service

4. In the past, the population served by house connections in the MSA was estimated on the basis of 8.1 persons (about 1.3 households) per connection. However, a census of about 360,000 households in 54 zones in the NCR indicates that the population already served by connections is larger than estimated, averaging more than 9 persons per connection (one and a half households). This reduces the additional population to be served and past per capita consumption. For the water demand used in the appraisal the number of persons per connection is assumed to be 9.0.

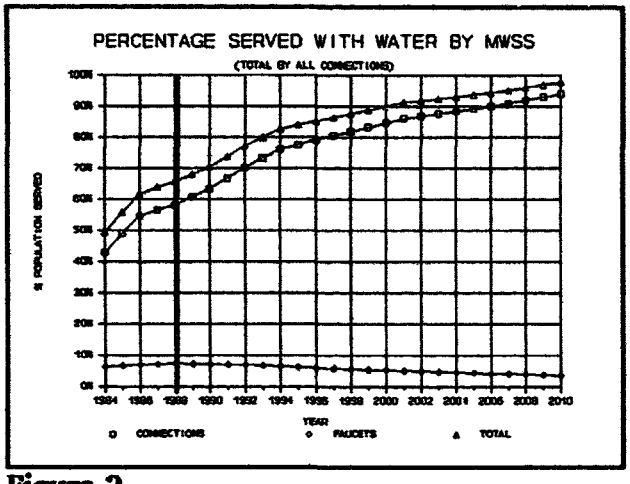

Figure 2

5. The population per connection is expected to decline slowly over time, as housing becomes less crowded, each house has a separate connection, and population growth slows. This would increase the number of connections, but not the water consumption which is based on per capita estimates. The population served by domestic house connections is expected to increase from 58% in 1988 to 75% by 1994 and 85% by the year 2000. The total population with water supply, including commercial connections and about 1,400 public faucets, is expected to reach 82% by 1994 and 90% by the year 2000 (Figure 2).

6. Although only about 10% of the population is connected to sewerage service, the mandatory regulation of one septic tank per house greatly reduces water pollution problems. About 90% of the population has sanitary toilets, most of them with a water seal.

Water Demand

7. There have been numerous studies of water demand for Manila, including sophisticated analysis of income elasticity of different groups of consumers, price elasticity, the effect of gross national product, etc. However, all of them have been excessively optimistic in forecasting the water demand, which did not materialize, even for the year when the study was completed. Although there was a major increase in water demand as a result of the Manila II and Water Distribution Projects, the increase in water sales stabilized at a rate of about 5.5% p.a. (Figure 3). A major consideration in these projections has been the assumption of a rapid shift from groundwater to MWSS's supply. In 1983 the estimated extraction by 2,300 large wells was about 660 MLD, while another 20,000 smaller wells were extracting about 40 MLD. This over exploitation of the aquifer, resulted in lower groundwater levels and salinity intrusion, particularly near Manila Bay.

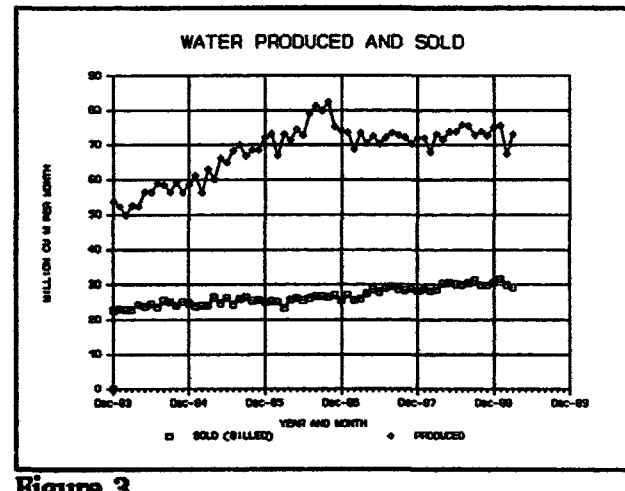

Figure 3

TABLE 1 MAIN ASSUMPTIONS FOR WATER DEMAND

	--ACTUAL - 1985	1988	% INCRESE 1985-88	--- TARGETS END OF PERIOD --------- 1989-1990	1991-1992	1993-1994	1995-1996	1997-2001	2002-2006	2007-2010
Population Under MWSS - Million	8.005	8.712	2.86%	9.228	9.685	10.171	10.639	11.749	12.764	13.507
% Population Served by Domestic Connections	46.1%	53.7%	5.2%	59.0%	66.0%	72.0%	75.0%	82.0%	86.0%	90.0%
Resulting Total Population Served by All Connections	56.0%	65.6%	5.4%	70.6%	77.3%	82.8%	85.3%	91.3%	94.4%	97.9%
% Non-Revenue Water	61.5%	59.6%	-1.1%	52.0%	45.0%	38.0%	33.0%	30.0%	28.0%	26.0%
Peak Water Demand Factor				1.1	1.1	1.1	1.1	1.1	1.1	1.1
	---- ANNUAL INCREASE ----									
	1985	1988	1985-88	1989-1990	1991-1992	1993-1994	1995-1996	1997-2001	2002-2006	2007-2010
Domestic Volume Sold per person	148.0	134.8	-3.1%	2.0%	3.0%	3.0%	2.0%	2.0%	1.0%	1.0%
Number of Public Faucets	1.12	1.33	6.0%	1.5%	1.0%	-1.0%	-1.0%	-1.5%	-2.0%	-2.0%
Number of Commercial Connections	26.47	40.42	15.1%	1.5%	1.5%	2.0%	2.0%	2.0%	1.5%	1.5%
Volume Sold per Commercial Conn.	327.3	225.8	-11.6%	2.0%	2.0%	3.0%	2.0%	3.0%	2.5%	2.5%
Number of Industrial Connections	1.69	6.07	53.3%	0.5%	0.5%	0.5%	0.5%	0.5%	1.5%	1.5%
Volume Sold per Industrial Conn.	688.1	363.2	-19.2%	5.0%	8.0%	8.0%	8.0%	10.0%	10.0%	8.0%

8. If all commercial and industrial water consumption were to be supplied by MWSS, its sales would increase by 50%. However, as seen in Figure 4, this demand has not materialized. The demand for MWSS's water depends on the alternative cost of underground water, the speed of expansion of the network, the expansion of sewerage facilities, the construction of better housing, the schedule for connecting medium-income subdivisions, the reduction in NRW, etc. The appraisal re-estimated the water demand based on detailed monthly data and trends on water demand for the last five years. The appraisal assumptions for water demand are presented in Table 1 below and the resulting demand is detailed in Tables 2 to 6. The appraisal forecast is considerably lower than the Feasibility Report (see Table 7).

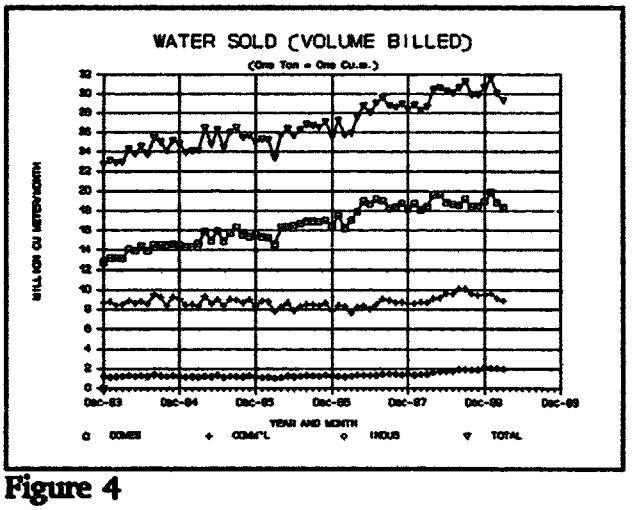

Figure 4

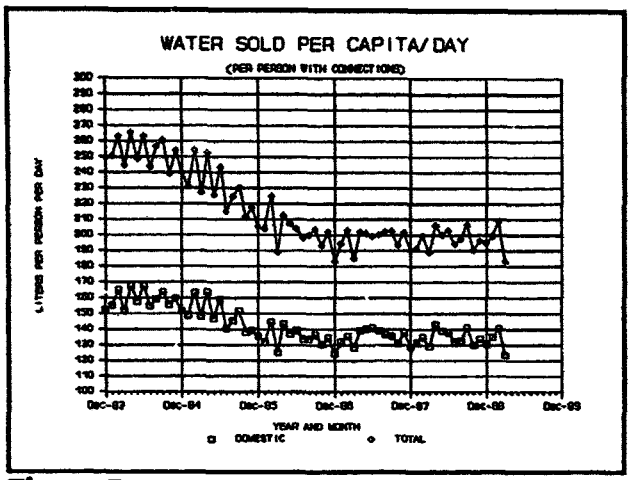

Figure 5

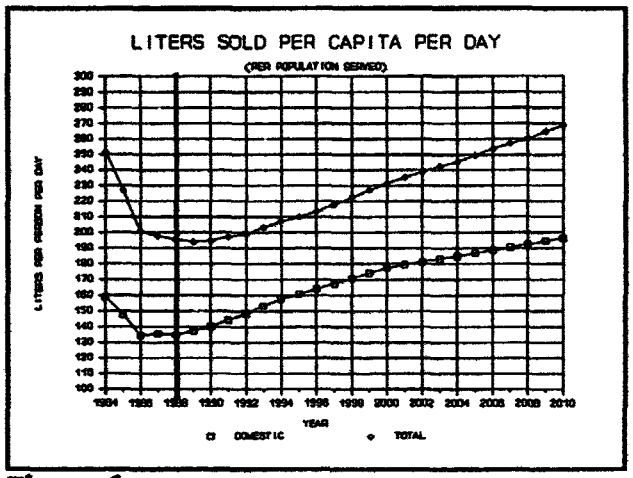

Figure 6

9. Domestic Demand. During 1984-86, per capita water consumption in the MSA fell considerably, with total consumption declining from about 250 liters per capita per day (lcd) to about 200 lcd and domestic consumption declining from 160 lcd to 135 lcd (Figure 5). This reflected the economic downturn of the period as well as the effects of water rationing and shortages, the inadequate distribution system, and the lower water consumption of the additional, lower-income population connected in those years.

10. About 20% of the population is suffering water rationing and intermittent supply. However, with the resumption of economic growth (at about 6% p.a.), higher per capita income, billing of part of the NRW, and the additional water made available by the reduction in non-revenue water, and by the proposed project, domestic water consumption is expected to return to 160 lcd by 1994, with the total water consumption reaching about 250 lcd by 2005 (Figure 6, Tables 2 and 4). Under the above mentioned assumptions domestic water demand will increase from 617 MLD in 1988 to 913 MLD by 1992 and 1119 MLD by 1994. Detailed forecasts are presented in Tables 2, 3 and 4.

11. Industrial and Commercial Demand. Total commercial and industrial usage of water is currently estimated at about 900 MLD, only 36% of which is supplied by MWSS. Previous estimates of MWSS demand have projected large increases in water sales, because industrial consumers would switch from groundwater to the MWSS supply as a result of saline intrusion in the aquifer and lower groundwater levels due to overexploitation. These estimates appear overoptimistic, however, in view of continuing consumer concerns about the quality of MWSS's service and the higher cost of MWSS's water. The low water distribution pressures and unreliability of the MWSS supply are not expected to improve in the next few years due to the tight supply forecasted. Furthermore, the cost of pumping underground water (without treatment, as needed by most industrial users) is only about P 2 per ton compared to the P 9 per ton (including sewerage and environmental charges) currently paid by MWSS's industrial customers. And, although groundwater exploitation has undoubtedly depleted resources in some areas, particularly adjacent to Manila Bay, the overall water resources in other areas is still substantial.

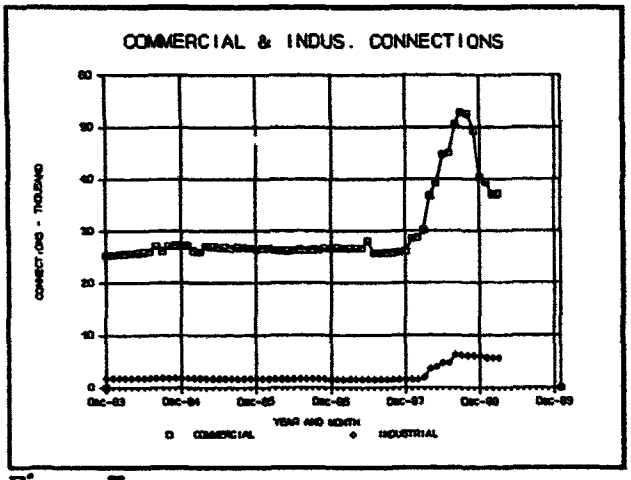

Figure 7

12. The number of industrial and commercial consumers declined during the last four years, and its sudden increase in late 1988 (Figure 7) is only the result of reclassifying as commercial or industrial connections some domestic consumers which have small commercial or industrial activities in the same house. The consumption of these consumers is small and reduced drastically the average consumption per connection for these categories. Therefore the demand in the Feasibility Study appear overoptimistic, and the estimates of industrial and commercial water demand used for the appraisal and agreed with MWSS are much lower.

13. Commercial and industrial connections are expected to increase at about 1.5%-2% and 0.5%, respectively, less than the increase in population, in view of the availability of underground water, the lower water quality requirements for some applications and the poor service provided to the industrial zone, which is at the end of MWSS's distribution system. However, the water sold per connection is expected to increase rapidly (by about 3% for commercial and 8% for industrial connections), because of GNP grow, and diminishing underground supply in some areas. Under these assumptions the water sold to commercial and industrial consumers is expected to increase from 353 MLD in 1988 to 400 MLD by 1992 and 445 MLD by 1994. Detailed forecasts for commercial and industrial demand are presented in Tables 5 and 6. As a proportion of total demand, commercial water demand is expected to decrease from 32% to 24% of total demand between 1988 and 1994 because of the rapid increase in domestic water demand. Industrial water demand is expected to remain at about 4.5% of total demand. These estimates depend, of course, on MWSS's pricing policies (which now cross-subsidize low-income consumers), the reliability of MWSS's service and the cost of extracting and/or treating underground water.

Non-Revenue Water

14. Non-revenue water (NRW) has been a major problem for MWSS (Figure 8). If NRW is not reduced water sales will be significantly affected, because the effective delivery capacity of the system will be reduced. During the last ten years, NRW has never been lower than 45%, and when the La Mesa treatment plant entered into operation in 1985 and normal pressures were restored, NRW peaked to about 66% of the water produced.

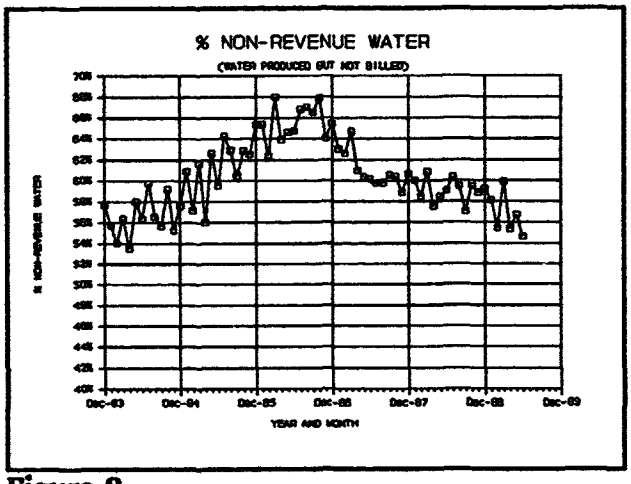

Figure 8

15. With the objective of reducing gradually the NRW to less than 30%, MWSS is now undertaking a comprehensive leak detection and rehabilitation program, employing 1,800 persons specifically for this purpose. Financing for the program is being provided by two ADB rehabilitation loans. However, as shown in Figure 8, the major improvements being made have not yet been reflected in the overall NRW, which remains at about 60%. Recent results from eight rehabilitated areas shows that NRW was reduced from 70% to less than 30%, while water billing (including new consumers) increased by almost 20% in these zones.

16. The continuing NRW problem has also been approached by measures to curtail illegal connections. However, extensive surveys have detected less than 2% illegal connections (other than in Pasay, a low-income area where the survey detected 15% illegal connections). Results from the rehabilitation projects indicate that about 80% of NRW is due to leakage, with the remaining 20% attributed to metering errors and to unregistered or illegal connections. Results from areas where distribution systems have been rehabilitated indicate that NRW can be reduced to less than 30%. Further investigations indicate that part of the NRW problem may result from the use of inaccurate and, more important, overly large water meters. As a result of these activities, NRW decline to 55% by mid-1989. MWSS is aiming to reduce NRW to 43%-46% by 1992 and 37%-40% by 1994 (Figure 9). Faster declines have proven unrealistic in other Bank projects.

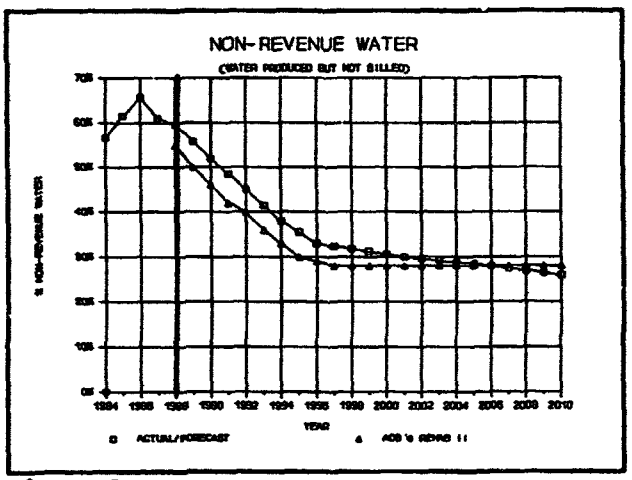

Figure 9

New Water Connections

17. MWSS has been quite successful in increasing the number of connections and the population served increased rapidly between 1984 and 1987 as a result mainly of the Manila II project. However, slower trends have been observed recently, which has required to focus the attention of MWSS's management on how to continue a high-rate of increase in water connections. To ensure that the lower income population would be connected, MWSS should review the connection charges (now averaging P 2,000 to P 4,000 per connection). Although these charges are not large in absolute terms, they represent more than one month's salary for low income families. Therefore, MWSS should consider to extend the period of payment for connection charges from one to five years, and even give free the house connections (as done in 1987) for low-income population.

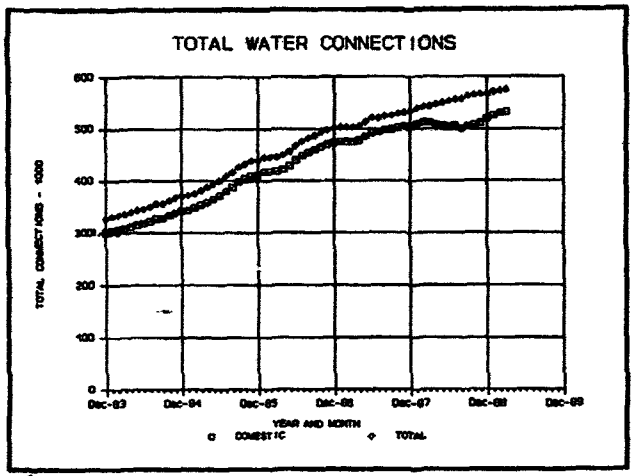

Figure 10

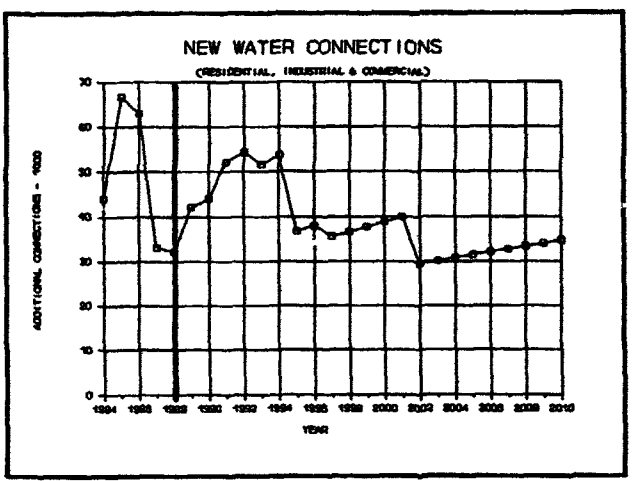

Figure 11

18. Under the above assumptions and investment programs, the total number of connections is expected to increase substantially during the period 1989-1992 (Figure 11). Although the targets for new connections would be almost twice the number of connections achieved in 1988, these are feasible, as indicated by the achievements in 1986-87.

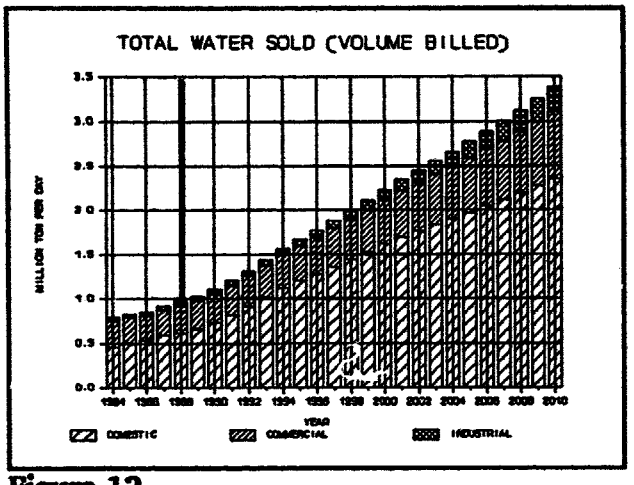

Figure 12

Bulacan Water Demand

The population and water demand for the 8 municipalities in the Bulacan Province that would receive bulk supply from Angat is shown in Table 8. The water demand is based on the Feasibility Study and Final Design prepared by the consultants, and forecasts the demand for the year 1995. This seem over estimated, particularly the per capita consumption, and the capacity of the municipalities to reduce non-revenue water to 20% by the year 1995. It is likely that this water demand will materialize only by the year 2000. This would not affect MWSS, which can utilize any water which is not used by Bulacan. The water sales to Bulacan would require a price agreement between MWSS and the Province which would affect the demand. Because of this incertitude, the overall demand projections are based on the demand of MSA alone; the water used by Bulacan would and or expand such demand, which is conservative for financial and economic analysis.

Forecasted Demand and Supply

19. Water demand in Manila is highly seasonal. While regression analysis of total and per capita water sold shows that water sales would reach about 38 million cu m per month by the year 1993, the existence of rationing in the past which pent up demand and the higher GNP growth rates expected in the future suggest that sales of 48 million cu m per month can be expected by 1994 (Table 2). The actual and forecasted water sales to domestic, commercial and industrial consumers between 1984 and 2010 are shown in Figure 12, and Tables 4 to 5.

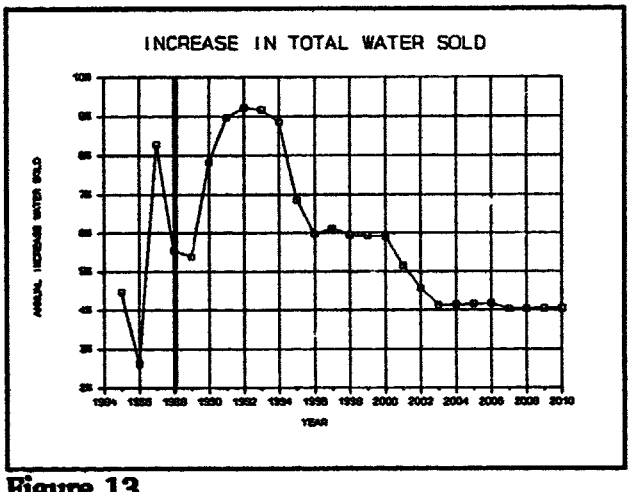

Figure 13

20. The overall increase in water sold by MWSS is expected to be faster than in the past (Figure 13) because of: (a) a dynamic effort to increase the percentage of population connected; (b) higher per capita income; (c) better pressures and distribution systems; (d) elimination of intermittent supply; (e) detection of illegal connections and billing for this water; however, the demand of water by illegal users may be curtailed considerably when they have to pay MWSS's rates; and (f) better meters. The increase in water sales because of (e) and (f) will increase MWSS's revenues, but since that water is already used, it would not require additional supply. When the percentage of population reach high levels (above 90%) the increase in MWSS's water sales is expected to be lower, although still higher than the annual increase in population served (Figure 13). Total forecasted demand and supply are shown in the main report, Figure 2.6.

21. Water demand forecasted in previous projects and in the Feasibility Study are compared in Figure 14 with the estimates used for the appraisal. The line for the appraisal estimate (identified as Actual/Now in Figure 14), shows the actual water sales until 1988 (and part of 1989), to facilitate the comparison of previous forecasts and ongoing trends. If such much higher demand materialized the project benefits would be even higher, and MWSS's financial situation would be excellent.

Production Capacity

21.1 MWSS's total water production capacity is about 2,590 MLD, (2,500 MLD from the Angat Dam and the treatment plants at Balara and La Mesa and 90 MLD from deep wells). Of its actual total production of about 869 million cu m in 1988, MWSS supplied about 359 million cu m (the remaining is NRW). The projections of future demand (Tables 2 and 3) indicate that MWSS's water production capacity would be exhausted by 1994, even if NRW were to be reduced below 38%. Total water consumption by that time would increase to about 1,564 MLD and the maximum daily water production needed will be about 2,800 MLD. The proposed project would expand MWSS's water production capacity by 1,300 MLD in 1993, with the potential of supplying an additional 1,277 MLD (from Umiray) by the year 2002. Groundwater sources providing water to some distant districts, will be expanded 52%, but would supply only 133 MLD by 1994.

22. The total forecasted demand of water from MWSS, and MWSS's water production capacity are shown in Figure 2.6 in the main text, which indicates that, even if NRW is reduced below the targeted levels, the proposed investment in the Angat Project would still be justified (i.e. the peak water demand in any year after 1994 is much higher than existing capacity, although NRW is assumed to be reduced to 30% in the year 2000. Moreover, MWSS should also be able to supply the maximum daily demand, which peaks during the period January-June. The daily peak is generally estimated as 10% to 20% higher than the annual average demand. Using a peak factor of only 1.1 for maximum daily demand, the capacity of the project will be fully used about seven years after project completion, which previous Bank studies have shown is economically optimal for bulk water supply projects. If NRW is not reduced to less than 30% by that time, the additional capacity provided by the project would be exhausted much earlier.

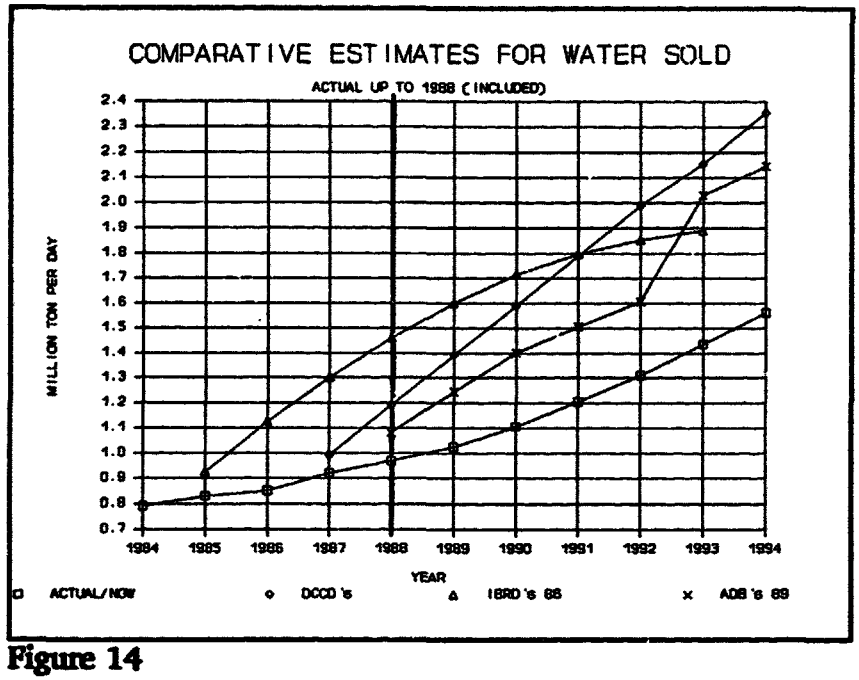

Figure 14

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 2 - TOTAL WATER DEMAND (DOMESTIC, COMMERCIAL, INDUSTRIAL)

Year	Population Under MWSS 1]	% Population with MWSS's Water	Connections 1000 (End of Period)	Annual Increase connections	VOLUME SOLD (Million Cu M per Year)				% Annual Increase Total Water Sold	% Domestic/ Total Water Sold	Total Liters per person Served per day	Tons per Month per Connection	Annual Increase in Water Sold	% Non-Revenue Water	Water Production Million Cu M per Year
SUM	Million			1000	Domestic	Commercial	Industrial	Total							
1984	7.759	49.5%	371.6	44.1	168.5	106.4	15.0	289.9		58.1%		65.0		56.6%	668
1985	8.005	56.0%	438.3	66.6	183.5	104.8	14.5	302.8	4.5%	60.6%	227	57.6	4.5%	61.5%	787
1986	8.233	61.8%	501.2	62.9	195.5	100.8	14.5	310.8	2.6%	62.9%	201	51.7	2.6%	65.6%	905
1987	8.468	63.9%	534.3	33.1	210.5	101.8	16.3	336.5	8.3%	64.9%	198	52.5	8.3%	61.0%	863
1988	8.712	65.6%	566.5	32.2	225.9	112.7	16.6	355.2	5.5%	63.6%	196	52.2	5.5%	59.6%	879
1989	8.967	68.1%	608.6	42.1	244.3	112.5	17.4	374.3	5.4%	65.3%	194	51.2	5.4%	55.8%	847
1990	9.228	70.6%	652.8	44.1	268.8	116.5	18.3	403.6	7.8%	66.6%	195	51.5	7.8%	52.0%	841
1991	9.454	73.9%	704.9	52.2	299.4	120.6	19.8	439.8	9.0%	68.1%	197	52.0	9.0%	48.5%	854
1992	9.685	77.3%	759.3	54.4	334.1	124.9	21.4	480.3	9.2%	69.5%	199	52.7	9.2%	45.0%	873
1993	9.925	80.0%	810.9	51.6	370.4	130.9	23.1	524.3	9.2%	70.6%	203	53.9	9.2%	41.5%	896
1994	10.171	82.8%	864.6	53.7	408.3	137.5	24.9	570.8	8.9%	71.5%	207	55.0	8.9%	38.0%	921
1995	10.402	84.0%	901.3	36.8	439.9	143.1	26.9	609.9	6.9%	72.1%	210	56.4	6.9%	35.5%	946
1996	10.639	85.3%	939.3	38.0	468.4	148.8	29.1	646.3	6.0%	72.5%	213	57.3	6.0%	33.0%	965
1997	10.852	86.5%	975.0	35.6	497.5	156.4	32.0	685.9	6.1%	72.5%	218	58.6	6.1%	32.4%	1015
1998	11.070	87.7%	1011.6	36.7	527.2	164.3	35.2	726.7	5.9%	72.5%	223	59.9	5.9%	31.8%	1065
1999	11.292	88.9%	1049.4	37.7	558.5	172.6	38.7	769.8	5.9%	72.5%	227	61.1	5.9%	31.2%	1119
2000	11.518	90.1%	1088.2	38.9	591.4	181.3	42.6	815.3	5.9%	72.5%	232	62.4	5.9%	30.6%	1175
2001	11.749	91.3%	1128.2	40.0	620.0	190.5	46.8	857.3	5.2%	72.3%	235	63.3	5.2%	30.0%	1225
2002	11.945	91.9%	1157.6	29.4	646.3	198.7	51.5	896.5	4.6%	72.1%	239	64.5	4.6%	29.6%	1273
2003	12.145	92.5%	1187.6	30.0	670.1	206.7	56.7	933.5	4.1%	71.8%	242	65.5	4.1%	29.2%	1318
2004	12.348	93.2%	1218.3	30.7	694.7	215.1	62.3	972.1	4.1%	71.5%	245	66.5	4.1%	28.8%	1365
2005	12.554	93.8%	1249.7	31.4	720.2	223.7	68.6	1012.5	4.2%	71.1%	250	67.5	4.2%	28.4%	1414
2006	12.764	94.4%	1281.9	32.1	746.5	232.8	75.4	1054.7	4.2%	70.8%	254	68.6	4.2%	28.0%	1465
2007	12.946	95.3%	1314.6	32.7	773.7	242.2	81.4	1097.3	4.0%	70.5%	257	69.6	4.0%	27.5%	1514
2008	13.130	96.1%	1347.9	33.4	801.7	252.0	88.0	1141.6	4.0%	70.2%	260	70.6	4.0%	27.0%	1564
2009	13.318	97.0%	1382.0	34.1	830.7	262.1	95.0	1187.8	4.0%	69.9%	265	71.6	4.0%	26.5%	1616
2010	13.507	97.9%	1416.8	34.8	860.6	272.7	102.6	1235.9	4.0%	69.6%	269	72.7	4.0%	26.0%	1670

1] Excludes the proposed 9 municipalities in Bulacan Province, which will be provided with bulk water.

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 3 - FORECASTED DEMAND AND SUPPLY OF WATER (MILLION CUBIC METERS PER DAY)

Year	VOLUME SOLD (Million Liters per Day - MLD)					% Non-Revenue Water	Water Production Needed	PRODUCTION CAPACITY ---Million Liters/day---				Average Surplus or Deficit	Peak Water Production	Peak Surplus or Deficit
CAPAC	Domestic	Commercial	Industrial	Total	Million Tons Per Month		MLD	Groundwater	La Mesa	Angat & Umiray	Total	MLD	MLD	MLD
1984	460.5	290.7	40.8	792.1	24.2	56.6%	1825	70	1755		1825	0	2007	-182
1985	502.9	287.2	39.6	829.7	25.2	61.5%	2156	81	2075		2156	0	2371	-216
1986	535.5	276.1	39.8	851.4	25.9	65.6%	2478	83	2395		2478	0	2726	-248
1987	598.6	278.8	44.6	921.9	28.0	61.0%	2363	77	2311		2388	25	2600	-211
1988	617.1	307.9	45.4	970.4	29.6	59.6%	2401	87	2311		2398	-3	2641	-243
1989	669.3	308.3	47.8	1025.5	31.2	55.8%	2320	97	2332		2429	110	2551	-122
1990	736.3	319.2	50.2	1105.7	33.6	52.0%	2304	107	2332		2439	136	2534	-95
1991	820.2	330.5	54.2	1204.9	36.6	48.5%	2340	117	2332		2449	110	2574	-124
1992	912.7	341.2	58.4	1312.4	40.0	45.0%	2386	133	2332	1300	3765	1379	2625	1141
1993	1014.7	358.6	63.2	1436.6	43.7	41.5%	2456	133	2332	1300	3765	1310	2701	1064
1994	1118.7	376.7	68.3	1563.7	47.6	38.0%	2522	133	2332	1300	3765	1243	2774	991
1995	1205.3	392.0	73.8	1671.0	50.8	35.5%	2591	133	2332	1300	3765	1175	2850	916
1996	1279.8	406.7	79.4	1765.9	53.9	33.0%	2636	133	2332	1300	3765	1130	2899	866
1997	1363.0	428.4	87.6	1879.0	57.2	32.4%	2780	133	2332	1300	3765	986	3058	708
1998	1444.3	450.1	96.4	1990.8	60.6	31.8%	2919	133	2332	1300	3765	846	3211	554
1999	1530.0	472.9	106.0	2109.0	64.1	31.2%	3065	133	2332	1300	3765	700	3372	394
2000	1615.9	495.5	116.3	2227.7	67.9	30.6%	3210	133	2332	1300	3765	556	3531	235
2001	1698.6	522.0	128.3	2348.8	71.4	30.0%	3355	133	2332	1300	3765	410	3691	75
2002	1770.6	544.4	141.1	2456.1	74.7	29.6%	3489	133	2332	2074	4539	1050	3838	701
2003	1835.8	566.3	155.2	2557.4	77.8	29.2%	3612	133	2332	2074	4539	927	3973	566
2004	1898.1	587.6	170.3	2656.0	81.0	28.8%	3730	133	2332	2074	4539	809	4103	436
2005	1973.1	613.0	187.8	2773.9	84.4	28.4%	3874	133	2332	2074	4539	665	4262	278
2006	2045.2	637.7	206.6	2889.6	87.9	28.0%	4013	133	2332	2074	4539	526	4415	124
2007	2119.7	663.5	223.1	3006.3	91.4	27.5%	4147	133	2332	2074	4539	392	4561	-22
2008	2190.5	688.4	240.3	3119.2	95.1	27.0%	4273	133	2332	2074	4539	266	4700	-161
2009	2275.8	718.2	260.3	3254.2	99.0	26.5%	4428	133	2332	2074	4539	112	4870	-331
2010	2357.7	747.1	281.1	3385.9	103.0	26.0%	4576	133	2332	2074	4539	-37	5033	-494

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 4 - DOMESTIC WATER DEMAND

Year DOM	Population Under MWSS 1] Million	Connections 1000 (End of Period)	Annual Increase in connection	Volume Sold Mill. Ton	Volume Sold Ton per Connec/ Month	Liters per person Served per day	Persons per Connection	Population with Connec. Million	% Population with House Connec.	Number Of Public Faucets '1000	Persons Served per Public Faucet	Persons Served Public Faucets Million	%Population with Public Faucets	Total Population Served Million
1984	7.759	342.59		168.55	43.69	159	9.00	3.08	39.7%	1.04	486	0.51	6.5%	3.39
1985	8.00[illegible]	410.13	67.54	183.55	40.51	148	9.00	3.69	46.1%	1.12	486	0.54	6.8%	3.92
1986	8.233	472.91	62.78	195.47	36.83	135	9.00	4.26	51.7%	1.19	486	0.58	7.0%	4.34
1987	8.468	506.67	33.76	218.48	37.14	136	9.00	4.56	53.9%	1.25	486	0.61	7.2%	5.01
1988	8.712	520.01	13.34	225.85	37.01	135	9.00	4.68	53.7%	1.33	486	0.65	7.4%	5.33
1989	8.967	561.51	41.49	244.30	37.65	138	9.00	5.05	56.4%	1.35	486	0.66	7.3%	5.71
1990	9.228	604.98	43.47	268.76	38.40	140	9.00	5.44	59.0%	1.37	486	0.67	7.2%	6.11
1991	9.454	656.51	51.53	299.37	39.35	144	9.00	5.91	62.5%	1.38	486	0.67	7.1%	6.58
1992	9.685	710.20	53.69	334.07	40.74	149	9.00	6.39	66.0%	1.40	486	0.68	7.0%	7.07
1993	9.925	760.91	50.71	370.37	41.96	153	9.00	6.85	69.0%	1.38	486	0.67	6.8%	7.52
1994	10.171	813.70	52.79	408.32	43.22	158	9.00	7.32	72.0%	1.37	486	0.67	6.5%	7.99
1995	10.402	849.53	35.84	439.93	44.08	161	9.00	7.65	73.5%	1.36	486	0.66	6.3%	8.30
1996	10.639	886.58	37.05	468.39	44.97	164	9.00	7.98	75.0%	1.34	486	0.65	6.1%	8.63
1997	10.852	921.23	34.65	497.49	45.86	168	9.00	8.29	76.4%	1.32	486	0.64	5.9%	8.93
1998	11.070	956.92	35.68	527.18	46.78	171	9.00	8.61	77.8%	1.30	486	0.63	5.7%	9.25
1999	11.292	993.66	36.75	558.46	47.72	174	9.00	8.94	79.2%	1.28	486	0.62	5.5%	9.57
2000	11.518	1031.50	37.83	591.41	48.67	178	9.00	9.28	80.6%	1.26	486	0.61	5.3%	9.90
2001	11.749	1070.45	38.95	619.97	49.16	180	9.00	9.63	82.0%	1.24	486	0.61	5.1%	10.24
2002	11.945	1098.95	28.50	646.27	49.65	181	9.00	9.89	82.8%	1.22	486	0.59	5.0%	10.48
2003	12.145	1128.11	29.16	670.08	50.15	183	9.00	10.15	83.	1.20	486	0.58	4.8%	10.73
2004	12.348	1157.93	29.82	694.70	50.65	185	9.00	10.42	84.4%	1.17	486	0.57	4.6%	10.99
2005	12.554	1188.44	30.51	720.17	51.15	187	9.00	10.70	85.2%	1.15	486	0.56	4.4%	11.25
2006	12.764	1219.64	31.20	746.50	51.67	189	9.00	10.98	86.0%	1.13	486	0.55	4.3%	11.52
2007	12.946	1251.41	31.78	773.68	52.18	191	9.00	11.26	87.0%	1.10	486	0.54	4.1%	11.80
2008	13.130	1283.85	32.44	801.73	52.70	193	9.00	11.55	88.0%	1.08	486	0.53	4.0%	12.08
2009	13.318	1316.96	33.11	830.68	53.23	194	9.00	11.85	89.0%	1.06	486	0.51	3.9%	12.37
2010	13.507	1350.75	33.79	860.56	53.76	196	9.00	12.16	90.0%	1.04	486	0.50	3.7%	12.66

1] Excludes the proposed 9 municipalities in Bulacan Province, which will be provided with bulk water.

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 5 - COMMERCIAL WATER DEMAND

Year COM	Population Under MWSS Million	Connections 1000 (End of Period)	Annual Increase in connection 1000	Volume Sold Mill. Ton	Volume Sold Ton per Connection	Lpcd Per Total Population	Persons per Connection	Population Served 1000	% Population served	Commercial on Total Water Sold
1984	7.759	27.252		106.40	338.2	39	9	0.245	3.3%	36.7%
1985	8.005	26.473	-0.779	104.84	327.3	38	9	0.238	3.1%	34.6%
1986	8.233	26.704	0.231	100.79	318.0	35	9	0.240	3.0%	32.4%
1987	8.468	26.113	-0.591	101.76	321.6	35	9	0.235	2.9%	30.2%
1988	8.712	40.420	14.307	112.70	225.8	37	9	0.364	4.2%	31.7%
1989	8.967	41.026	0.606	112.55	230.3	35	9	0.369	4.1%	30.1%
1990	9.228	41.642	0.615	116.52	234.9	35	9	0.375	4.1%	28.9%
1991	9.454	42.266	0.625	120.63	239.6	35	9	0.380	4.0%	27.4%
1992	9.685	42.900	0.634	124.89	244.4	36	9	0.386	4.0%	26.0%
1993	9.925	43.758	0.858	130.89	251.7	37	9	0.394	4.0%	25.0%
1994	10.171	44.633	0.875	137.51	259.3	37	9	0.402	3.9%	24.1%
1995	10.402	45.526	0.893	143.07	264.5	38	9	0.410	3.9%	23.5%
1996	10.639	46.437	0.911	148.85	269.8	39	9	0.418	3.9%	23.0%
1997	10.852	47.365	0.929	156.38	277.9	40	9	0.426	3.9%	22.8%
1998	11.070	48.313	0.947	164.29	286.2	41	9	0.435	3.9%	22.6%
1999	11.292	49.279	0.966	172.61	294.8	42	9	0.444	3.9%	22.4%
2000	11.518	50.265	0.986	181.34	303.6	43	9	0.452	3.9%	22.2%
2001	11.749	51.270	1.005	190.52	312.7	45	9	0.461	3.9%	22.2%
2002	11.945	52.039	0.769	198.69	320.5	46	9	0.468	3.9%	22.2%
2003	12.145	52.819	0.781	206.71	328.6	47	9	0.475	3.9%	22.1%
2004	12.348	53.612	0.792	215.06	336.8	48	9	0.483	3.9%	22.1%
2005	12.554	54.416	0.804	223.74	345.2	49	9	0.490	3.9%	22.1%
2006	12.764	55.232	0.816	232.78	353.8	50	9	0.497	3.9%	22.1%
2007	12.946	56.061	0.828	242.17	362.7	52	9	0.505	3.9%	22.1%
2008	13.130	56.902	0.841	251.95	371.7	53	9	0.512	3.9%	22.1%
2009	13.318	57.755	0.854	262.13	381.0	54	9	0.520	3.9%	22.1%
2010	13.507	58.621	0.866	272.71	390.6	56	9	0.528	3.9%	22.1%

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 6 - INDUSTRIAL WATER SUPPLY

Year IND	Population Under MWSS Million	Connections 1000	Annual Increase in connection 1000	Volume Sold Million Ton	Volume Sold Ton per Connection	Lpcd Per Total Population	Persons per Connection	Population Served Million	% Population served	Industrial on Total Water Sold
1984	7.759	1.801		14.95	677.1	5.5	4.5	0.01	0.1%	5.2%
1985	8.005	1.685	-0.116	14.46	688.1	5.2	4.5	0.01	0.1%	4.8%
1986	8.233	1.608	-0.077	14.52	725.8	5.1	4.5	0.01	0.1%	4.7%
1987	8.468	1.552	-0.056	16.27	865.2	5.5	4.5	0.01	0.1%	4.8%
1988	8.712	6.074	4.522	16.62	363.2	5.5	4.5	0.03	0.3%	4.7%
1989	8.967	6.104	0.030	17.45	238.8	5.4	4.5	0.03	0.3%	4.7%
1990	9.228	6.135	0.031	18.32	249.5	5.5	4.5	0.03	0.3%	4.5%
1991	9.454	6.166	0.031	19.79	268.1	5.8	4.5	0.03	0.3%	4.5%
1992	9.685	6.196	0.031	21.37	288.1	6.1	4.5	0.03	0.3%	4.4%
1993	9.925	6.227	0.031	23.08	309.6	6.4	4.5	0.03	0.3%	4.4%
1994	10.171	6.259	0.031	24.93	332.7	6.8	4.5	0.03	0.3%	4.4%
1995	10.402	6.290	0.031	26.92	357.6	7.2	4.5	0.03	0.3%	4.4%
1996	10.639	6.321	0.031	29.07	384.3	7.6	4.5	0.03	0.3%	4.5%
1997	10.852	6.353	0.032	31.98	420.6	8.2	4.5	0.03	0.3%	4.7%
1998	11.070	6.385	0.032	35.18	460.3	8.8	4.5	0.03	0.3%	4.8%
1999	11.292	6.417	0.032	38.70	503.8	9.5	4.5	0.03	0.3%	5.0%
2000	11.518	6.449	0.032	42.57	551.5	10.2	4.5	0.03	0.3%	5.2%
2001	11.749	6.481	0.032	46.83	603.6	11.0	4.5	0.03	0.2%	5.5%
2002	11.945	6.578	0.097	51.51	657.4	11.9	4.5	0.03	0.2%	5.7%
2003	12.145	6.677	0.099	56.66	712.4	12.9	4.5	0.03	0.2%	6.1%
2004	12.348	6.777	0.100	62.32	772.1	13.9	4.5	0.03	0.2%	6.4%
2005	12.554	6.879	0.102	68.56	836.7	15.1	4.5	0.03	0.2%	6.8%
2006	12.764	6.982	0.103	75.41	906.8	16.3	4.5	0.03	0.2%	7.2%
2007	12.946	7.086	0.105	81.45	964.9	17.4	4.5	0.03	0.2%	7.4%
2008	13.130	7.193	0.106	87.96	1026.7	18.4	4.5	0.03	0.2%	7.7%
2009	13.318	7.301	0.108	95.00	1092.4	19.7	4.5	0.03	0.2%	8.0%
2010	13.507	7.410	0.110	102.60	1162.4	21.0	4.5	0.03	0.2%	8.3%

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TABLE 7 - COMPARATIVE ANALYSIS OF FORECASTED WATER SALES MLD

Year	---DOMESTIC -- Actual & this Fore-cast	DOCD's Report	--COMMERCIAL-- Actual & this Fore-cast	DOCD's Report	--INDUSTRIAL-- Actual & this Fore-cast	DOCD's Report	-- TOTAL WATER SOLD MLD--- Actual & this Fore-cast	DOCD's Report	IBRD's 2676-PH (2/86)	ADB's REHAB II (1/89)	- % NON-REVENUE WATER - Actual & this Fore-cast	DOCD's Report	ADB's REHAB II	--ADDITIONAL SALES ASSUMED DOCD's REPORT MLD	%
1984	461	461	291	291	41	41	792				56.6%				
1985	503	503	287	287	40	40	830		925		61.5%				
1986	536	536	276	276	40	40	851		1125		65.6%				
1987	599	668	279	280	45	45	922	994	1301		61.0%			72	7.8%
1988	617	775	308	338	45	80	970	1193	1461	1082	59.6%		55.0%	222	22.9%
1989	669	882	308	397	48	114	1025	1392	1600	1244	55.8%		50.0%	367	35.8%
1990	736	988	319	455	50	148	1106	1591	1714	1401	52.0%		46.0%	486	43.9%
1991	820	1095	330	513	54	182	1205	1791	1798	1507	48.5%		42.0%	586	48.6%
1992	913	1202	341	572	58	216	1312	1990	1854	1609	45.0%	40.0%	40.0%	677	51.6%
1993	1015	1312	359	605	63	238	1437	2156	1892	2031	41.5%	36.0%	36.0%	720	50.1%
1994	1119	1435	377	660	68	261	1564	2336		2146	38.0%	33.0%	33.0%	792	50.6%
1995	1205	1476	392	715	74	282	1671	2473			35.5%	30.0%	30.0%	802	46.0%
1996	1280	1532	407	785	79	311	1766	2629			33.0%	29.0%	29.0%	863	48.9%
1997	1363	1573	428	848	88	338	1879	2759			32.4%	28.0%	28.0%	880	46.8%
1998	1444	1627	450	921	96	369	1991	2917			31.8%	27.0%	28.0%	926	46.5%
1999	1536	1673	473	993	106	393	2109	3060			31.2%	26.0%	28.0%	951	45.1%
2000	1616	1727	495	1081	116	420	2228	3228			30.6%	25.0%	28.0%	1000	44.9%
2001	1699	1782	522	1174	128	450	2349	3406			30.0%	25.6%	28.0%	1057	45.0%
2002	1771	1840	544	1275	141	481	2456	3596			29.6%	25.0%	28.0%	1140	46.4%
2003	1836	1899	566	1385	155	515	2557	3799			29.2%	25.0%	28.0%	1241	48.5%
2004	1898	1960	588	1504	170	551	2656	4015			28.8%	25.0%	28.0%	1359	51.2%
2005	1973	2023	613	1634	188	589	2774	4246			28.4%	25.0%	28.0%	1473	53.1%
2006	2045	2089	638	1774	207	631	2890	4494			28.0%	25.0%	28.0%	1604	55.5%
2007	2120	2156	663	1927	223	675	3006	4758			27.5%	25.0%	28.0%	1752	58.3%
2008	2191	2225	688	2093	240	722	3119	5041			27.0%	25.0%	28.0%	1922	61.6%
2009	2276	2297	718	2274	260	773	3254	5343			26.5%	25.0%	28.0%	2089	64.2%
2010	2358	2371	747	2470	281	827	3386	5667			26.0%	25.0%	28.0%	2281	67.4%

SUMMARY RESULTS:	1985- Actual	--1987-91-- This Fore-cast	DOCD's Report	-1991-2000- This Fore-cast	DOCD's Report
% Annual Increase in Domestic Demand	2.9%	8.2%	13.2%	7.8%	5.2%
% Annual Increase in Commercial Demand	-1.5%	4.3%	16.3%	4.6%	8.6%
% Annual Increase in Industrial Demand	6.1%	5.0%	41.5%	8.9%	9.7%
% Annual Increase in Total Demand	5.4%	6.9%	15.9%	7.1%	6.8%

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 8 - BULACAN WATER DEMAND 1]

EXISTING WATER SERVICES IN 1987

Municipality	Population 1000	Population Served 1000	% Served
Balagtas	40.0	4.8	12.1%
Bocaue	64.0	18.9	29.6%
Bulacan	47.4	5.6	11.8%
Guiguinto	39.1	0.0	0.0%
Malolos	126.2	14.2	11.2%
Marilao	58.2	6.8	11.7%
Meycauayan	112.8	9.0	8.0%
Obando	50.5	5.5	10.9%
TOTAL	538.1	64.8	12.1%

PROJECTED WATER SERVICES IN 1995

Municipality	Population 1000	Population Served 1000	% Served	Liters per Capita /Day	--Cubic Meter per Day - Water Sold	Average Water Demand	Maximum Demand	Existing Supply	Supply by Angat
Balagtas	55.0	41.3	75.2%	127	5248	6560	7826	2823	5003
Bocaue	80.1	60.9	76.1%	143	8706	10883	13026	3408	9618
Bulacan	59.9	44.9	75.0%	161	7256	9070	10709	3205	7504
Guiguinto	56.1	24.6	44.0%	143	3517	4396	5090		5090
Malolos	162.0	92.8	57.3%	202	18776	23470	27494	10084	17410
Marilao	84.0	38.2	45.5%	360	13755	17194	19628	570	19058
Meycauayan	161.1	88.4	54.9%	189	16696	20870	23915	2201	21714
Obando	63.7	40.7	63.9%	108	4415	5519	6599	687	5912
TOTAL	721.8	432.0	59.8%	181	78370	97962	114287	22978	91309

1] Based on the Detailed Design for Bulacan Central Water Supply Project by C. Lotti & Associati and DCCD Engineering Corporation (1988)

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

PROJECT DESCRIPTION

1. The project includes construction of raw water transmission, water treatment and distribution facilities for an additional supply of 15 cums (1,300 MLD), and consist of two major parts and related engineering consulting services:

Part A: Transmission and Bulk Water Supply, comprising construction of (i) tunnel No. 3; (ii) aqueduct No. 5; (iii) second La Mesa by-pass; and (iv) water mains to provide treated water in bulk to eight towns in Bulacan Province; and

Part B: Power Station, Treatment and Distribution Facilities, comprising construction of: (i) modification of the power station; (ii) La Mesa II treatment plant; (iii) expansion of the distribution system; (iv) water reservoir; and (v) telemetering.

2. A detailed description of these components is presented below.

3. Modification of the Power Station. The release of the additional water for MWSS from the Angat reservoir will be made by modification of penstocks in the power generating plant and installation of a new turbine in the auxiliary powerhouse. This will consist of tapping the 3.0 m diameter penstock of the main turbine unit No. 2 of the main power station and installation of a new pipe of 2.3 m diameter, about 80 m long, which will connect to a new auxiliary turbine unit No. 5. This will discharge water in the Angat river upstream of the Ipo dam. A new structure, with an overhead traveling crane, will be erected next to the existing auxiliary power plant to house the new auxiliary turbine. The modification is designed for an annual average of 24 cums, to accommodate planned expansion by 9 cums from the Umiray river.

4. Tunnel No. 3 will be constructed at about 60 m distance along the route of existing tunnel No. 2. It will start at the existing intake structure at the Ipo dam and end at Bicti. The design flow of the tunnel is 24 cums for normal water levels of 101 m at the Ipo dam and 91.5 m at Bicti. The tunnel is circular with diameter 4.6 m and 4.3 m without and with lining, respectively, and its length is 6.2 km.

5. Aqueduct No. 5 will start at the end of tunnel No 3. and will run in parallel with the existing aqueduct No 4. Near the Novaliches reservoir it will have three outlets: one, with a capacity of 10.4 cums, will connect with the new La Mesa II treatment plant, the second, with a capacity of 4.6 cums, will connect with the existing La Mesa I treatment plant and the third will overflow in the Novaliches reservoir. The aqueduct has a diameter of 3.6 m, is 16.1 km long, including four tunnel segments totaling 3.2 km, and its design capacity is 24 cums.

6. Second La Mesa By-Pass will connect Bicti-Novaliches Aqueducts Nos 2 & 3 to Novaliches-Balara Aqueducts Nos 1,2 & 3. The by-pass has a diameter of 3.6 m and is 2.5 km long. It will provide raw water to the Balara treatment plant during dry periods when the water level at the Novaliches reservoir is low.

7. La Mesa Treatment Plant II will have a rated capacity of 10.4 cums or 900 MLD. It will include rapid mixing, flocculation, sedimentation, rapid filtration and disinfection. The plant units will be arranged to allow for direct filtration when the raw water quality will permit such an operation.

8. Treated Water Reservoir and Aqueduct No 6. From La Mesa II treatment plant water will gravitate through the aqueduct No 6. (3.6 m diameter, 500 m long) in the balancing reservoir of 260,000 cu m storage capacity. The reservoir will regulate water pressure in the distribution system and would be utilized as an emergency storage in case of emergency disruption in operation of the treatment plant.

9. Distribution System. The distribution system will be reinforced by (i) installation of about 119 km of mains with diameters equal or greater than 300 mm, 300 km of pipes ranging from 250 mm to 100 mm, and 100 km of smaller pipes ranging from 75 mm to 50 mm diameter; (ii) construction of three and upgrading of two pumping stations with total capacity of 485,000 cu m/day; and (iii) installation of 345,000 connections.

10. Bulk Supply to Bulacan Province. The bulk water supplied to the Bulakan Province (about 2% of MWSS's production capacity in 1992) will solve critical water shortages in eight municipalities neighboring the MSA, and will be provided in return for the water taken by MWSS from the Angat River, which is located in the Bulakan Province.

11. The system will consist of installation of mains with diameters ranging from 300 mm to 1,200 mm and total length of 35 km, to supply about 1.1 cums to existing reservoirs in eight municipalities of the Province with treated water from MWSS's system. The operation and maintenance of distribution systems in the involved municipalities will be the responsibility of the respective Water Districts (WDs). A substantial extension and improvement of the distribution systems will be undertaken by the WDs assisted by the Local Water Utilities Administration (LWUA) concurrently with the Angat project. Detailed designs for expansion of the eight systems is under preparation.

12. Originally, the water source was ground water proposed to be extracted from a well field located along the lower reaches of the Angat river and pumped to the balancing reservoirs in each municipality through transmission mains. The alternative of the surface water source from the Angat reservoir, which could provide supply to the municipalities by gravity, was not considered since water rights for all available water quantity have been granted to MWSS. On request of the Provincial Governor MWSS agreed to provide the treated water in bulk to balancing reservoirs in the municipalities from its system instead from the proposed well field. This proved to be the least-cost water source for the towns, having lower capital as well as operating costs.

13. Telemetering System will collect information on water flows, water pressure, and water quality from about 220 monitoring points in the distribution system through either radio frequency or cable transmission. The information will be centralized in a Central Operating Center provided with computers to sort, format, store, display and print out the data as required by MWSS. The telemetering system will include: (i) supply and installation of 205 flow, pressure, and water level measuring instruments; (ii) provision of 15 water quality analyzers to monitor pH, turbidity, and residual chlorine; (ii) provision of 98 frequency shift keying modem; (iii) supply and installation of 53 km of transmission cables; (iv) construction of 150 data acquisition and radio transmission units; (v) construction of a transmission tower; and (vi) provision of a microcomputer system at data base station.

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

PROJECT COSTS ESTIMATES AND FINANCING PLAN

TABLE 1 - TOTAL PROJECT COST

WORKS	MILLION PESOS Local	MILLION PESOS Foreign	MILLION PESOS Total	% OF BASE COST	MILLION US$ Local	MILLION US$ Foreign	MILLION US$ Total	% Foreign
IBRD-FINANCED WORKS	580.7	477.1	1057.8	21.3%	27.65	22.72	50.37	45.1%
ADB-FINANCED WORKS	655.5	1136.1	1791.5	36.1%	31.21	54.10	85.31	63.4%
OECF-FINANCED WORKS	706.2	896.1	1602.3	32.3%	33.63	42.67	76.30	55.9%
LOCALLY-FINANCED WORKS	407.5	97.1	504.6	10.2%	19.40	4.63	24.03	19.2%
BASIC COST, PRICES OF DEC. 1988	2349.8	2606.4	4956.2	100.0%	111.9	124.1	236.0	52.6%
PHYSICAL CONTINGENCIES	185.4	209.1	394.5	8.0%	8.4	9.3	17.6	53.0%
PRICE CONTINGENCIES	571.1	600.7	1171.7	23.6%	19.4	18.4	37.8	51.3%
TOTAL COST 1]	3106.3	3416.1	6522.5	131.6%	139.7	151.7	291.4	52.4%

1] Includes taxes equivalent to about $7.6 million. Due to rounding the last digit in totals may appear different than the sum of digits.

TABLE 2 - PROJECT FINANCING PLAN

	TOTAL MILLION PESOS	TOTAL MILLION US$	% OF TOTAL	MILLION PESOS 1989	1990	1991	1992	1993	1994
PROJECT COST	6522.5	291.4	80.5%	546.6	1742.8	1907.2	1238.7	839.0	248.2
(A) IBRD-Financed Works	1348.4	61.3	16.9%	191.3	426.9	463.2	210.8	56.2	0.0
(B) ADB-Financed Works	2484.7	108.7	30.0%	9.4	465.3	707.5	622.1	432.2	248.2
(C) OECF-Financed Work	2050.4	92.2	25.5%	183.2	609.3	648.9	326.7	282.3	0.0
(D) Locally-Financed	638.9	29.2	8.1%	162.7	241.3	87.5	79.1	68.3	0.0
INTEREST CAPITALIZED	1659.2	70.5	19.5%	27.5	120.4	260.4	367.5	426.3	457.0
World Bank	212.3	8.9	2.5%	2.4	9.0	27.1	43.1	58.2	72.4
ADB	576.0	24.2	6.7%	3.5	25.1	71.3	120.8	162.9	192.5
PNB/UB	870.9	37.3	10.3%	21.6	86.4	162.0	203.7	205.2	192.1
TOTAL TO BE FINANCED	8181.7	361.9	100.0%	574.1	1863.2	2167.6	1606.2	1265.3	705.2
FINANCED BY:									
IBRD LOAN	920.3	40.0	11.1%	63.0	106.9	187.0	213.4	252.7	97.4
ADB LOAN	2991.8	130.0	35.9%	12.7	481.1	764.7	730.4	586.5	416.5
OECF LOAN (EQUITY TO MWSS)	1794.7	80.0	22.1%	96.0	528.7	563.1	237.1	244.9	124.8
PNB/UB BOND	1200.0	55.2	15.3%	240.0	480.0	360.0	120.0	0.0	0.0
INTERNAL CASH GENERATION	801.0	34.5	9.5%	0.0	0.0	247.9	305.3	181.3	66.5
LOCAL FUNDS (EQUITY, OP. LOANS)	473.8	22.2	6.1%	162.5	266.5	44.9	0.0	0.0	0.0
TOTAL FINANCING	8181.7	361.9	100.0%	574.1	1863.2	2167.6	1606.2	1265.3	705.2

1] Due to rounding the last digit in totals may appear different than the sum of digits.

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TABLE 3 - PROJECT COST COMPONENTS FINANCED BY IBRD 1]

WORKS	MILLION PESOS			% OF BASE COST	MILLION US$			Physical Contin-gencies	% Foreign	MILLION US$				
	Local	Foreign	Total		Local	Foreign	Total			1989	1990	1991	1992	1993
A-1 - TUNNEL #3	158.95	148.69	307.64	29.08%	7.57	7.08	14.65	6.4%	48.3%	3.37	6.15	5.13	0.00	0.00
Civil Works	98.6	40.5	139.1	13.15%	4.69	1.93	6.62	8.0%	29.1%	1.52	2.78	2.32	0.00	0.00
Equipment	60.4	108.2	168.6	15.94%	2.87	5.15	8.03	5.0%	64.2%	1.85	3.37	2.81	0.00	0.00
A-2 - AQUEDUCTS #5B AND #5-C	240.74	184.44	425.18	40.19%	11.46	8.78	20.25	6.5%	43.4%	4.66	8.50	7.09	0.00	0.00
Civil Works	153.3	54.5	207.8	19.65%	7.30	2.60	9.90	8.0%	26.2%	2.28	4.16	3.46	0.00	0.00
Equipment	87.4	129.9	217.3	20.55%	4.16	6.19	10.35	5.0%	59.8%	2.38	4.35	3.62	0.00	0.00
A-3 - BULACAN WATER SYSTEM	83.0	87.0	170.0	16.07%	3.95	4.14	8.10	12.0%	51.2%	0.00	2.02	2.43	2.02	1.62
(a) Civil Works	39.0	21.0	60.0	5.67%	1.86	1.00	2.86	12.0%	35.0%	0.00	0.71	0.86	0.71	0.57
(b) Equipment & Materials	44.0	66.0	110.0	10.40%	2.10	3.14	5.24	12.0%	60.0%	0.00	1.31	1.57	1.31	1.05
A-4 - SECOND LA MESA BY-PASS	83.0	57.0	140.0	13.23%	3.95	2.71	6.67	12.0%	40.7%	0.00	0.00	2.00	4.67	0.00
(a) Civil Works	57.0	18.0	75.0	7.09%	2.71	0.86	3.57	12.0%	24.0%	0.00	0.00	1.07	2.50	0.00
(b) Equipment & Materials	26.0	39.0	65.0	6.14%	1.24	1.86	3.10	12.0%	60.0%	0.00	0.00	0.93	2.17	0.00
A-5 - ENGINEERING	12.0	0.0	12.0	1.13%	0.57	0.00	0.57	0.0%	0.0%	0.17	0.19	0.09	0.07	0.06
(a) Studies & Designs	6.0	0.0	6.0	0.57%	0.29	0.00	0.29	0.0%	0.0%	0.17	0.11	0.00	0.00	0.00
(b) Construct. Administration	6.0	0.0	6.0	0.57%	0.29	0.00	0.29	0.0%	0.0%	0.00	0.07	0.09	0.07	0.06
A-6 - RIGHT OF WAY (Bulk Supply)	3.0	0.0	3.0	0.28%	0.14	0.00	0.14	5.0%	0.0%	0.07	0.07	0.00	0.00	0.00
BASIC COST, PRICES OF DEC. 1988	580.7	477.1	1057.8	100.00%	27.65	22.72	50.37		45.1%	8.27	16.94	16.73	6.76	1.68
PHYSICAL CONTINGENCIES	47.6	38.8	86.4	8.17%	2.16	1.75	3.91	8.2%	44.8%	0.52	1.19	1.32	0.80	0.19
PRICE CONTINGENCIES	123.8	80.4	204.2	19.30%	4.39	2.64	7.03		37.5%	0.32	1.84	2.77	1.52	0.46
TOTAL COST 1]	752.1	596.3	1348.4	127.47%	34.20	27.11	61.31		44.2%	9.11	19.97	20.81	9.09	2.33

1] Includes taxes equivalent to about $1.4 million. Due to rounding the last digit in totals may appear different than the sum of digits.

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TABLE 4 - PROJECT COST COMPONENTS FINANCED BY ADB 1]

WORKS	MILLION PESOS Local	MILLION PESOS Foreign	MILLION PESOS Total	% OF BASE COST	MILLION US$ Local	MILLION US$ Foreign	MILLION US$ Total	Physical Contin-gencies	% Foreign	MILLION US$ 1989	1990	1991	1992	1993	1994
B1 - POWER PLANT (Excl.Compensation)	59.3	278.2	337.5	18.8%	2.83	13.25	16.07	10.0%	82.4%	0.00	7.89	7.09	1.09	0.00	0.00
(a) Civil Works	27.2	44.7	71.9	4.0%	1.29	2.13	3.42	10.0%	62.2%	0.00	1.44	1.78	0.21	0.00	0.00
(b) Electric & Mechanic Eq.	32.2	233.5	265.6	14.8%	1.53	11.12	12.65	10.0%	87.9%	0.00	6.45	5.31	0.89	0.00	0.00
B2 - LA MESA II - TREATMENT PLANT	117.6	167.3	284.9	15.9%	5.60	7.97	13.57	6.4%	58.7%	0.00	3.79	5.69	4.09	0.00	0.00
(a) Civil Works	88.0	49.4	137.4	7.7%	4.19	2.35	6.54	8.0%	36.0%	0.00	0.98	2.88	2.68	0.00	0.00
(b) Electric & Mechanic Eq.	29.6	117.9	147.5	8.2%	1.41	5.61	7.02	5.0%	79.9%	0.00	2.81	2.81	1.40	0.00	0.00
B3 - TERT.DISTRIBUTION & CONNECTIONS	270.0	480.7	750.6	41.9%	12.86	22.89	35.74	6.1%	64.0%	0.00	5.36	6.43	8.58	8.58	6.79
(a) Civil Works	179.5	90.2	269.7	15.1%	8.55	4.30	12.84	8.0%	33.5%	0.00	1.93	2.31	3.08	3.08	2.44
(b) Equipment	90.5	390.4	480.9	26.8%	4.31	18.59	22.90	5.0%	81.2%	0.00	3.44	4.12	5.50	5.50	4.35
B4 - TELEMETERING	37.6	151.0	188.6	10.5%	1.79	7.19	8.98	25.0%	80.1%	0.00	0.00	0.00	5.30	3.68	0.00
(a) Civil Works	3.8	15.1	18.9	1.1%	0.18	0.72	0.90	25.0%	80.1%	0.00	0.00	0.00	0.45	0.45	0.00
(b) Equipment	33.8	135.9	169.7	9.5%	1.61	6.47	8.08	25.0%	80.1%	0.00	0.00	0.00	4.85	3.23	0.00
B5 - ENGINEERING	71.4	58.9	130.4	7.3%	3.40	2.81	6.21	0.0%	45.2%	0.43	1.36	1.75	1.20	0.78	0.48
(a) Feasibility Studies	3.9	0.0	3.9	0.2%	0.19	0.00	0.19	0.0%	0.0%	0.13	0.06	0.00	0.00	0.00	0.00
(b) Prel.& Final Design	17.1	15.6	32.6	1.8%	0.81	0.74	1.55	0.0%	47.7%	0.08	0.39	0.45	0.31	0.20	0.12
(c) Construction Supervision	50.4	43.3	93.8	5.2%	2.40	2.06	4.47	0.0%	46.2%	0.22	1.12	1.29	0.89	0.58	0.36
B6 - COMPENS. POWER LOSS DUR.CONSTR.	99.5	0.0	99.5	5.6%	4.74	0.00	4.74	10.0%	0.0%	0.00	0.00	4.74	0.00	0.00	0.00
BASIC COST, PRICES OF DEC. 1988	655.5	1136.1	1791.5	100.0%	31.21	54.10	85.31		63.4%	0.43	18.61	25.70	20.26	13.04	7.27
PHYSICAL CONTINGENCIES	52.7	111.4	164.1	9.2%	2.31	4.86	7.17	9.2%	67.8%	0.00	1.33	1.95	2.24	1.44	0.41
PRICE CONTINGENCIES	215.1	313.9	529.1	29.5%	6.89	9.34	16.23		57.5%	0.02	1.83	4.14	4.32	3.48	2.25
TOTAL COST 1]	923.3	1561.5	2484.7	138.7%	40.42	68.30	108.72		62.8%	0.45	21.77	31.78	26.82	17.96	9.94

1] Includes taxes equivalent to about $3.4 million. Due to rounding the last digit in totals may appear different than the sum of digits.

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TABLE 5 - PROJECT COST COMPONENTS FINANCED BY OECF 1]

WORKS	MILLION PESOS Local	MILLION PESOS Foreign	MILLION PESOS Total	% OF BASE COST	MILLION US$ Local	MILLION US$ Foreign	MILLION US$ Total	Physical Contin-gencies	% Foreign	MILLION US$ 1989	1990	1991	1992	1993	1994
C1 - TREATED WATER RESERV.& AQUED.	341.9	288.9	630.9	39.4%	16.28	13.76	30.04	6.5%	45.8%	6.91	12.62	10.51	0.00	0.00	0.00
Civil Works	214.9	109.2	324.0	20.2%	10.23	5.20	15.43	8.0%	33.7%	3.55	6.48	5.40	0.00	0.00	0.00
Equipment and Materials	127.1	179.8	306.8	19.1%	6.05	8.56	14.61	5.0%	58.6%	3.36	6.14	5.11	0.00	0.00	0.00
C2 - MAIN DISTRIBUTION SYSTEM	356.6	577.7	934.3	58.3%	16.98	27.51	44.49	6.1%	61.8%	0.00	11.12	13.35	11.12	8.90	0.00
(a) Civil Works	230.6	102.4	333.0	20.8%	10.98	4.88	15.86	8.0%	30.7%	0.00	3.96	4.76	3.96	3.17	0.00
(b) Equipment	126.0	475.3	601.3	37.5%	6.00	22.63	28.63	5.0%	79.1%	0.00	7.16	8.59	7.16	5.73	0.00
C3 - ENGINEERING	7.7	29.4	37.1	2.3%	0.37	1.40	1.77	0.0%	79.3%	1.06	0.71	0.00	0.00	0.00	0.00
BASIC COST, PRICES OF DEC. 1988	706.2	896.1	1602.3	100.0%	33.63	42.67	76.30		55.9%	7.97	24.45	23.86	11.12	8.90	0.00
PHYSICAL CONTINGENCIES	48.3	52.7	101.0	6.3%	2.19	2.37	4.55	6.3%	52.0%	0.45	1.50	1.50	0.68	0.54	0.00
PRICE CONTINGENCIES	165.3	181.9	347.2	21.7%	5.68	5.66	11.34		49.9%	0.30	2.55	3.79	2.29	2.29	0.00
TOTAL COST 1]	919.7	1130.7	2050.4	128.0%	41.49	50.70	92.19		55.0%	8.72	28.50	29.15	14.08	11.73	0.00

1] Includes taxes equivalent to about $2.5 million. Due to rounding the last digit in totals may

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 6 - PROJECT COST COMPONENTS LOCALLY FINANCED 1]

WORKS	MILLION PESOS			% OF BASE COST	MILLION US$			Physical Contin-gencies	% Foreign	MILLION US$					
	Local	Foreign	Total		Local	Foreign	Total			1989	1990	1991	1992	1993	1994
D1 - AQUEDUCT 5A	126.8	97.1	223.9	44.4%	6.04	4.63	10.66	6.5%	43.4%	0.00	2.67	3.20	2.67	2.13	0.00
(a) Civil Works	80.8	28.7	109.5	21.7%	3.85	1.37	5.21	8.0%	26.2%	0.00	1.30	1.56	1.30	1.04	0.00
(b) Equipment & Materials	46.0	68.4	114.5	22.7%	2.19	3.26	5.45	5.0%	59.8%	0.00	1.36	1.64	1.36	1.09	0.00
D2 - LAND ACQU.SITION	11.9	0.0	11.9	2.3%	0.56	0.00	0.56	10.0%	0.0%	0.34	0.23	0.00	0.00	0.00	0.00
D3 - OVERALL CONSTRUCTION ADM.	268.8	0.0	268.8	53.3%	12.80	0.00	12.80	10.0%	0.0%	6.40	6.40	0.00	0.00	0.00	0.00
BASIC COST, PRICES OF DEC. 1988	407.5	97.1	504.6	100.0%	19.40	4.63	24.03		19.2%	6.74	9.29	3.20	2.67	2.13	0.00
PHYSICAL CONTINGENCIES	36.8	6.2	43.0	8.5%	1.71	0.27	1.99	8.5%	13.7%	0.67	0.84	0.21	0.17	0.14	0.00
PRICE CONTINGENCIES	66.9	24.4	91.3	18.1%	2.47	0.73	3.20		22.9%	0.33	1.16	0.53	0.57	0.57	0.00
TOTAL COST 1]	511.2	127.7	638.9	126.6%	23.58	5.63	29.21		19.3%	7.75	11.29	3.93	3.41	2.84	0.00

1] Includes taxes equivalent to about $0.3 million.

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TABLE 7 - TOTAL PROJECT COST INCLUDING CONTINGENCIES IN EACH CATEGORY

WORKS	MILLION PESOS			% OF BASE COST	MILLION US$			% Foreign	MILLION PESOS					
	Local	Foreign	Total		Local	Foreign	Total		1989	1990	1991	1992	1993	1994
IBRD-FINANCED WORKS	752.1	596.3	1348.4	20.7%	34.2	27.1	61.3	44.2%	191.3	426.9	463.2	210.8	56.2	0.0
ADB-FINANCED WORKS	923.3	1561.5	2484.7	38.1%	40.42	68.3	108.7	62.8%	9.4	465.3	707.5	622.1	432.2	248.2
OECF-FINANCED WORKS	919.7	1130.7	2050.4	31.4%	41.5	50.7	92.2	55.0%	183.2	609.3	648.9	326.7	282.3	0.0
LOCALLY-FINANCED WORKS	511.2	127.7	638.9	9.8%	23.6	5.6	29.2	19.3%	162.7	241.3	87.5	79.1	68.3	0.0
TOTAL PROJECT COST 1]	3106.3	3416.1	6522.5	100.0%	139.7	151.7	291.4	52.4%	546.6	1742.8	1907.2	1238.7	839.0	248.2

1] Due to rounding the last digit in totals may appear different than the sum of digits.

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 8 - PROJECT COST COMPONENTS FINANCED BY IBRD

INCLUDING CONTINGENCIES IN EACH CATEGORY

WORKS	MILLION PESOS			% OF BASE COST	MILLION US$			% Foreign	MILLION PESOS				
	Local	Foreign	Total		Local	Foreign	Total		1989	1990	1991	1992	1993
A-1 - TUNNEL #3	195.90	175.91	371.81	35.1%	9.06	8.14	17.20	47.3%	77.97	153.97	139.86	0.00	0.00
Civil Works	122.79	48.89	171.68	16.2%	5.68	2.26	7.94	28.5%	35.9	71.1	64.6	0.0	0.0
Equipment	73.11	127.02	200.13	18.9%	3.38	5.88	9.26	63.5%	42.1	82.8	75.2	0.0	0.0
A-2 - AQUEDUCTS #5B AND #5-C	296.83	218.35	515.19	48.7%	13.73	10.10	23.83	42.4%	107.97	213.39	193.83	0.00	0.00
Civil Works	190.97	65.83	256.80	24.3%	8.83	3.05	11.88	25.6%	53.7	106.4	96.7	0.0	0.0
Equipment	105.86	152.52	258.38	24.4%	4.90	7.06	11.95	59.0%	54.3	107.0	97.2	0.0	0.0
A-3 - BULACAN WATER SYSTEM	119.44	120.95	240.39	22.7%	5.27	5.33	10.60	50.7%	0.0	53.3	69.7	63.0	54.4
(a) Civil Works	56.12	29.19	85.32	8.1%	2.47	1.29	3.76	34.2%	0.0	18.9	24.7	22.4	19.3
(b) Equipment & Materials	63.32	91.75	155.07	14.7%	2.79	4.05	6.84	59.2%	0.0	34.4	45.0	40.6	35.1
A-4 - SECOND LA MESA BY-PASS	122.27	81.12	203.38	19.2%	5.33	3.54	8.87	39.9%	0.0	0.0	57.6	145.8	0.0
(a) Civil Works	83.97	25.62	109.58	10.4%	3.66	1.12	4.78	23.4%	0.0	0.0	31.0	78.5	0.0
(b) Equipment & Materials	38.30	55.50	93.80	8.9%	1.67	2.42	4.09	59.2%	0.0	0.0	26.6	67.2	0.0
A-5 - ENGINEERING	14.20	0.00	14.20	1.3%	0.65	0.00	0.65	0.0%	3.8	4.4	2.2	2.0	1.7
(a) Studies & Designs	6.50	0.00	6.50	0.6%	0.31	0.00	0.31	0.0%	3.8	2.7	0.0	0.0	0.0
(b) Construct. Administratio	7.71	0.00	7.71	0.7%	0.34	0.00	0.34	0.0%	0.0	1.7	2.2	2.0	1.7
A-6 - RIGHT OF WAY (Bulk Supply	3.44	0.00	3.44	0.3%	0.16	0.00	0.16	0.0%	1.6	1.8	0.0	0.0	0.0
TOTAL PROJECT COST 1]	752.08	596.32	1348.40	127.5%	34.20	27.11	61.31	44.2%	191.35	426.88	463.21	210.80	56.17

1] Due to rounding the last digit in totals may appear different than the sum of digits.

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

I M P L E M E N T A T I O N S C H E D U L E

WORKS	DESCRIPTION	COST MILL. P 1989	1989 (1 2 3 4 5 6 7 8 9 10 11 12)	1990 (1 2 3 4 5 6 7 8 9 10 11 12)	1991 (1 2 3 4 5 6 7 8 9 10 11 12)	1992 (1 2 3 4 5 6 7 8 9 10 11 12)	1993 (1 2 3 4 5 6 7 8 9 10 11 12)	1994 (1 2 3 4 5 6 7 8 9 10 11 12)
1 - TUNNEL & AQUEDUCTS 5-B & C			DDDDDDDDAAAA					
(a) Tunnel No. 3	6 kms (4.6m)	308	23%	55%	100%			
(b) Aqueduct 5 Part B	5.3 kms (3.6m)	203	23%	55%	100%			
(c) Aqueduct 5 Part C	3.7 kms (3.6m)	222	23%	55%	100%			
2 - AQUEDUCT 5 - Part A	6.1 kms (3.6m)	224	DDDDDDDDAAAA 23%	55%	100%			
3 - LA MESA BY-PASS	2.5 KM (3.6 M)	140		DDDDDDDDDDDDDDDDDDDDDDDD	BBBBAA 25%	100%		
3 - BULACAN WATER SYSTEM	35 kms (0.5 to 1.1 m)		DDDDDDDDDDDDDDDDDDDDDDDD	BBBBAAA				
(a) Civil Works		60		35%	65%	85%	100%	
(b) Equipment		110		45%	75%	100%		
4 - RIGHT OF WAY (Raw Water)		3	50%	100%				
5 - POWER STATION	24 cu m per second		DDDDDDDDDDDDDDDDDDDDDDDD	DDDDBBAAAA				
(a) Civil Works		72		42%	94%	6%		
(b) Electric & Mechanic Eq.		266		51%	100%			
6 - LA MESA II - TREAT. PLANT	10.4 cu m per second		DDDDDDDDDDDDDDDDDDDDDDDD	DDDDBBAAAA				
(a) Civil Works		137		15%	59%	100%		
(b) Electric & Mechanic Eq.		148		40%	80%	100%		
7 - WATER RESERVOIR & AQUED.	260,000 cu m			DDDDBBAAAA				
(a) Civil Works		324		15%	59%	100%		
(b) Equipment		307		20%	60%	100%		
8 - DISTRIBUTION SYSTEM	520 km			DDDDBBAAAA				
(a) Civil Works		603		15%	33%	57%	81%	100%
(b) Equipment		1082		18%	33%	57%	81%	100%
9 - TELEMETERING	One System							
(a) Civil Works		19				50%	100%	
(b) Equipment		170				50%	100%	
10- ENGINEERING								
(a) Studies & Designs		43	DDDDDDDDDDDDDDDDDDDDDDDD	DDDDDDDDDDDD				
(b) Supervision Construction		131		15%	33%	57%	81%	100%
(c) Construction Administrat		275	AAAAAA 40%	80%	100%	57%	81%	100%
					AAAA 57%	100%		
11 - COMPENSATION								
Right-of Way Acquisition		12	20%	40%	70%	70%	90%	100%
Compensation Power Losses		100			100%			
TOTAL ANGAT PROJECT		4956	5%	35%	65%	80%	90%	100%

A = AWARDING; B = BIDDING; D = DESIGN; N = NEGOTIATIONS.

ANNEX 5

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ANGAT WATER SUPPLY PROJECT

ECONOMIC AND SOCIAL ANALYSIS

1. Least Cost Solution. The analysis of the least cost solution is in the Feasibility Study (available in the Project File), and is explained in paras. 6.4 to 6.8.

2. Bulacan Bulk Water System. The supply of water to Bulacan municipalities is mainly in return for MWSS taking to another province practically all the water available from Angat River. Nevertheless, studies have been undertaken and exploratory wells started to provide water to these municipalities from a well field north of the cities. MWSS could compensate the Province by paying the cost of constructing alternative water source (the wells). However as shown in Table 1, this alternative is more expensive both in economic and financial terms. The construction costs in million 1988 pesos of the ground water is estimated in Table 1 as follows:

Table 1 - Cost of Well Field

(a)	Well Field	151.5
(b)	Ground Reservoir	0.9
(c)	Main Pumping Station	9.1
	Sub-total	161.4
(d)	Transmission Mains	169.6
	Total	331.0

3. The water supply from MWSS or from well require a similar transmission pipeline distributing the water in bulk to each town, with an estimated cost of P 170 million. In addition there is the incremental costs of water supply and treatment from Angat. This cost can be estimated in proportion of the water used by the Bulacan Municipalities (1.1 cums of 15 cums). This cost in constant prices of December 1988 is estimated at P 72.7 million (P 13.5 million for the power station, P 30 million for the raw transmission and P 29.2 for the water treatment). Therefore the total construction cost for the supply from is P 242.7 million, 27% lower than the wells alternative. Moreover, since MWSS would only use the additional 15 cs by 2002, the economic costs is null until that time, and the present value of the Angat supply will be even lower.

4. The operational expenses of the well field are estimated at P 16.1 million per year. MWSS's incremental expenses, based on the operational cost at La Mesa treatment Plant will be about P 13.2 million (P 2.1 for chemicals, P 7.6 million for staff and P 3.5 for maintenance; supply will be by gravity. Therefore, operational costs are also lower (18%).

5. Economic Costs. For the economic analysis the project expenditures were separated in local and foreign, and all costs are expressed in constant prices as of December 1988 prices. In local expenditures the percentage of unskilled labor was estimated for each project component (see Table 1). The shadow price for unskilled labor was estimated at 60% of its nominal cost. Taxes, estimated at 5% of the project cost, were excluded from the cost of the local and foreign components. To reflect the cost of foreign exchange a general conversion factor of 0.9 was used for all foreign costs, Table 2 (the shadow exchange rate was estimated at 20% in the Feasibility Study).

6. The project's operational expenses are easily estimated since the project duplicates the existing capacity and supply from Angat. However, there are economies of scale in MWSS's general personnel and administrative cost. Therefore, the project operational expenses were estimated as the increment from 1989 in the overall MWSS's operational expenses (in constant 1988 prices), as estimated in the financial projections (Annex 10) and forecasted after 1996 at the same unit price per meter of water produced..

7. Compensation. MWSS would compensate to NPC for the cost of the alternative generation of peak power (gas), and for the lower power generated through turbine no. 5, which has an hydraulic head 30 m lower than present turbines. These cost are

estimated at P 56 million p.a. in 1988 prices for the maximum flow of 15 cums. However, due to the expected reduction in NRW the water used and power generation reduction would raise gradually to reach the maximum by the year 2000. In addition, there is the potential need to build a new plant for peak generation. This requires a complex study, to analyze not only the MWSS's water demand, but the cyclic weather variations and flows in the Angat Dam. Angat is not a reliable source for peak power (was only used one week at capacity during 1987) and may have to be replaced, regardless of the project, by a reliable all-year power generation plant. The economic cost of this replacement would also be proportional to the water used. As a part of the economic analysis a sensitivity analysis was made (Table 3), assuming a cost for peak generation capacity of US$40 million (for 15 cums). To allow for construction of the new facilities, this cost is assumed two years before the reduction in peak generation capacity. It is also assumed that since there are continuous investments in power generating capacity, there is no need for a lump investment as a result of the project.

8. Other Investments. It is not possible to separate the benefits of the ongoing rehabilitation projects and the proposed project. This is because the improvement in distribution and number of connections would also be due to those projects, and, even more, because if leakage is not reduced the amount of water that could be sold by the project would be less than half the water production. Therefore, the investment cost in these projects, based on the financial projections and expressed in constant prices, is included as "other investments" (Annex 6, Table 3). Since the tunnel and aqueducts are sized for the final additional capacity of 24 cs, the project benefits are extended until this capacity is used. This requires to add the cost of the development of the Umiray Basin, to convey 9 cs to the project (estimated at P 1408 million in 1988 prices). Normally the cost of house connections has to be added to the investments in networks and mains. However, since MWSS recovers the costs of the house connections through direct charges (other than tariffs), these costs and revenues balances out in each year and do not need to be included in the tables.

9. Water Demand. The water demand is extremely critical for the economic analysis. The water demand used is the appraisal forecast (Annex 2) is much lower than the estimated in the Feasibility Study. If the water sold forecasted in the Feasibility Study were to materialize the economic rates of return would be much higher, not only because of higher revenues, particularly in the early years, but also because the earlier use of the capacity provided by the Angat and Umiray systems.

Economic Rates of Return (ERR)

10. Water Revenues. The economic rate of return is calculated based on existing prices and willingness to pay already demonstrated by existing tariffs. The benefits are estimated for each group of consumers at their average prices per ton (or cubic meter) of water as of December 1988 (P 3.3 for domestic, P 5.84 for commercial and P 7.61 for industrial consumers). The CERA surcharge of about 10% is also added (this surcharge is likely to double in current prices within the next ten years, but because of incertitude in future exchange rates it was kept constant, which is conservative).

11. Although the life of each individual asset is quite different (100 years for tunnels and aqueducts, 20 years for power station, 35 years for pipelines, 15 years for pumping stations, 5 years for meters, etc), the analysis was simplified by assuming an average economic life of 35 years for the project (after construction) and no residual value. This is conservative since the Umiray Basin investments would only be completed after the year 2000.

12. Economic Rate of Return. The economic rate of return, based on existing tariffs is 15% (Table 3). Sensitivity analysis shows that even if the total investments are increased by 10% and the benefits reduced 10% the ERR will still be 13%, which is satisfactory. However, the existing tariffs not only underestimate the price that consumers will be willing to pay, the difference being the consumer surplus estimated in para. 14. This ERR excludes the benefits of improvement in services to existing consumers (continuous service, adequate pressures, reliability of service) and many other benefits which are difficult to quantify reliably. Some of these benefits are roughly estimated below.

13. Sickness Cost. Only a small percentage of deaths, mainly for infants, could be attributed to water diseases and their a cost is very difficult to quantify in economic terms. However, there are other costs that can be roughly estimated, in

particular loss of productive work because of water-borne sickness and the cost of treatment for such diseases. These costs were estimated in the Feasibility Study based on the income loss (at minimum wages), the average number of days loss, the morbidity rates, the labor participation, the medical expenses, etc. Because of low wages (about $3 per day) and low cost of medical treatment, this analysis show rather small benefits. Moreover, water is only one of the factors contributing to these diseases (others include the adequacy of sanitation, proper personal hygiene, cleaning of vegetables and fruits, etc). Therefore only 10% of these costs (for the additional population served) were expected to be recovered by the safe water provided by the project. This provide a maximum benefit of P 82.7 million per year, to be achieved gradually from the project completion until the maximum water sales are achieved (Table 4).

14. Fire Prevention. The extension of water distribution will improve fire prevention savings in lives (not evaluated) and reducing damages to structures. This benefit could be estimated as the reduction in the insurance rates for such properties, but that information was not available. Therefore, this benefit was very conservatively estimated as an annual percentage (0.75%) of the cost of providing such fire hydrants. Under these assumptions this benefit is also minor (P 16.9 million per year). The result of both the sickness cost avoided and the fire prevention increase only marginally the rate of return to 16% (Table 4).

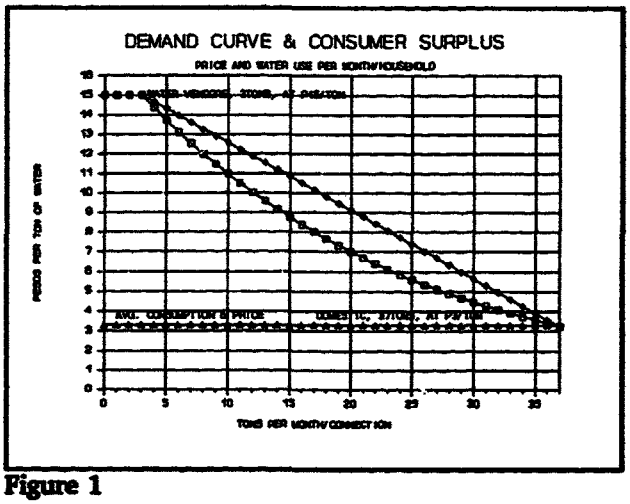

Figure 1

15. Consumer Surplus. Consumers are willing to pay for water a price somewhat higher that the tariffs applied by MWSS. In particular very high prices are accepted for the minimum water consumption (because it is needed to be alive). However, the willingness to pay diminish rapidly for higher water consumptions. The willingness to pay for low water consumption (about 30 lpcd) is demonstrated by the price of water purchased from water vendors. These prices vary within the MSA depending on the distance to MWSS's pipelines and the scarcity and pollution of underground sources. Normal prices are P 0.30 per 20 liter can (P15 per ton, about five times MWSS's average water price for domestic consumers). Prices 50% higher are used in some remote areas. The price also depend on if the consumer carry the water itself, or if water is delivered at home by the water vendor. In this case the price per 20 liters can be P 0.60 or higher. Carrying the water is heavy work particularly for large families, and usually done by women. If a straight demand line is assumed between the price of P 15 per ton for about 3 tons of consumption per month and the average price of P 3.30 for 36.8 tons per month, the consumer surplus (the price willing to be paid above the average tariff) will be 1.9 times the price shown by the water tariff, and the total benefits should be estimated for the domestic consumers at a tariff almost three times the present tariff.

16. However, the water demand and willingness to pay are likely to be an exponential rather than a linear curve. An exponential demand curve can be assumed between the average price (Y1, P 3.30 per ton) and average consumption (X1, 36.8 tons per connection), and the price paid to water vendors (Yo, P 15 per ton) and the water purchased (Xo, for a minimum consumption per family). This is an equation of the form $Y=Ce^{-bX}$ that was fitted between these values. The integration of this curve (neglecting the benefits in the area (Y1-Yo)*Xo) provides the area A = (Xo-X1)/ln(Y1/Yo). This area measures the total consumer benefits, including its consumer surplus and is K times larger than the benefits (X1*Y1) measured by the traditional rate of return using the average tariff. K can then be expressed as:

$$K = (Y1-Yo)/Y1/\ln(Y1/Yo) = (1-Yo/Y1)/\ln(Y1/Yo)$$

17. The application of this equation to the project results in a K of 2.3 (lower than the 2.9

estimated from a lineal demand). This indicates a willingness to pay of 2.3*P 3.3= P 7.6 per ton. Using this value as a proxy for the consumer surplus of the domestic consumers and maintaining the existing average tariffs for other consumers, the economic rate of return increases to 24%. Consumer surpluses for industrial and commercial users are more difficult to estimate and have been neglected.

18. Another benefit is the increase in value of lands which are provided with water supply and is therefore suitable for urbanization and high-density occupancy rather than agricultural use. From existing records in areas with and without MWSS's water supply, the Feasibility Study estimated that actual differences in prices range from P 133 for residential land, to P 258 and P 276 respectively for land used for commercial and industrial purposes. The additional area to be served was also estimated, excluding open spaces, as 15,580 ha. It is estimated that this land appreciation benefit will be achieved gradually over four years after the project completion. Moreover, there are many other factors affecting the price of land, even if the comparison is between areas with or without water services, particularly the demand and supply of urban land. Therefore only 30% of these benefits are attributed to the project. The ERR including the estimated land benefits increases to 23% (Table 4).

19. Taking in consideration all the above benefits the ERR increases to 34%. However, some overlap may exist between the fire and health benefits and the consumer surplus, depending on the consumer education. But the quantified benefits for health and fire protection are so small, that they increase the overall ERR by less than 1%.

Marginal Cost

20. The marginal cost was estimated using the long-term average marginal cost method. The marginal cost for the project is estimated at P 3.30 per ton for a discount rate of 12% (Table 3). About 74% of this cost is fixed (investment) while the remaining 26% reflects the variable cost of operation. The marginal cost coincides with the average domestic tariff and is about 30% lower than MWSS's average tariff. The financial tariff is higher than the marginal cost for this project, because of MWSS's cash requirements for debt service and to contribute to the rapid-expansion of its water services. Moreover, the present tariff reflects the NRW problem, and that only about 40% of the water produced is billed.

Population and Urban Poor Served

21. Water production per capita averages 500 lcd, mainly because of the excessive levels of NRW. The additional supply of 15 cums can provide water to about 3 million persons at 430 lpcd, and if NRW is reduced, as planned, to 30% about 4.3 million persons would benefit from the project. In 1988 MWSS provided water connections to 58% of the total MSA serving mainly medium and high income consumers, although there are some low-income persons served in areas like Tondo and other blighted areas. The total population served is shown in Table 5, as well as the incremental population served from 1989. Since the project is the only additional source of water, practically all the additional population to be served by MWSS would benefit from the project investment and complementary works. The total population with house connections to be served by MWSS is expected to increase from 5.1 million in 1988 to 7.7 million in 1994 and 9.8 million in 2000. The incremental population served by the project and the impact of the rehabilitation projects (which are closely related to the project) will reach 2.3 million in 1994 and 4.3 million in 2000, which is satisfactory. Additional population would also benefits after the year 2000 from the capacity provided by the project to convey the water from the Umiray system.

22. As the population served by house connections increases, most of the additional population will be urban poor (when the population served is close to 100% all the urban poor will be served). The population with incomes below the poverty threshold are classified as urban poor. The poverty threshold in 1985 prices is estimated at P3,282 per family per month in Metro Manila (from "A Monograph on the Estimation of the 1985 Poverty and Subsistence Thresholds and Incidences"). The percentage of urban poor in MSA is estimated by the Government at about 45%, of which almost one million are assumed to have water connections in 1989. The total and additional urban poor are estimated in Table 5. The incremental urban poor served are expected to reach 2.6 million in 1994 (69% of the incremental population served) and 3.7 million in 2000 (62% of the incremental population served).

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 2 - ECONOMIC COST OF PROJECT COSTS EXPENDITURES

PROJECT EXPENDITURES INCLUDING PHYSICAL CONTINGENCIES, MILLION PESOS DECEMBER 1988

LOCAL PROJECT EXPENDITURES

YEAR	TUNNEL & AQUEDUCT	OTHER CIVIL WORKS	EQUIP-MENT	CONSUL-TANTS	COMPEN-SATION	TOTAL FINAN-CIAL COST	TOTAL UN-SKILLED LABOR COST	TOTAL TAXES (6%)	TOTAL ECONO-MIC COST 1]
% Unskilled Labor	35.0%	35.0%	30.0%	0.0%	0.0%				
1989.0	57.9	49.4	63.2	148.7	1.5	320.8	56.5	0.0	298.2
1990.0	126.0	209.2	211.3	159.5	1.5	707.4	180.7	0.0	635.1
1991.0	129.5	241.2	210.4	21.4	99.5	702.1	192.9	0.0	624.9
1992.0	60.1	150.1	122.4	15.0	0.0	347.5	110.3	0.0	303.4
1993.0	16.2	98.9	78.4	10.0	0.0	203.4	63.8	0.0	177.9
1994.0	0.0	34.1	17.2	5.4	0.0	56.7	17.1	0.0	49.9
SUBTOTAL LOCAL EXPENDITURES						2338.0	621.3	0.0	2089.5

1] Using a shadow price of 60% for the cost of the skilled labor.

FOREIGN PROJECT EXPENDITURES (MILLION PESOS)

YEAR	TUNNEL & AQUEDUCT	OTHER CIVIL WORKS	EQUIP-MENT	CONSUL-TANTS	COMPEN-SATION	TOTAL FINAN-CIAL COST	TOTAL TAXES ON FOREIGN COMP. 6.0%	TOTAL ECONO-MIC COST 1] FOREIGN COMP.	TOTAL ECONO-MIC COST LOCAL & FOREIGN
1989.0	21.9	25.1	96.1	20.6	0.0	163.7	9.3	172.6	470.8
1990.0	47.1	116.4	552.7	26.5	0.0	742.8	42.0	783.2	1418.4
1991.0	47.3	136.5	556.4	17.1	0.0	757.2	42.9	798.5	1423.4
1992.0	19.8	83.0	394.9	11.8	0.0	509.5	28.8	537.2	840.7
1993.0	5.7	53.9	270.0	7.7	0.0	337.3	19.1	355.7	533.6
1994.0	0.0	17.1	74.2	4.7	0.0	96.0	5.4	101.3	151.1
SUBTOTAL FOREIGN EXPENDITURES						2606.4	147.5	2748.5	4837.9
TOTAL PROJECT COST						4944.4			4837.9

1] Using a general conversion factor of 0.9

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

TABLE 3 - ECONOMIC RATE OF RETURN AND MARGINAL COST

YEAR	PROJECT EXPENDITURES: PROJECT INVESTMENT 1]	OTHER INVESTMENT 2]	POWER ECONOMIC LOSS 3]	OPERATIONAL COSTS 4]	TOTAL EXPENDITURES	INCREMENTAL WATER SOLD (MILLION TONS PER YEAR 5]: Domestic	Commercial	Industrial	Total	WATER REVENUES Million Pesos 6]	OTHER REVENUES 7]	NET BENEFITS (Base Case)
1989	470.8	1032.0			1502.8							-1502.8
1990	1418.4	630.3		24.5	2073.1	24.5	4.0	0.9	29.3	121.6		-1951.5
1991	1423.4	330.3		51.8	1805.5	55.1	8.1	2.3	65.5	271.4		-1534.1
1992	840.7	129.6	2.9	85.9	1059.1	89.8	12.3	3.9	106.0	438.0		-621.1
1993	533.6	0.0	5.5	110.6	649.7	126.1	18.3	5.6	150.1	622.6		-27.0
1994	151.1	0.0	8.1	136.1	295.4	164.0	25.0	7.5	196.5	818.4		523.0
1995		200.0	10.9	162.1	373.0	195.6	30.5	9.5	235.6	985.5		612.5
1996		200.0	13.0	187.3	400.3	224.1	36.3	11.6	272.0	1144.0		743.7
1997		200.0	18.5	266.6	485.1	253.2	43.8	14.5	311.6	1322.3		837.3
1998		376.0	24.1	347.4	747.4	282.9	51.7	17.7	352.4	1507.7		760.3
1999		376.0	30.0	432.1	838.0	314.2	60.1	21.2	395.5	1704.1		866.1
2000		552.0	36.1	520.9	1109.0	347.1	68.8	25.1	441.0	1912.2		803.2
2001		552.0	41.6	600.1	1193.7	375.7	78.0	29.4	483.0	2110.5		916.8
2002		352.0	47.0	677.3	1076.3	402.0	86.1	34.1	522.2	2297.6		1221.4
2003		100.0	51.9	748.8	900.8	425.8	94.2	39.2	559.2	2478.7		1578.0
2004		100.0	-599.4	823.2	323.8	450.4	102.5	44.9	597.8	2669.1		2345.4
2005		100.0	-594.1	900.6	406.5	475.9	111.2	51.1	638.2	2869.5		2463.0
2006		100.0	-588.5	981.2	492.7	502.2	120.2	58.0	680.4	3080.5		2587.8
2007		100.0	-583.1	1058.5	575.3	529.4	129.6	64.0	723.0	3290.1		2714.7
2008		100.0	-577.6	1138.4	660.8	557.4	139.4	70.5	767.3	3509.2		2848.4
2009			-571.8	1221.2	649.4	586.4	149.6	77.5	813.5	3738.5		3089.2
2010-2028			-565.9	1306.9	649.4	586.4	149.6	77.5	813.5	3738.5		3089.2
Present Value at 0% Discount	4838	5530	-11147	28772	26709	14591	3464	1674	19729	89231	0	62523

THE ECONOMIC RATE OF RETURN (ERR) IS: 15.1%

SENSITIVITY ANALYSIS FOR ECONOMIC RATE OF RETURN	Economic Rate of Return
Benefits reduced by 10%	13.7%
Benefits Reduced by 30% for 10 Years	12.9%
Investment Cost Increased by 10%	14.1%
Investment Cost Increased by 10% and Benefits Reduced by 10%	12.8%

MARGINAL COST ANALYSIS

Discount Rate	PRESENT VALUES OF: Investment M Pesos	Total Expenses M Pesos	% Invest on Total	MARGINAL COST: Volume Sold Mill.Ton	Investment P/Ton	Total Cost P/Ton
5%	7987	14462	55%	7585	1.1	1.9
8%	7050	10861	65%	4387	1.6	2.5
10%	6542	9333	70%	3179	2.1	2.9
12%	6106	8208	74%	2375	2.6	3.5

1] In 1988 prices, including the cost of the two rehabilitation projects, physical contingencies, adjusted for the shadow prices of labor and foreign expenditures and excluding taxes. Details in Annex 6, Table 1.
2] Includes all investments in rehabilitation required to reduce non-revenue water. After 1996 includes the investments required to use 9 cu m per second from Umiray Basin.
3] Based on the difference in power generated, because of a 30 m lower hydraulic head (P 42 million) and loss of peak generation (P 14 million). Peak generation at Angat is unreliable and was available only one week in 1987. Therefore, additional peak capacity may have to be provided by NPC regardless of the project. Moreover, this loss would increase gradually until the 15 cums are used. Under these circumstances the compensation for loss of peak capacity additional 9 cu m from Umiray will create economic gains of about 500 GWH at the same price. is estimated at P60 million per year (19'
4] Estimated as the increment in constant prices in the operation cost of water supply, as forecasted in the financial projections. The average incremental cost of P2/Ton Produced in 1996 (P 2.7 per volume sold) is used thereafter.
5] Difference with water sales in 1989 based in demand shown in Annex 2. The full production capacity is used now and all investments to increase capacity or connections are included.
6] Revenues are estimated in constant prices, based in the tariff on December 1988. Average rates are P3.30 for domestic, P$ 5.84 for commercial and P$ 7.61 for industrial water sales. 10% added for CERA.
7] Connection costs are compensated by connections fees and are not included.

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TABLE 4 - ECONOMIC RATE OF RETURN INCLUDING INDIRECT BENEFITS

YEAR	ESTIMATED COMPENS. TO BUILD PEAK PLANT 1]	NET BENEF. INCLUD. COMPENS. FOR PEAK PLANT	ESTIMATE CONSUMER SURPLUS 2]	NET BENEF. INCLUD. CONSUMER SURPLUS	INCREASE IN LAND BENE-FITS 3]	NET BENEF. INCLUD. LAND BENEFITS	FIRE & HEALTH BENEFITS 4]	NET BENEF. INCLUD. FIRE & HEALTH	TOTAL WITH ALL BENE-FITS	BASE CAS ASSUMING TWO YEAR YEARS CONSTRUC DELAY 5]
1989		-1502.8	0.0	-1502.8		-1502.8		-1502.8	-1502.8	-901.7
1990		-1951.5	104.9	-1846.6		-1951.5		-1951.5	-1846.6	-1253.7
1991	43.1	-1577.2	236.3	-1297.8		-1534.1		-1534.1	-1297.8	-1104.0
1992	44.5	-665.6	385.1	-236.0		-621.1		-621.1	-236.0	-793.4
1993	33.8	-60.9	540.9	513.8	2003.2	1976.2	19.9	-7.1	2537.0	-508.9
1994	88.8	434.2	703.7	1226.6	2003.2	2526.2	29.9	552.9	3259.7	-15.0
1995	90.5	522.0	839.3	1451.8	2003.2	2615.8	39.8	652.4	3494.9	-491.7
1996	94.9	648.8	961.4	1705.0	2003.2	2746.9	59.8	803.4	3768.0	-59.2
1997	99.5	737.8	1086.2	1923.5		837.3	69.7	907.0	1993.2	855.8
1998	88.8	671.5	1213.6	1973.9		760.3	89.6	849.9	2063.5	784.4
1999	86.5	779.6	1347.8	2213.9		866.1	99.6	965.7	2313.5	896.1
2000	80.1	723.2	1489.1	2292.4		803.2	99.6	902.8	2392.0	839.4
2001	0.0	916.8	1611.7	2528.4		916.8	99.6	1016.4	2628.0	958.4
2002	0.0	1221.4	1724.5	2945.8		1221.4	99.6	1321.0	3045.4	1268.3
2003		1578.0	1826.6	3404.6		1578.0	99.6	1677.6	3504.2	1629.9
2004		2345.4	1932.3	4277.6		2345.4	99.6	2445.0	4377.2	1745.9
2005		2463.0	2041.5	4504.5		2463.0	99.6	2562.6	4604.1	1868.9
2006		2587.8	2154.5	4742.2		2587.8	99.6	2687.4	4841.8	1999.3
2007		2714.7	2271.1	4985.8		2714.7	99.6	2814.3	5085.4	2131.6
2008		2848.4	2391.4	5239.8		2848.4	99.6	2948.0	5339.4	2270.8
2009		3089.2	2515.6	5604.8		3089.2	99.6	3188.8	5704.4	2517.4
2010-2028		3089.2	2515.6	5604.8		3089.2	99.6	3188.8	5704.4	2431.6

ECONOMIC RATE OF RETURN (ERR):		If Benefits Reduced 10% and Investment Increased 10%
Base Case (no indirect benefits)	15.1%	12.8%
Including Payment for Peak Capacity	14.6%	14.3%
Two Years Delay in Project Completion 4]	14.3%	13.8%
Base Case plus Estimated Consumer Surplus	24.3%	20.9%
Base Case Plus Estimated Land Benefits	23.3%	19.1%
Base Case Plus Estimated Health and Fire Benefits	15.6%	13.2%
Including All Above Benefits	33.6%	28.3%

1] Assuming that the replacement of peak generation capacity would cost US$40 million for full capacity of 15 cums. The economic cost would be in proportion to the incremental water used. To allow for construction, the cost is assumed two years earlier. Given the continuous investments in power generation, it is assumed that no lump investments would be needed because of losses of capacity in this project.

2] Based on average residential demand of 38.6 tons/month at P3.30 per ton, compared with water from water vendors at P0.3 per 20 liters (P15 per ton). The consumer surplus for residential users will be (1-15/3.3)/Ln(3.3/15)=2.3 the present tariff.

3] Assuming that about 30% of the increase in value of land in the project area to be served (21,469 ha, 34% of MSA) is due to the availability of water. Observed price increases varied from P132 to P232 per sq m. After the project completion these benefits are distributed in four years.

4] Based on the Feasibility Study (P99.6 million maximum), reached gradually by the year 2000.

5] The investment is assumed to be 30% lower during the first three years and added to the last three years, extending the construction by two extra years. It is then assumed that the initial benefits are postponed two years and reach only 70% of the forecasted values until 1995.

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TABLE 5 - POPULATION AND URBAN POOR SERVED BY HOUSE CONNECTIONS

YEAR	Population Under MWSS Million Persons	TOTAL POPUL. SERVED BY MWSS: Total Popul. with Connections	% Popul. Served by Connec.	Incremental Population since 1989	URBAN POOR SERVED 1]: Population Mill. Persons	Incremental Poor Served	% Poor on Incr. Popul. Served
1984	7.759	3.337	43.0%				
1985	8.005	3.937	49.2%				
1986	8.233	4.504	54.7%				
1987	8.468	4.802	56.7%				
1988	8.712	5.071	58.2%		0.715		
1989	8.967	5.450	60.8%		0.967		
1990	9.228	5.847	63.4%	0.397	1.141	0.174	44%
1991	9.454	6.317	66.8%	0.866	1.495	0.528	61%
1992	9.685	6.806	70.3%	1.356	1.867	0.900	66%
1993	9.925	7.270	73.3%	1.820	2.208	1.241	68%
1994	10.171	7.753	76.2%	2.303	2.566	1.599	69%
1995	10.402	8.084	77.7%	2.634	2.779	1.812	69%
1996	10.639	8.426	79.2%	2.975	2.893	1.926	65%
1997	10.852	8.746	80.6%	3.296	3.103	2.136	65%
1998	11.070	9.076	82.0%	3.626	3.320	2.353	65%
1999	11.292	9.415	83.4%	3.965	3.544	2.577	65%
2000	11.518	9.765	84.8%	4.315	3.660	2.693	62%
2001	11.749	10.125	86.2%	4.674	3.898	2.931	63%
2002	11.945	10.389	87.0%	4.938	4.058	3.091	63%
2003	12.145	10.658	87.8%	5.208	4.100	3.133	60%
2004	12.348	10.934	88.6%	5.484	4.267	3.300	60%
2005	12.554	11.217	89.3%	5.766	4.438	3.471	60%
2006	12.764	11.505	90.1%	6.055	4.485	3.518	58%
2007	12.946	11.799	91.1%	6.349	4.679	3.712	58%
2008	13.130	12.099	92.1%	6.649	4.877	3.911	59%
2009	13.318	12.405	93.1%	6.955	5.081	4.114	59%
2010	13.507	12.718	94.2%	7.267	5.289	4.322	59%

1] Based on an estimated level of urban poverty of 50% in Metro Manila.

ANNEX 7

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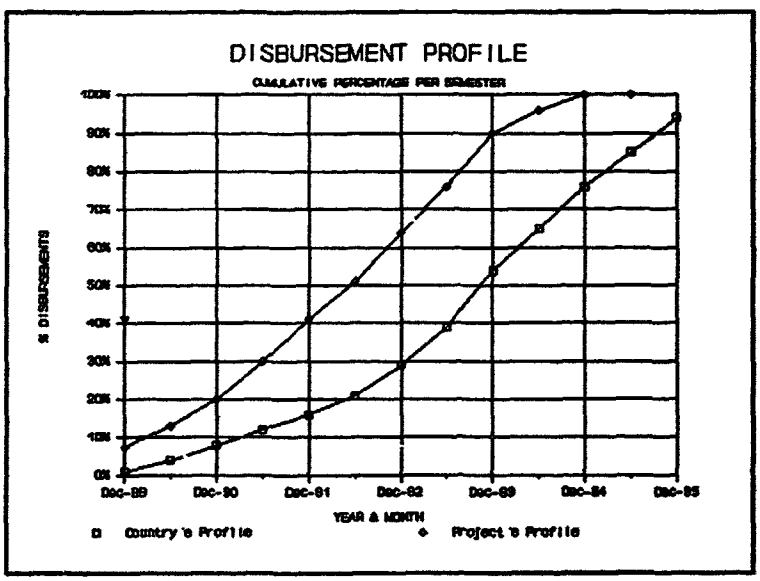
ANGAT WATER SUPPLY OPTIMIZATION PROJECT

ESTIMATED SCHEDULE OF LOAN DISBURSEMENTS 1/

Bank's Fiscal Year	Year and Semester Ending	--- US$ million --- Disbur-sements 1]	Cumulative Disbur-sements	DISBURSEMENT PROFILE OF Country	Project
1990	31-Dec-89	3.0	3.0	1.0%	7.5%
	30-Jun-90	2.2	5.2	4.0%	13.0%
1991	31-Dec-90	2.8	8.0	8.0%	20.0%
	30-Jun-91	4.0	12.0	12.0%	30.0%
1992	31-Dec-91	4.4	16.4	16.0%	41.0%
	30-Jun-92	4.0	20.4	21.0%	51.0%
1993	31-Dec-92	5.2	25.6	29.0%	64.0%
	30-Jun-93	4.8	30.4	39.0%	76.0%
1994	31-Dec-93	5.6	36.0	54.0%	90.0%
	30-Jun-94	2.4	38.4	65.0%	96.0%
1995	31-Dec-94	1.6	40.0	76.0%	100.0%
	30-Jun-95	0.0	40.0	85.0%	100.0%



1/ Includes the initial disbursement for the Special Account

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ANGAT WATER SUPPLY OPTIMIZATION PROJECT

MWSS'S DEVELOPMENT PROGRAM

INTRODUCTION

1. Under the leadership of President Corazon C. Aquino, the MWSS Management with the support of the Board of Trustees has been carrying out plans and programs to increase the supply of water, improve the provision of water and sewerage services and uplift the living conditions of the 8.3 million population within its service area. A major part of this program is the completion by 1994 of the Angat Water Supply Optimization Project (AWSOP). This project will provide an additional supply of about 15 cu.m. of water per second, or 1.3 million cu.m. of water per day and will serve about 3.0 million people more by 1994.

2. Complemented by the turbo-generator, tunnel and aqueduct capacities already built-in the AWSOP to be able to handle an additional nine cubic meter of water per second from the Umiray Basin, Angat will double MWSS present capacity ensuring adequate water supply to areas in Metropolitan Manila, Cavite, Rizal and Bulacan under MWSS jurisdiction which will be sufficient up to year 2000. Their service area shall then consist of five cities and about 43 municipalities. However, this huge expansion to provide adequate water supplies by the year 2000 to more than 12 million people requires also a similar commitment and planning to develop the System, and improve its staff, its planning activities and facilities, in such a way that the development and improvement of the institution will surpass and precede the physical development program.

WATER SUPPLY

3. It is estimated that about 84% of the population in the MWSS Service Area is serviced, of which 55% is served directly through house service connections. A number of those served by public faucets and indirect service connections would require direct house service connections sooner or later. Since additional water will be available within the next three years, either from the water saved as a result of the two Rehabilitation Projects (MWSRP I and MWSRP II) and from the Angat Water Supply Optimization Project, MWSS expects to provide house connections to most of the houses requesting water connections within the distribution system, and would extend the water pipelines to new areas as well.

4. This will considerably expand the population served, and share the benefits of water supply among increasing number of people within the MWSS service area. The percentage of population benefitting from about 360,000 new house service connections is expected to increase to 65% by 1990, 70% by 1992 and 75% by 1994.

5. There are two main water treatment plants that had been operating for many years. Balara had been operating at its full capacity of 1320 MLD since 1979 while La Mesa Treatment Plant is operating since 1984 at 58-60% of its capacity of 1500 MLD. There are several improvements in the operations of Balara which are planned to be implemented during the next four years. Initially MWSS requested grant financing from JICA to do the feasibility study for the rehabilitation of Balara Treatment Plant in order to increase its present capacity by 15%. Existing aqueducts and tunnels will be checked for possible slime formation and defects. A metering system that will accurately measure raw and treated water going into and coming out of the water treatment plants shall be implemented. The Second La Mesa By-pass from Bicti-Novaliches Aqueducts to Novaliches-Balara Aqueducts will be implemented to reduce seepage/leakage and control evapo-transpiration within the Novaliches Reservoir.

6. There are several communities in the MWSS service area that are on the fringes or too far away to be connected to the central distribution system. For these communities, MWSS plans to expand their water supply using underground water or other water resources. This includes in particular the nine

municipalities in the Rizal Province Water Supply Improvement Project, that is now undergoing feasibility study. The implementation of this project will start in 1990 and would be completed in 1992. This also includes the reactivation of the Wawa Dam and construction of a new treatment plant in Rodriguez (Montalban) to service the towns of Rodriguez and San Mateo.

NON-REVENUE WATER

7. The greatest challenge to MWSS Management at present is the problem of controlling Non-Revenue Water (NRW). Reducing the NRW is a priority, and two Rehabilitation Projects (to be completed respectively in 1991 and 1993) are being undertaken simultaneously in order to reduce NRW to about 30% in more than 100 of the 120 zones subdividing the existing MWSS Service Area. The Rehabilitation Projects are upgrading the deteriorated service pipes and mainlines (up to 250 mm in diameter) by locating and repairing leaks, replacing galvanized iron service pipes with non-corroding materials and repairing/replacing water meters, among others.

8. The Rehabilitation Projects will also develop an efficient metering program and reduce meter reading errors. These, coupled with revitalized regular maintenance activities, are Management's response to the NRW challenge. The Rehabilitation Projects were planned to precede the Angat Water Supply Optimization Project which is expected to spread-even adequate water pressure within MWSS's Service Area. The lessons learned from the Manila Water Supply Project II, which subjected the old and rusty distribution lines to higher pressure, thereby causing more leaks, has now become a useful planning guide. Rehabilitation Projects are now tightening up the distribution system to receive additional water supply from AWSOP.

9. MWSS is also planning to complete by 1993 the following additional improvements in the operating system: (a) in order to attain a more evenly distribution of water pressure, MWSS is planning to install pressure reducing valves in secondary mains. These pressure regulating valves will also facilitate implementation of water conservation measures, particularly the throttling of valves during the dry season. Key points of the distribution system will be identified and continuously monitored for pressure changes; (b) a Computer Model will be used to simulate field conditions with flow and pressure readings at key points as inputs; and (c) enhanced remote sensing of the water sources, treatment and distribution network will be realized through the AWSOP.

10. The installation of a Telemetering System by 1993 is included in the AWSOP. This will enable remote monitoring of actual water flows, pressures and levels at strategic points of the distribution network. Monitoring will be undertaken at a Monitoring Center with the data transmitted through radio and/or cable. With these improvements, MWSS is presently targeting to increase the revenue water from 41% in 1988 to 47% in 1990 and 57% in 1993.

SEWERAGE AND SANITATION

11. The Sewerage and Sanitation Master Plan for Metro Manila has been completed in 1978. The expansion of the sewerage system however has been lagging behind expansion of water supply. Of the total existing MWSS water customers of 583,000 only about 77,000 or 13% of households in the service area are served by the existing MWSS sewerage system. The ongoing rehabilitation of the sewer mains in Manila (Central) sewerage system will be finished this year. The construction of the 1800 mm Manila Bay Outfall and the new Tondo Pumping Station and the rehabilitation of the seven sewer lift stations has been completed. However, unless adequate measures are taken to properly dispose of the additional sewage, the benefits of water supply will not be fully achieved and environmental degradation and health problems may increase in some areas.

12. For this purpose, MWSS is completing the detailed engineering of the second sewerage and sanitation project, METROSS II. This project which is expected to start by 1991 and to be completed in 1995 will provide sewerage in the southern portion of the MWSS service area. Starting in 1989, MWSS is also expanding its septic tank maintenance program, through a 10-year cycle desludging of septic tanks (free of charge) involving a total of 620,000 septic tanks or about 62,000 septic tanks per year. To date, a total of 186,025 household septic tanks has been surveyed by the Sewerage System Department, and a total of 17,891 septic tanks have been desludged. MWSS has also an ongoing program for the design

and development of appropriate septic tanks sludge disposal facility.

13. MWSS has requested the United Nation Development Project (UNDP) to finance a feasibility study for the development of appropriate waste disposal facility. With the industrial development of Metro Manila, there is serious concern about industrial pollution, which, if not controlled, will increase the pollution of ground water, rivers and the Manila Bay. MWSS will seek grant financing to study this problem, establish regulations for the discharge of heavy metals or other dangerous substances, and rationalize future industrial location considering such problems.

WATER DEMAND

14. MWSS requires a more accurate estimate of water demand, not only to plan its investments, but even more to ensure that revenues, which depend on water sales, are adequate to meet the financial needs of the System. This will involve, among others, verification of some of the key parameters of water demand in the MWSS service area, most notably the percentage of population already served, the evaluation of current use of groundwater including assessment of the pollution and cost to users of underground water.

15. MWSS also plans to intensify the campaign against illegal connections and device a new water service connection program that will reduce the time to provide water service connections to MWSS customers.

TARIFFS

16. The regular examination of the tariff, both the level and the structure, will be maintained vigorously over the years. The tariff level may be adjusted upward over the years to partially fill up any shortfall in internal cash generation to meet its financial requirements. Due to the planned improvements of NRW it is expected that tariff increases may be equal to the inflation rate. The tariff structure would continue to promote water conservation, with higher unit prices for excessive water consumption, and would remain affordable to low-income customers. Cross-subsidy among consuming groups will be continued.

BILLING AND COLLECTION

17. The billing and collection functions have registered gradual improvement since 1986. Billing efficiency have increased and collection efficiency have likewise increased from 88% in end 1986 to 94% in end of 1988.

18. Improvements in the billing and collection policies and systems reduced billing time and resulted in higher collection. These improvements were accompanied by the conversion of manual meter reading to the computerized ROVER meter reading and billing system, that reduced billing time from 14 days to 3 days. The installation of this system would be supplemented with a program to computerize by 1992 the revenue collection and other functions at the Branch Offices.

19. Major billing and collection programs being initiated, and are expected to be substantially completed by 1993, as follows:

For Billing:

a). Acceleration of house service connection activities including revision of connection policies to expedite such connections;

b). Enhancement of the Rover System and Facilities to provide more effective data control and monitoring of services;

c). Increased metering and meter replacement activities to reduce billing based on average rather than actual consumption;

d). Expansion of consumption studies per industry groupings, to identify substantial variances in metered consumption, and investigate their causes.

For Collection:

a). Continue the opening of more branches and extension offices;

b). Rotation Program among supervisors/managers;

c). Intensified Government Arrears Program in coordination with Department of Budget

and Management, Department of Finance and Bureau of Treasury. This program which includes account reconciliations with government offices and a budget "earmarking" strategy through the Executive Branch, shall reduce government arrears to 4 month receivables level by the end of 1990.

20. The target for the future years is to further improve billing efficiency. Collection efficiency will be increased to 95% of current billing, and recovery of collectible arrears at a level of 10% of total collection yearly.

STAFF TRAINING AND DEVELOPMENT

21. In support of the corporate vision and programs, the human resource development efforts of the System with the staff support of the Human Resource Development Department (HRDD) will focus on the following program thrusts for 1990-94.

a) Organization Commitment and Positive Work Attitudes Building. A critical element in the move for a transformation of the System, renewal of commitments to organizational goals and the building of positive work attitudes among all personnel will be a major and continuing concern of the Department.

b) Operational Skills Competency Development. Because of the continuing expansion of System and the concern for high operational standards including the reduction of non-revenue water, the training and development of skilled workers to operate and maintain the water supply and sewerage facilities shall be one of the most important undertakings of the Department.

c) Managerial and Supervisory Skills Development and Advancement. The pivotal role of managers and supervisors to achieve organization efficiency and effectiveness make them a priority concern of the Department. While quarterly executive and supervisory meetings were conducted in the past few years, the System will direct its training efforts more and more towards strengthening specific supervisory skills which are particularly critical to MWSS day-to-day operations.

d) Developing Skills and Behavioral Patterns for Effective Customer Relations and Collection Techniques. As a public service institution, the manner by which the day-to-day business with people is conducted by each employee goes a long way towards building up public trust and confidence in the System. Such is the value of effective customer relations that it shall be a continuing major concern of the System. Collection shall be trained in effective collection techniques.

e) Upgrading of Professional/Technical Expertise. If managers provide the brains for the organization, its professional and technical staff may be said to be its backbone. The diversity of fields of expertise would require not only in-house training but also external training, local and overseas scholarships, and training/ exchange programs. To meet the projected increased in computer applications in the System, training would focus on relevant computer courses during the period.

f) Training Impact Evaluation. The real test of effectiveness of training ultimately rests on the amount of transfer of knowledge and skills learned to the job situation. For this reason, the improvement of follow-up and monitoring systems and conduct of research and evaluation studies surface concrete indicators of training effectiveness shall be a major interest of the Department.

g) Manpower Planning and Development. While a career planning and development program serves as a means of mapping out manning needs for projections and preparing those who have the potential to assume positions of higher responsibility, it significantly contributes also towards motivating personnel in the performance

of their tasks in the System. HRDD would gradually proceed with its Personnel Skills Inventory and Employee Data Bank, Career Succession Tables and Implementation of Career Development Plans.

LABOR-MANAGEMENT INCENTIVE PROGRAM

22. A system of labor-management cooperation for increased productivity and a system for sharing the resulting incremental monetary benefits have been established to serve as incentive to every employee's ideas and cooperative effort. The system is designed to increase revenues and savings, and decrease expenses through cooperation, group teamwork, cost consciousness and high quality of work among employees.

23. To realize the program's objectives, a Labor-Management Productivity Committee has been organized in each Department, Sector, and Project Manager's Office. It is composed of the Manager as Chairman with the Division Chiefs and equal number of elected representatives of labor as members. This Committee filters all the productivity ideas submitted by the employees within the Department/Sector/Project Manager's Office and implements the same, if no action is required from higher authorities. Otherwise, the ideas are presented to the Labor-Management Productivity Screening Committee under each Area. This Committee is composed of the Deputy Administrators of the area concerned as Chairman, with all the Managers and an equal number of elected representatives of labor within the Area as members. At present, there are 33 Labor-Management Productivity Committees and seven Area Labor-Management Productivity Screening Committees.

24. The Area Screening Committee reviews, screens, or channels to other area screening committee all suggestions designed to increase productivity or reduce non-revenue water waste and unnecessary expenses. If the idea submitted is implementable within its level, then it is implemented within its jurisdiction. Afterwards, it is disseminated to other areas where it may be applicable.

25. Employee ideas/suggestions which cannot be resolved by the Area Screening Committee are forwarded to the Executive Committee. This Committee is chaired by the Administrator with the Deputy Administrators as members. It decides on the productivity idea proposed, decides on its implementation, or, if needed, recommends for approval to the Board of Trustees the action required for improved productivity.

26. The productivity incentive benefits to be derived from this program will continue to accrue to all MWSS employees over and above the salary standardization program of the government as mandated by the Constitution. The increased productivity is shared monthly in this fashion: (a) 70% goes to MWSS; and (b) 30% is shared by all employees in proportion to their gross pay and attendance. Seventy percent of the employee's share is paid monthly. The balance of 30% goes to a reserve pool, payable at during lean months.

Approved:

Luis V. Z. Sison

Administrator

August 4, 1989

Original is in Project File.

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

WATER AND SEWERAGE CHARGES

Water and Sewerage Tariffs

1. MWSS tariff include two components: the water rate and the CERA (Compensation Exchange Rate Adjustment), a charge increased automatically with the revaluation of foreign debt. MWSS tariffs are progressive (increased price with increased water usage) to discourage wasteful use of water, encourage conservation and cross subsidize low income users, facilitating access to safe water to the urban poor. The average water rate in 1988 was about P 4.4 per ton. The average rate for domestic consumers was about 80% of the average rate, while average commercial and industrial rates were 132% and 176% of the average rate.

2. The results of the progressive tariff are reflected in MWSS's billing statistics. In December 1988, domestic consumers were 86.1% of total, used 61.6% of the water sold, and paid 47.9% of MWSS's revenues. Commercial consumers were only 12.7% in number, but used 21.6% of the water and provided 28% of the revenues. Industrial consumers are very few (0.6%), used 6.9% of the water and provided 11.6% of the revenues. Government services, which are billed according to the kind of service (domestic, commercial or industrial), are 0.8% of the accounts, use 9.9% of the water and are 12.5% of the billing.

3. CERA charges vary with the ratio of the current foreign debt service per ton of water sold, to the debt service per ton for 1984 (the reference year). CERA surcharges are equivalent now to about 10% of the average water tariff.

4. Sewerage charges, levied on those houses that have sewerage connections, are 50% of the water charges, which is reasonable. The remaining population pays environmental charges equal to about 10% of the water consumption. These charges are used to expand the sewerage system, clean-up septic tanks and implement other environmental protection measures, including minor drainage and flood control.

5. An analysis of the new water tariff (approved in July 1989) for domestic, industrial and commercial consumers is shown in Tables 1A, 1B and 1C, respectively. This analysis is based on the histogram of water billing for September 1988. These tables show the total consumption, the average consumption, the total bill and the average bill (pesos per ton of water) for each group of consumers and compare them with the previous rate. MWSS has two domestic rates: one for domestic consumers which have small commercial and industrial activities in the same premises, and a general domestic rate for the remaining domestic consumers. Since these two tariffs differ very little (P 0.10 per ton, less than 2% of the average), and to show all domestic consumers in the same graph, the analysis assumes that the general domestic tariff is applied to all domestic consumers.

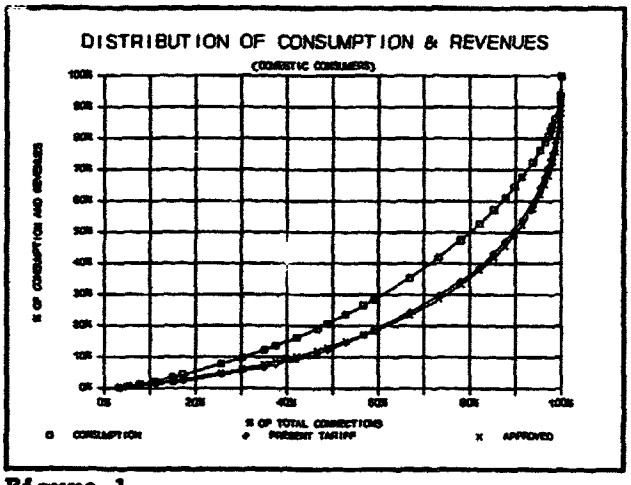


Figure 1

6. The 60% lowest consumers in the domestic category (normally the low-income population) use less than 30% of the domestic water consumption; conversely 70% of the water is used by the 30% larger consumers (Figure 1). Because of the progressivity of MWSS's tariff, just 20% of the high-water consumers (normally the high income population) were billed 80% of the total domestic billing (lowest line in Figure 1). The approved tariffs

(para. 8) would reduce slightly the burden for small users (low-income population), which would now pay about P 16 for 10 tons of water per month, and make charges more equitable.

7. Improvements in MWSS's tariff structure. The recently approved tariff included many improvements, which are satisfactory to the Bank, in particular:

(a) fixed charges were applied to wide ranges of consumption. This resulted in high unit charges for consumptions at the lowest end of a range and low unit charges for higher consumption within that range. For domestic consumers, a minimum increase in consumption from 24.9 to 25.0 tons per month increased their monthly payment by 53%, from P 30 to P 46, Figure 2. The same problem existed at other intervals and for small consumption by commercial and industrial establishments.

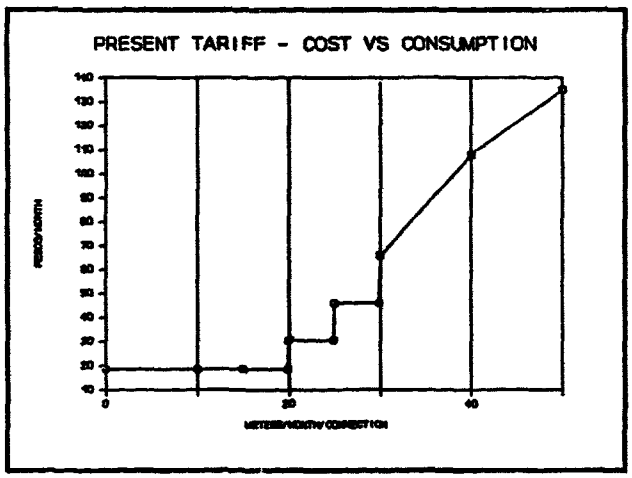
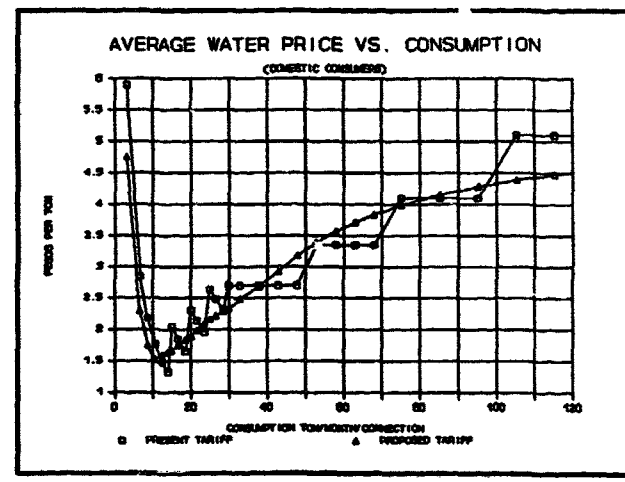


Figure 2

(b) 26% of the domestic consumers used less than 15 tons per month, but had to pay for at least 15 tons per month. Low water consumption is due to low income, but also to lack of indoor plumbing. This resulted in high rates in pesos per ton for the lowest consumers (see Figure 3). Therefore, MWSS reduced the minimum to 10 tons per month, (i.e., 42 lcd for a family of 8 persons, which is reasonable). About 11% of the population uses less than 10 tons per month per connection. The minimum charge per month under the approved tariff was reduced to P 16 from P 18.60 (Table 1A).

8. Tariff Improvements. The recently-approved tariffs provide for progressive charges, which increase rapidly with consumption (from P 1.6 to P 6 between 10 and 100 tons of water per month per connection). The initial consumption intervals, set at a subsidized price, facilitate the use of water needed by the urban poor, but there is no need to discriminate excessive consumption (presently based on 8 ranges of consumption), which should be charged at the same (maximum) price. Since 85% of the domestic connections use less than 50 tons per month, this is an excessive level, equivalent to 210 lcd for a family of 8 persons. Setting the same unit price for excessive consumption would also result in a lower maximum price, more comparable with the marginal cost. For example, a similar tariff with a minimum of P 15 for 10 tons, and unit prices of P 2.0, P 2.6, P 3.2 and P 4.0 for the next consumption intervals of 5, 5, 10 and 10 tons respectively, would provide the same revenues as the approved tariff, but the maximum rate would be only P 5.40 per ton for excessive consumption above 40 tons. Another improvement would be to reduce the maximum charges for industrial consumption (and to a lesser extent for commercial consumption), which are P 8.15 per ton. This high price reduces the price to be paid by low income users, but encourages commercial and industrial users to continue depleting and damaging the aquifer instead of using MWSS's water. This improvement would only be possible when NRW is reduced to less than 40% (reducing the average cost of water and increasing its availability), particularly when the water supplied by the project is available in 1992, ending water rationing, and allowing more water to be supplied for non-domestic consumers. MWSS is aware of the need for these improvements and its Corporate Planning Department is analyzing these matters for the 1990 tariff.



MWSS'S APPROVED WATER TARIFF

TABLE 1.1 (DOMESTIC)

	CONSUMPTION PER MONTH ADDITIONAL	CUMULATIVE	TARIFF	AMOUNT AT INTERVAL
Up to	10.0	10.0	16.00 /Conn.	16.0
Next	10.0	20.0	2.15 /Cu.M	37.5
Next	10.0	30.0	2.70 /Cu.M	64.5
Next	10.0	40.0	3.25 /Cu.M	97.0
Next	10.0	50.0	3.80 /Cu.M	135.0
Next	10.0	60.0	4.35 /Cu.M	178.5
Next	20.0	80.0	4.90 /Cu.M	276.5
Next	20.0	100.0	5.45 /Cu.M	385.5
	More		6.00 /Cu.M	

TARIFF ANALYSIS SUMMARY:

Avg. Consumption, Ton/Month	36.82
Avg. Bill (Pesos/Month):	112.12
Avg. Tariff (Pesos/Ton):	3.04
Avg. Tariff Increase:	-7.82%
Total Revenues (Mill.Pesos)	56.56

NO. OF SERVICES	CONSUMPTION 1000 TON	AVG. CONSUMPTION TON PER MONTH	CUMULATIVE NO. OF SERVICES	CUMULATIVE CONSUMPTION MILL.TON	AVERAGE WATER TARIFF Pesos/Ton	BILL PER CONNECTION Pesos	%INCREASE THIS BILL ON THE PRESENT BILL	BILLED AMOUNT 1000 Pesos	CUMULAT. BILLED AMOUNT 1000 Pesos	CUMULATIVE PERCENTAGE OF SERVICES	OF CONSUMPTION	OF REVENUES
16.243	51.220	3.15	16.24	51.2	5.07	16.00	-14.0%	259.9	260	3.2%	0.3%	0.5%
9.932	64.934	6.54	26.18	116.2	2.45	16.00	-14.0%	158.9	419	5.2%	0.6%	0.7%
13.085	111.568	8.53	39.26	227.7	1.88	16.00	-14.0%	209.4	628	7.8%	1.2%	1.1%
16.765	176.331	10.52	56.03	404.1	1.63	17.11	-8.0%	286.9	915	11.1%	2.2%	1.6%
20.010	250.393	12.51	76.04	654.4	1.71	21.40	15.1%	428.3	1343	15.1%	3.5%	2.4%
10.956	153.384	14.00	86.99	807.8	1.76	24.60	32.3%	269.5	1613	17.2%	4.3%	2.9%
42.350	638.250	15.00	129.54	1446.1	1.78	26.75	-12.6%	1138.2	2751	25.7%	7.8%	4.9%
23.527	388.276	16.50	153.07	1834.4	1.82	29.98	-2.0%	705.4	3456	30.3%	9.9%	6.1%
23.984	449.669	18.50	177.05	2278.0	1.85	34.27	12.0%	822.0	4278	35.1%	12.3%	7.6%
12.716	254.320	20.00	189.77	2532.3	1.88	37.50	-18.5%	476.9	4755	37.6%	13.6%	8.4%
23.130	497.180	21.50	212.90	3029.5	1.93	41.54	-9.7%	960.7	5716	42.2%	16.3%	10.1%
22.634	531.558	23.48	235.53	3561.1	2.00	46.91	2.0%	1061.7	6778	46.7%	19.2%	12.0%
11.378	284.450	25.00	246.91	3845.5	2.04	51.00	-22.5%	580.3	7358	48.9%	20.7%	13.0%
20.195	534.991	26.49	267.11	4380.5	2.08	55.03	-16.4%	1111.3	8469	52.9%	23.6%	15.0%
19.094	543.989	28.49	286.20	4924.5	2.12	60.42	-8.2%	1153.7	9623	56.7%	26.5%	17.0%
11.754	352.620	30.00	297.95	5277.1	2.15	64.50	-20.4%	758.1	10381	59.1%	28.4%	18.4%
39.454	1298.996	32.92	337.41	6576.1	2.25	74.00	-16.8%	2919.8	13301	66.9%	35.4%	23.5%
31.573	1197.180	37.92	368.98	7773.3	2.38	90.23	-11.9%	2848.9	16150	73.1%	41.8%	28.6%
24.862	1067.051	42.92	393.84	8840.4	2.52	108.09	-6.7%	2687.4	18837	78.1%	47.6%	33.3%
20.175	966.119	47.89	414.02	9806.5	2.65	126.97	-1.8%	2561.6	21399	82.1%	52.8%	37.8%
15.977	845.304	52.91	429.99	10651.8	2.79	147.65	-16.7%	2359.0	23758	85.2%	57.3%	42.0%
12.605	730.262	57.93	442.60	11382.0	2.93	169.51	-12.7%	2136.7	25895	87.7%	61.3%	45.8%
10.082	634.476	62.93	452.68	12016.5	3.06	192.86	-8.5%	1944.5	27839	89.7%	64.7%	49.2%
8.205	557.636	67.96	460.89	12574.2	3.20	217.52	-4.5%	1784.7	29624	91.4%	67.7%	52.4%
11.851	891.098	75.19	472.74	13465.3	3.36	252.94	-18.0%	2997.6	32621	93.7%	72.5%	57.7%
8.119	692.322	85.27	480.86	14157.6	3.58	305.23	-12.7%	2478.2	35100	95.3%	76.2%	62.1%
5.430	516.965	95.21	486.29	14674.5	3.77	359.37	-7.9%	1951.4	37051	96.4%	79.0%	65.5%
3.790	399.004	105.28	490.08	15073.5	3.96	417.17	-22.3%	1581.1	38632	97.1%	81.1%	68.3%
2.735	315.188	115.24	492.81	15388.7	4.14	476.95	-18.8%	1304.5	39936	97.7%	82.8%	70.6%
1.933	242.301	125.35	494.74	15631.0	4.29	537.60	-15.9%	1039.2	40976	98.1%	84.1%	72.4%
2.698	377.032	139.74	497.44	16008.1	4.47	623.97	-12.4%	1683.5	42659	98.6%	86.2%	75.4%
5.357	1068.536	199.47	502.80	17076.6	4.92	982.29	-3.4%	5262.1	47921	99.7%	91.9%	84.7%
1.002	373.527	372.78	503.80	17450.1	5.42	2022.19	6.4%	2026.2	49947	99.9%	93.9%	88.3%
0.657	1125.593	1713.23	504.46	18575.7	5.87	10064.89	15.2%	6612.6	56560	100.0%	100.0%	100.0%
504.458	18575.7	36.82			3.04	112.12	-7.8%	56560.1				

TABLE 1.2 (COMMERCIAL)

CONSUMPTION PER MONTH ADDITIONAL	CUMULATIVE	TARIFF	AMOUNT AT INTERVAL
Up to 25.0	25.0	152.500 /Conn.	152.5
Next 300.0	325.0	6.100 /Cu.M	1982.5
Next 675.0	1000.0	6.100 /Cu.M	6100.0
Next More		6.400 /Cu.M	

TARIFF ANALYSIS SUMMARY:

Avg. Consumption, Ton/Month	195.82
Avg. Bill (Pesos/Month):	1238.61
Avg. Tariff (Pesos/Ton):	6.33
Avg. Tariff Increase:	8.26%
Total Revenues (Mill.Pesos)	62.26

NO. OF SERVICES (1000)	CONSUMPTION 1000 TON	AVG. CONSUMPTION TON PER MONTH	CUMULATIVE NO. OF SERVICES	CUMULATIVE CONSUMPTION MILL.TON	AVERAGE WATER TARIFF Pesos/Ton	BILL PER CONNECTION Pesos	BILLED AMOUNT 1000 Pesos	CUMULAT. BILLED AMOUNT 1000 Pesos	CUMULATIVE PERCENTAGE OF SERVICES	CUMULATIVE PERCENTAGE OF CONSUMPTION	CUMULATIVE PERCENTAGE OF REVENUES
15.967	246.320	15.43	15.967	246.3	9.89	152.5	2435.0	2435.0	31.8%	2.5%	3.9%
13.408	490.818	36.61	29.375	737.1	6.10	223.3	2994.0	5429.0	58.4%	7.5%	8.7%
10.011	702.881	70.21	39.386	1440.0	6.10	428.3	4287.6	9716.5	78.4%	14.6%	15.6%
4.994	693.794	138.93	44.380	2133.8	6.10	847.4	4232.1	13948.7	88.3%	21.7%	22.4%
4.346	1888.523	434.54	48.726	4022.3	6.10	2650.7	11520.0	25468.7	96.9%	40.9%	40.9%
1.539	5820.578	3782.05	50.265	9842.9	6.32	23905.1	36790.0	62258.7	100.0%	100.0%	100.0%
50.265	9842.91	195.82			6.33	1238.6	62258.7				

TABLE 1.3 (INDUSTRIAL)

CONSUMPTION PER MONTH ADDITIONAL	TOTAL	TARIFF PESOS	TOTAL BILL PESOS
Up to 25.0	25.0	170.000 /Conn.	170.0
Next 300.0	325.0	6.800 /Cu.M	2210.0
Next 675.0	1000.0	6.800 /Cu.M	6800.0
Next More		8.150 /Cu.M	

TARIFF ANALYSIS SUMMARY:

Avg. Consumption, Ton/Month	314.68
Avg. Bill (Pesos/Month):	2402.17
Avg. Tariff (Pesos/Ton):	7.63
Avg. Tariff Increase:	0.38%
Total Revenues (Mill.Pesos)	14.76

NO. OF SERVICES (1000)	CONSUMPTION 1000 TON	AVG. CONSUMPTION TON PER MONTH	CUMULATIVE NO. OF SERVICES	CUMULATIVE CONSUMPTION MILL.TON	AVERAGE WATER TARIFF Pesos /Ton	BILL PER CONNECTION Pesos	BILLED AMOUNT 1000 Pesos	CUMULAT. BILLED AMOUNT 1000 Pesos	CUMULATIVE PERCENTAGE OF SERVICES	CUMULATIVE PERCENTAGE OF CONSUMPTION	CUMULATIVE PERCENTAGE OF REVENUES
1.273	19.58	15.38	1.273	19.6	11.05	170.0	216.4	216	20.7%	1.0%	1.5%
3.043	166.40	54.68	4.316	186.0	6.80	371.8	1131.5	1348	70.2%	9.6%	9.1%
0.922	126.32	137.01	5.238	312.3	6.80	931.7	859.0	2207	85.2%	16.2%	15.0%
0.524	159.11	303.65	5.762	471.4	6.80	2064.8	1082.0	3289	93.8%	24.4%	22.3%
0.176	122.72	697.30	5.938	594.1	6.80	4741.6	834.5	4123	96.6%	30.7%	27.9%
0.207	1339.56	6471.30	6.145	1933.7	7.94	51391.1	10638.0	14761	100.0%	100.0%	100.0%
6.145	1933.69	314.68			7.63	2402.2	14761.4				

TABLE 1.4 - SUMMARY RESULTS FOR THE APPROVED TARIFF

CATEGORY	NO. OF SERVICES (1000)	CONSUMPTION 1000 TON	AVG. CONSUMPTION TON PER MONTH	AVERAGE WATER TARIFF Pesos/Ton	BILL PER CONNECTION Pesos	BILLED AMOUNT 1000 Pesos	TARIFF INCREASE OVER PRESENT TARIFF	PERCENTAGE OF SERVICES	PERCENTAGE OF CONSUMPTION	PERCENTAGE OF REVENUES
Domestic	504.46	18575.72	36.82	3.04	112.12	56560.1	-7.82%	89.94%	61.20%	42.34%
Commercial	50.27	9842.91	195.82	6.33	1238.61	62258.7	8.26%	8.96%	32.43%	46.61%
Industrial	6.15	1933.69	314.68	7.63	2402.17	14761.4	0.38%	1.10%	6.37%	11.05%
Total	560.87	30352.33	547.32	4.40	238.17	133580.1	0.01%	100.00%	100.00%	100.00%

MWSS'S FINANCIAL PROJECTIONS **ANNEX 10 - Page 1**

TABLE 1 INCOME STATEMENT 1]

Million Pesos

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Population Under MWSS-1000	8233	8468	8712	8967	9228	9454	9685	9925	10168	10417	10673
% with Water Connections	54.8%	56.8%	58.5%	61.1%	63.7%	67.1%	70.6%	73.5%	76.5%	77.9%	79.2%
% Served by Public Faucets	6.8%	7.0%	7.2%	7.3%	7.2%	6.9%	6.6%	6.3%	5.7%	5.1%	4.9%
% with Sewerage Connections	8.5%	8.1%	7.7%	7.7%	7.7%	8.0%	8.2%	8.5%	8.8%	8.9%	8.9%
Water Connections-1000	501.2	534.3	566.5	608.6	652.8	704.9	759.3	810.9	864.6	901.3	939.3
Volume of Water Billed-Mill.Tons	310.8	336.5	359.4	378.6	407.9	444.1	484.6	528.6	575.0	614.2	650.6
Volume Billed (lpcd)	189	192	193	189	190	192	194	198	202	207	211
Water Production-Million Tons	904.5	862.6	878.8	856.5	849.7	862.3	881.1	903.6	927.5	952.2	971.0
Non-Revenue Water (Unaccounted-for	65.6%	61.0%	59.1%	55.8%	52.0%	48.5%	45.0%	41.5%	38.0%	35.5%	33.0%
# of Sewerage Connections-1000	77.4	76.1	74.3	76.5	78.8	83.5	88.6	93.9	99.5	102.5	105.6
Volume of Sewerage Billed-Mill.Ton	59.1	60.7	61.0	62.0	64.5	68.0	72.9	78.0	83.5	88.1	91.6
Average Water Tariff- P$/Ton	3.99	4.02	4.36	4.63	4.99	5.42	5.81	6.26	6.87	7.32	7.60
OPERATIONAL REVENUES											
Water Revenues	1252.0	1362.6	1578.0	1763.4	2116.4	2419.6	2829.3	3329.3	3968.6	4520.9	4969.3
Water Charges	1241.5	1351.9	1566.6	1751.3	2103.0	2405.2	2813.7	3311.7	3948.6	4498.7	4946.6
Maintenance Service Charges	10.4	10.7	11.3	12.1	13.4	14.3	15.5	17.5	19.9	22.2	22.7
Flat Rate Charges	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sewerage Revenues	233.7	269.9	303.9	323.7	380.5	443.2	514.0	599.9	710.2	804.8	877.9
Sewerage Revenues	128.1	134.7	147.1	148.5	176.9	202.7	232.6	268.8	315.4	354.9	383.2
Environmental Charges	105.6	135.2	156.8	175.1	203.6	240.5	281.4	331.2	394.9	449.9	494.7
Other											
Other Operational Revenues	8.0	24.2	23.3	23.5	23.8	24.0	24.2	24.5	24.7	25.0	25.2
Less Franchise Tax	0.0	0.0	0.0	41.2	49.7	57.4	66.0	77.5	92.2	104.9	115.1
TOTAL OPERATING REVENUES	1493.7	1656.7	1905.2	2069.4	2471.0	2829.4	3301.5	3876.2	4611.3	5245.8	5757.3
WATER SUPPLY:	459.0	500.2	576.9	650.9	729.4	819.6	928.2	1041.1	1165.9	1304.8	1456.1
Personnel	174.4	229.3	306.4	352.5	395.9	444.5	506.7	563.8	627.3	697.9	776.5
Power	147.0	124.7	105.8	115.2	129.6	146.2	165.4	186.8	211.2	238.8	268.2
Chemicals	49.8	40.7	52.8	56.3	60.9	67.4	74.7	82.7	91.7	101.7	112.0
Materials	26.4	31.2	24.4	28.1	32.2	37.1	42.4	48.0	54.2	60.3	67.0
Compensation Power Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	9.5	14.7	19.5
Other	61.5	74.4	87.5	98.7	110.8	124.4	139.0	154.7	172.1	191.4	212.9
SEWERAGE:	65.3	84.5	81.6	93.2	105.2	118.7	133.7	149.9	168.1	188.1	210.0
Personnel	38.5	51.1	53.4	61.8	69.7	78.7	88.3	98.8	110.5	123.5	138.1
Power	10.6	12.1	11.2	12.7	14.8	17.2	20.2	23.6	27.6	31.7	36.0
Materials and Others	16.2	21.4	17.0	18.8	20.7	22.8	25.1	27.5	30.1	32.9	35.9
Provision for Doubtful Accounts	59.5	65.3	75.0	67.5	73.6	72.2	85.8	98.4	112.8	127.8	143.1
OPERATING EXPENSES	583.8	650.0	733.5	811.7	908.2	1010.5	1147.7	1289.4	1446.8	1620.6	1809.2
INCOME BEFORE DEPRECIATION	909.9	1006.7	1171.7	1257.7	1562.8	1818.9	2153.8	2586.8	3164.5	3625.2	3948.1
Depreciation	154.5	218.0	237.7	272.5	362.2	446.4	572.1	687.4	838.7	968.2	1071.4
OPERATING INCOME	755.4	788.7	934.0	985.2	1200.6	1372.5	1581.7	1899.4	2325.8	2656.9	2876.8
Interest Income	107.9	97.7	167.3	108.0	25.8	25.2	34.5	47.4	71.3	96.8	144.5
Other Income (net)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operational Interest	9.0	361.0	562.0	762.8	318.2	384.7	537.1	515.5	469.6	866.6	913.9
Amortization Deferred Charges	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taxes	0.0	0.0	0.0	0.0	311.5	374.6	423.6	522.0	639.4	613.1	725.4
NET INCOME FOR YEAR	854.3	525.4	538.9	330.4	596.6	638.3	655.5	909.3	1288.0	1274.1	1382.0
Amortization Debt Revaluation Loss		0.3	0.5	0.8	4.8	26.7	80.4	176.1	323.5	470.6	457.1
NET INCOME AFTER DEBT REVALUATION	854.3	525.1	538.3	329.6	591.8	611.7	575.0	733.2	964.5	803.5	924.9
Increase in Volume of Water Sold		8.3%	6.8%	5.3%	7.7%	8.9%	9.1%	9.1%	8.8%	6.8%	5.9%
% Tariff Increase		0.6%	8.5%	6.1%	7.9%	8.5%	7.2%	7.9%	9.6%	6.7%	3.8%
Increase in Operating Revenues		10.9%	15.0%	8.6%	19.4%	14.5%	16.7%	17.4%	19.0%	13.8%	9.8%
Total Cost/Ton Produced (P$/Ton)	0.8	1.0	1.1	1.3	1.5	1.7	2.0	2.2	2.5	2.7	3.0
Working Ratio	39.1%	39.2%	38.5%	39.2%	36.8%	35.7%	34.8%	33.3%	31.4%	30.9%	31.4%
Operating Ratio	49.4%	52.4%	51.0%	52.4%	51.4%	51.5%	52.1%	51.0%	49.6%	49.4%	50.0%
Net Income Before Taxes on Equity	9.2%	5.4%	5.1%	2.7%	6.1%	5.6%	5.3%	6.2%	7.3%	6.3%	6.3%
Average Asset's Rate Base	8121	9885	10783	12225	14611	17037	19775	23741	29062	33199	35952
Rate of Return on Revalued Assets	9.3%	8.0%	8.7%	8.1%	8.2%	8.1%	8.0%	8.0%	8.0%	8.0%	8.0%

1] Due to rounding, the last digit in totals may appear different than the sum of columns.

TABLE 2 SOURCES AND APPLICATIONS OF FUNDS

MILLION PESOS

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
SOURCES OF FUNDS:											
Income Before Depreciation	909.9	1006.7	1171.7	1257.7	1562.8	1818.9	2153.8	2586.8	3164.5	3625.2	3948.1
Plus Other Income, Less Taxes	107.9	97.7	167.3	108.0	-285.7	-349.4	-389.1	-474.6	-568.2	-516.3	-580.9
GROSS INTERNAL SOURCES OF FUNDS	1017.8	1104.4	1339.0	1365.7	1277.1	1469.4	1764.7	2112.2	2596.3	3108.9	3367.3
EQUITY CONTRIBUTIONS & GRANTS	100.0	364.5	168.5	316.3	889.9	1046.4	361.3	369.6	190.8	0.0	0.0
Equity (tranfer of OECF's Loan)	0.0	0.0	0.0	96.0	528.7	563.1	237.1	244.9	124.8	0.0	0.0
Equity METROSS II & Other	0.0	0.0	0.0	179.0	0.0	51.3	124.2	124.7	66.0	0.0	0.0
Subsidies Franchise & Income Tax	0.0	0.0	0.0	41.2	361.2	432.0	0.0	0.0	0.0	0.0	0.0
FOREIGN GRANTS (Balara Rehab.)	0.0	0.0	0.0	0.0	224.6	410.0	0.0	0.0	0.0	0.0	0.0
BORROWING:											
Foreign Borrowing:	616.1	271.9	520.3	912.8	1102.7	1526.2	1711.4	1529.7	593.7	0.0	0.0
IBRD-Angat Project	0.0	0.0	0.0	63.0	106.9	187.0	213.4	252.7	97.4	0.0	0.0
ADB-Angat Project	0.0	0.0	0.0	9.9	480.9	764.5	730.1	586.2	420.8	0.0	0.0
Other Foreign Loans	616.1	271.9	520.3	839.9	514.9	574.8	767.9	690.9	75.6	0.0	0.0
Local Borrowing	0.0	0.0	0.0	280.0	580.0	470.0	270.0	0.0	0.0	0.0	0.0
PNB-UB Bonds	0.0	0.0	0.0	240.0	480.0	360.0	120.0	0.0	0.0	0.0	0.0
Other Local Loans	0.0	0.0	0.0	40.0	100.0	110.0	150.0	0.0	0.0	0.0	0.0
TOTAL BORROWING	616.1	271.9	520.3	1192.8	1682.7	1996.2	1981.4	1529.7	593.7	0.0	0.0
TOTAL SOURCES OF FUNDS	1733.9	1740.8	2027.8	2874.8	4074.3	4922.1	4107.5	4011.6	3380.8	3108.9	3367.3
APPLICATIONS OF FUNDS:											
ONGOING PROJECT WORKS	1144.5	782.9	818.8	1397.8	799.5	156.8	110.3	115.8	121.6	127.6	134.0
NEW PROJECT WORKS:	0.0	19.8	59.0	1165.1	2515.4	3175.1	2419.4	1726.0	897.9	410.0	700.0
Angat Water Supply	0.0	0.0	4.5	546.6	1742.8	1907.2	1238.7	839.0	248.2	0.0	0.0
Manila WS REHAB. II ('&WSRP II)	0.0	0.0	17.1	503.1	355.7	385.3	163.2	0.0	0.0	0.0	0.0
Manila WS III (MWSP III)	0.0	16.3	22.7	88.2	100.0	10.0	10.0	10.0	10.0	10.0	300.0
Fringe Areas WS (FAWSP)	0.0	0.0	2.1	13.1	52.7	54.6	73.7	7.2	0.0	0.0	0.0
Rizal Province WS (RPWSP)	0.0	3.5	12.5	14.2	39.6	66.0	105.6	38.6	0.0	0.0	0.0
Rehab. Balara & Train.(RBTP/NRTC	0.0	0.0	0.0	0.0	224.6	410.0	0.0	0.0	0.0	0.0	0.0
METROSS II	0.0	0.0	0.0	0.0	0.0	342.0	828.2	831.2	439.7	0.0	0.0
Other Works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	400.0	400.0
Interest During Construction	251.5	225.1	396.5	401.2	301.0	444.3	430.1	520.0	564.9	110.0	0.0
Other Assets (General)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL CAPITAL EXPENDITURES	1396.0	1027.8	1274.3	2964.2	3615.8	3776.2	2959.7	2361.8	1584.3	647.6	834.0
Amortisation	391.3	425.3	445.6	352.0	370.0	391.1	519.7	826.7	1036.4	836.9	900.6
Operational Interest	9.0	361.0	562.0	762.8	318.2	384.7	537.1	515.5	469.6	866.6	913.9
TOTAL DEBT SERVICE	400.3	786.3	1007.6	1114.7	688.2	775.8	1056.9	1342.2	1506.0	1703.4	1814.6
WORKING CAPITAL NEEDS BUT CASH (+)	50.0	147.9	-486.6	173.6	-244.5	193.1	-149.5	-105.2	-150.3	-52.9	-359.3
CHANGES OTHER ASSETS/LIABIL.	10.0	19.3	71.0	7.2	42.0	31.7	24.1	12.1	9.4	7.2	5.2
TOTAL APPLICATIONS OF FUNDS	1856.3	1981.2	1866.4	4259.6	4101.6	4776.9	3891.1	3610.9	2949.5	2305.3	2294.4
CASH INCREASE (+) OR DECREASE	-122.4	-240.4	161.4	-1384.8	-27.2	145.2	216.4	400.7	431.4	803.6	1072.9
Debt Service Ratio 1]	1.6	1.1	1.0	0.9	1.3	1.2	1.2	1.1	1.3	1.7	1.9
Internal Contribution to Investmen	39.9%	14.7%	58.6%	2.4%	21.9%	12.4%	28.2%	36.5%	77.7%	224.1%	228.6%
% Capital expend. of Net Assets	15.3%	9.7%	11.7%	21.9%	23.0%	20.6%	14.0%	9.0%	5.0%	1.9%	2.2%
% Loan Financing of Capital Expend	44.1%	26.5%	40.8%	40.2%	46.5%	52.9%	66.9%	64.8%	37.5%	0.0%	0.0%

1] Debt service ratio is the gross internal sources of funds, divided by the total debt service (including interest capitalized).

TABLE 3 BALANCE STATEMENT

MILLION PESOS

Fy ends December 31

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Fixed Assets in Operation	11240.1	12980.0	13586.5	16692.3	19531.8	22982.8	26763.8	33012.8	39915.7	44278.2	48885.4
Accumulated Depreciation	2102.0	2349.0	2652.0	3177.1	3825.3	4616.0	5580.4	6714.3	8090.1	9705.5	11553.4
NET FIXED ASSETS	9138.1	10631.0	10934.5	13515.2	15706.5	18366.8	21183.4	26298.6	31825.6	34572.6	37332.0
WORK IN PROGRESS	3792.0	2960.0	3623.4	4775.8	7054.4	9137.6	10269.8	8523.7	5846.2	5324.6	5093.7
Cash	1365.0	1233.0	1793.2	408.3	381.1	526.3	742.7	1143.4	1574.7	2378.3	3451.2
Net Accounts Receivable	416.5	369.6	476.8	373.4	246.2	292.2	329.2	375.9	398.8	402.6	287.6
Gross Accounts Receivable	704.7	723.2	904.9	869.1	815.4	933.7	1056.5	1201.6	1337.3	1468.8	1496.9
Allowance Doubtful Accounts	288.3	353.6	428.2	495.7	569.3	641.4	727.3	825.7	938.4	1066.2	1209.3
Other Account Receivable	19.5	45.0	53.5	55.7	58.4	61.4	64.4	67.7	71.0	74.6	78.3
Inventories For Operation	61.9	74.3	87.7	71.8	79.6	88.1	97.6	108.1	119.8	132.7	146.0
Inventories For Construction	74.6	101.6	181.5	179.4	232.0	233.2	177.1	128.9	71.4	37.6	58.4
Prepayments & Deposits	186.1	148.6	187.1	196.5	206.3	216.6	227.5	238.8	250.8	263.3	276.5
Sinking Fund-PNB/UB	0.0	0.0	0.0	8.4	26.5	46.5	58.2	57.3	53.1	46.0	36.2
TOTAL CURRENT ASSETS	2123.5	1972.1	2779.8	1293.5	1230.1	1464.3	1696.7	2120.1	2539.6	3335.1	4334.2
DEFERRED CHARGES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER ASSETS	11.9	13.4	33.7	35.3	37.1	39.0	40.9	43.0	45.1	47.4	49.7
TOTAL ASSETS	15065.5	15576.6	17371.3	19619.8	24028.2	29007.6	33190.8	36985.3	40256.5	43279.7	46809.6
Trust Funds Payable	104.6	157.3	204.3	157.3	204.3	214.5	225.2	236.5	248.3	260.7	273.7
Accounts Payable	842.9	736.0	1430.2	1041.8	1085.0	938.3	743.3	833.7	933.8	1045.0	1166.3
Income Tax Payable	0.0	0.0	0.0	0.0	0.0	0.0	423.6	522.0	639.4	613.1	725.4
Contractors'S Payable	286.3	210.6	165.0	307.6	397.8	399.8	303.6	221.0	122.3	64.5	100.1
Current Matur.Long-Term Debt	425.3	445.6	352.0	370.0	391.1	519.7	826.7	1036.4	836.9	836.9	836.9
TOTAL CURRENT LIABILITIES	1659.0	1549.5	2151.4	1876.7	2078.2	2072.4	2522.3	2849.5	2780.7	2820.1	3102.3
Other Liabilities	75.8	20.6	8.3	20.6	8.3	8.8	9.2	9.7	10.1	10.7	11.2
Total Long-Term Debt (net)	4094.1	4322.6	4578.4	5408.7	6967.9	8715.2	10202.5	11051.6	11215.2	10339.8	10242.7
Gross Foreign Debt	4519.4	4768.2	4930.3	5498.7	6499.1	7904.9	9496.2	10858.0	11234.9	10586.1	9751.2
Gross Local Debt	0.0	0.0	0.0	280.0	860.0	1330.0	1532.9	1230.0	817.2	654.4	491.5
Minus: Current Maturities	425.3	445.6	352.0	370.0	391.1	519.7	826.7	1036.4	836.9	900.6	0.0
TOTAL LIABILITIES	5828.9	5892.8	6738.2	7306.0	9054.5	10796.3	12734.0	13910.8	14006.1	13170.6	13356.2
Appraisal Surplus	5245.2	4802.7	5213.7	6248.5	7202.0	8371.5	9680.6	11195.6	13216.2	16271.3	18690.7
Operational Surplus (+)	1256.0	1781.1	2319.5	2649.1	3240.9	3852.6	4427.6	5160.8	6125.3	6928.9	7853.8
Capital	2735.4	3100.0	3100.0	3416.3	4530.8	5987.2	6340.6	6718.1	6908.9	6908.9	6908.9
TOTAL EQUITY	9236.6	9683.8	10633.1	12313.8	14973.7	18211.3	20456.8	23074.5	26250.4	30109.1	33453.4
TOTAL EQUITY AND LIABILITIES	15065.5	15576.6	17371.3	19619.8	24028.2	29007.6	33190.8	36985.3	40256.5	43279.7	46809.6
Current Ratio	1.3	1.3	1.3	0.7	0.6	0.7	0.7	0.7	0.9	1.2	1.4
Total Debt/Equity Ratio	48.9%	49.2%	46.4%	46.9%	49.1%	50.7%	53.9%	52.4%	45.9%	37.3%	30.6%
# Days Accounts Receivable (Net)	102	81	92	66	36	38	36	35	32	28	18

ANNEX 11

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

MONITORING INDICATORS FOR MWSS

MONIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
ACHIEVEMENT OF CORPORATION'S GOALS											
% Population with Water Connection	54.8%	56.8%	58.5%	61.1%	63.7%	67.1%	70.6%	73.5%	76.5%	77.9%	79.2%
End-Year Water Connections-1000	501.2	534.3	566.5	608.6	652.8	704.9	759.3	810.9	864.6	901.3	939.3
Additional Water Connections-1000	62.9	33.1	32.2	42.1	44.1	52.1	54.4	51.6	53.7	36.8	38.0
% Population with Sewerage Connect	8.5%	8.1%	7.7%	7.7%	7.7%	8.0%	8.2%	8.5%	8.8%	8.9%	8.9%
# Sewerage Connections- 000	77.4	76.1	74.3	76.5	78.8	83.5	88.6	93.9	99.5	102.5	105.6
Volume Billed liters/person/day	189	192	193	189	190	192	194	198	202	207	211
Use of Production Capacity	101.0%	96.6%	97.6%	95.3%	94.4%	95.7%	65.3%	67.1%	68.8%	70.6%	72.0%
MANAGEMENT:											
# Days Accounts Receivable, Gross	172	159	174	153	120	120	117	113	106	102	95
% Gross Receivables on Billing	47.2%	43.7%	47.5%	42.0%	33.0%	33.0%	32.0%	31.0%	29.0%	28.0%	26.0%
# Days Accounts Receivable, Net	102	81	92	66	36	38	36	35	32	28	18
# of Employees	5053	6812	6636	6704	6773	6842	7042	7114	7187	7261	7336
Employees per 1000 Water Connectio	10.1	12.7	11.7	11.0	10.4	9.7	9.3	8.8	8.3	8.1	7.8
% Non-Revenue Water	65.6%	61.0%	59.1%	55.8%	52.0%	48.5%	45.0%	41.5%	38.0%	35.5%	33.0%
FINANCIAL RATIOS:											
Average Water Tariff P$/Ton	4.0	4.0	4.4	4.6	5.0	5.4	5.8	6.3	6.9	7.3	7.6
% Tariff Increase		0.6%	8.5%	6.1%	7.9%	8.5%	7.2%	7.9%	9.6%	6.7%	3.8%
Total Oper. Revenues P$/Ton Sold	4.8	4.9	5.3	5.5	6.1	6.4	6.8	7.3	8.0	8.5	8.8
Tariff to Earn 6.0% on Equit	3.9	4.7	5.2	5.7	5.6	6.1	6.6	7.1	7.6	8.7	9.1
Working Ratio	39.1%	39.2%	38.5%	39.2%	36.8%	35.7%	34.8%	33.3%	31.4%	30.9%	31.4%
Operating Ratio	49.4%	52.4%	51.0%	52.4%	51.4%	51.5%	52.1%	51.0%	49.6%	49.4%	50.0%
Rate of Return on Net Fixed Assets	9.3%	8.0%	8.7%	8.1%	8.2%	8.1%	8.0%	8.0%	8.0%	8.0%	8.0%
Net Income Before Taxes on Equity	9.2%	5.4%	5.1%	2.7%	6.1%	5.6%	5.3%	6.2%	7.3%	6.3%	6.3%
Return on Capital (Debt + Equity)	8.1%	4.8%	4.5%	2.4%	3.7%	3.3%	3.0%	3.7%	4.7%	4.1%	4.0%
Internal Contribution to Investmen	39.9%	14.7%	58.6%	2.4%	21.9%	12.4%	28.2%	36.5%	77.7%	224.1%	228.6%
% of Investment Financed by Equity	7.2%	35.5%	13.2%	10.7%	24.6%	27.7%	12.2%	15.6%	12.0%	0.0%	0.0%
Debt Service ratio	1.6	1.1	1.0	0.9	1.3	1.2	1.2	1.1	1.3	1.7	1.9
Total Debt/Equity Ratio	48.9%	49.2%	46.4%	46.9%	49.1%	50.7%	53.9%	52.4%	45.9%	37.3%	30.6%
Current Ratio	1.3	1.3	1.3	0.7	0.6	0 7	0.7	0.7	0.9	1.2	1.4
ANALYSIS IN CONSTANT 1989 PRICES:											
Average Water Tariff P$/Ton	5.03	4.77	4.77	4.63	4.58	4.56	4.53	4.50	4.57	4.51	4.34
Real Tariff Increase		-5.1%	0.1%	-3.1%	-1.0%	-0.4%	-1.2%	-0.1%	1.5%	-1.2%	-3.9%
Total Oper. Revenues P$/Ton Sold	6.1	5.8	5.8	5.5	5.6	5.4	5.3	5.3	5.3	5.3	5.0
Revenues/Ton Sold for 6% on Equity	4.9	5.6	5.7	5.7	5.1	5.1	5.1	5.1	5.1	5.3	5.2

CRITICAL FINANCIAL INDICATORS BETWEEN 1986-1992

VARIABLE OR INDICATOR	MINIMUM	AVERAGE	MAXIMUM
Cash	381.1	1022.1	2378.3
Water Tariff P$/Ton (const.prices)	4.50	4.53	4.63
Working ratio	30.9%	34.6%	39.2%
Rate of Return on Avg.Fixed Assets	8.0%	8.0%	8.2%

VARIABLE OR INDICATOR	MINIMUM	AVERAGE	MAXIMUM
Debt Service Ratio	0.9	1.2	1.7
Return on Capital	2.4%	3.6%	4.7%
Days Accounts Receivable-Gro	102	119	153
Total Debt/Equity Ratio	37.2%	48.0%	53.9%

PHILIPPINES

ANGAT WATER SUPPLY OPTIMIZATION PROJECT

ASSUMPTIONS FOR FINANCIAL PROJECTIONS

1. Inflation. It is estimated that the annual (January-December) increase in consumer prices will be about 9% between 1989 and 1991, and 8% thereafter. Foreign price increases are estimated at 5.3% p.a. for 1989 and 1990, and 4.1% thereafter. The exchange rate for April 1989 was P 21 per US dollar. It is expected that exchange adjustments may be used to maintain on the average "purchasing power parity" with international prices. In order to ensure compatibility, the above assumptions are used for all tables in this report. ADB's project cost and financial tables use the same foreign inflation and a constant exchange rate of P 21 per US dollar. ADB's cost escalation for local costs assume an inflation of 10% in 1989 and 1990, 8% in 1991 and 1992, and 10% thereafter. OECF's tables use a local price escalation of 6% p.a. and foreign price escalation of 0% p.a.

2. Financial Projections. The water demand, project cost, financial projections and economic analysis use Lotus programs developed by the appraisal team. Only the main financial statements (Table 1 - Income, Table 2 -Flow of Funds, Table 3 - Balance, and Table 4 - Financial Plan are presented in Annex 10 (Financial Statements and Projections)). Additional tables, available in the project file, provide details for the assumptions and intermediate results regarding demand, fixed assets and revaluation, debt service, operational expenses, tariffs and revenues, etc. The main assumptions are explained below.

3. Water Demand. MWSS's water demand is difficult to forecast, since there is water rationing, combined with a large expansion of the distribution network and house connections in low-income areas (which use less water per capita). Industrial consumption is also uncertain, because it is not possible to forecast until when it will be economical for large industrial and commercial users to continue using large volumes of underground water. Annex 2 provides full details for the water demand. A major risk for the finances of MWSS is the NRW. If the forecasted reductions in NRW do not materialize, water sales would be reduced, operational cost would increase and the project capacity will be exhausted before the year 2000.

4. Revenues. The water revenues are based on existing tariffs, and the forecasted impact of CERA (an automatic adjustment for the increase in the ratio of debt service to water sales, which presently represents about 10% of the tariff). Sewerage charges are 50% of the water tariff for the population connected to the sewerage system (which is about 10% of the total, but includes many large users). The remaining population pays an environmental tax equivalent to 10% of the water billing. In addition there are minor charges for maintenance fees for water meters and some fixed charges (water hydrants). Water vendors, which operate public faucets, are included within the commercial customers.

5. The water sales for Bulacan, estimated at 1.1 cums are only tentative and would depend on MWSS's price for such bulk supply and agreements with the Province and municipalities. Agreements have been reached with the first two WDs (Meycauayan and Obando) and construction of their water supply would start in 1990. Particularly important for the agreement with the other six WDs is the price of water, which may be about half MWSS's average price, because it excludes the cost of distribution, billing and collection, and because NRW in a bulk water system should be below 10%. MWSS will send to the Bank a study for the price of this bulk water by December 31, 1989. Since these sales would be a minor part of MWSS's water sales, and because of the above mentioned incertitude, they are not included in the overall water demand projections. When they materialize, they would increase the financial and economic benefits of the project.

6. Operational Expenses. Detailed information on the projection of each of MWSS's expenses and debt service is available in the Project File. This includes a detailed forecast of number of employees

which is assumed to increase less than 1% p.a., to achieve a ratio of 9 and 8 operational staff per water connections by 1992 and 1994 respectively. The cost of chemicals and power is increased in proportion to the water produced and with expected real increases in the cost of electricity. Materials, maintenance and other expenses are increased with 50% to 70% of the increase in the number of connections. Separate projections are shown for sewerage services' expenditures, which represent less than 10% of the total expenses. The cost of house connections is paid by consumers, but MWSS is reconsidering this policy because even when payment facilities are given (one year), these charges discourage low income consumers from connecting to the system and may promote illegal connections.

7. Compensation to NPC. After the project enters in operation, MWSS would have to compensate to the National Power Corporation (NPC) for the alternative operational cost of peak generation and the reduction in the average power generated at Angat Dam. This compensation will be negotiated between NPC and MWSS and will be based on the volume of water used. It is estimated that this compensation would be about P 54 million per year for 15 cums. MWSS's cost would be proportional to the volume of water used above the existing capacity (2,592 MLD). After Umiray enters in operation, MWSS will generate additional power, to be sold to NPC. The financial projections do not include a payment for the cost of building a new peak generation plant. This require a complex study and is subject to negotiation between MWSS and NPC. Moreover, since Angat Dam has proven unreliable for peak generation (it was able to provide peak generation at capacity during only one week in 1987), NPC may require replacement of this capacity regardless of the project. Sensitivity analysis to this cost was included in the economic analysis, assuming that the cost of a reliable plant to replace the peak power that could be realistically generated by Angat would be about US$40 million for 15 cums. This cost is allocated proportionally to the water used, and is assumed to be paid two years before the capacity is used, to allow for construction of the new generation capacity. Given the continuous investments in power generation required by NPC it is also assumed that no lump investments in peak generation capacity would be needed because of the gradual losses of capacity resulting from the Angat project.

8. Doubtful Debts. In the past MWSS has had problems in collecting bills (particularly from Government Agencies). A provision for doubtful debts of 4% has been used until 1988. In accordance with COA this should be reduced, and is expected to reach 3% by 1990 and 2.5% after 1992.

9. Depreciation. MWSS's average depreciation rate is low (1.8% to 2%) but it is expected to increase gradually to 2.3% with the new assets entering in operation. The depreciation is relatively low because there are several fully depreciated assets, the value of land is considerable, and some of the largest assets (tunnels and aqueducts) have a long useful life (50 years) and low depreciation rates.

10. Investment Program. MWSS's investment program includes many subprojects of which Angat Optimization is the largest, but only one third of the total. The completion of ongoing subprojects will represent about 16% of the investments between 1989-94, and is a main priority, as well as the completion of the Manila WS Rehabilitation II Project (8.2% of the investment). The priority of other subprojects is low. In particular, investments in the Manila III Water Supply project should be kept at a nominal value, since this capacity would only be needed when the water supply from Angat/Umiray is exhausted, twelve to fifteen years from now.

11. The priority of the other subprojects is estimated to be as follows: (a) Balara Rehabilitation and Training (to be grant-financed by Japan); (b) METROSS II Sewerage project (being discussed with ADB); (c) treatment of the Laguna de Bay water (this would use a large pumping capacity which is unused by the National Irrigation Authority for nine months per year; although the treatment of this water is expensive, it could supply the east part of Manila which is the farthest zone from the existing treatment plants, and combined with an annual regulation of Angat may result in a substantial increase in the water supply; (d) Fringe Areas and Rizal Provinces Development, (to provide underground water supply to areas distant from the distribution system). Other than for on-going works, whose completion is priority, MWSS can accommodate the schedule of these other investments to match its cash sources. It is assumed that about 60% to 70% of these investments would be financed by foreign loans.

12. Balance Accounts. Accounts receivable are assumed reduced from about six months billing in 1988, to four months of billing by end-1990. This assumes the implementation of MWSS's Integrated Program for Revenue Improvement (IPRI), which includes 48 tasks aimed at reducing accounts receivables from private and government accounts. COA has authorized to write-off many uncollectible accounts receivable, which have been overdue for several years (about P 20 million). Inventories for operation, which include pipes and valves for maintenance, and chemicals for water treatment, are assumed at about one year of the cost of materials and supplies. Inventories for construction are assumed at about one month of the investments. Taxes payable are the amounts accrued on that year. Because of the delay between construction, billing and payments, contractors' payable are assumed at four months of the investments. Accounts payable, which are about two years of direct operating expenses, are expected to be reduced from about P 1430 million in 1988 to about P 740 million by 1992.

13. Assets Revaluation. MWSS is using satisfactory revaluation methods to update the value of its fixed assets. This is done annually based on the increases in consumer prices and/or variation in exchange rates. COA has now agreed that a formal inventory and valuation should be carried out in 1989/90, to get a more precise valuation of MWSS's assets. After this valuation is completed, the value of the fixed assets would continue to be indexed with consumer prices until the next formal revaluation.

14. Financial Plan. The overall financing plan (Table 3.2) includes the proposed Bank loan of US$40 million on standard conditions, and the US$130 million loan from ADB cofinancing the Angat Project (which finances the interest during construction). Agreement has been reached that given MWSS's high debt service, the Government would provide the equivalent of US$80 million as equity contributions. This amount is expected to be funded by an OECF loan cofinancing the project. This loan has been agreed in principle and is expected to be concluded later in 1989. In addition MWSS would receive disbursements from several ongoing loans for water and sewerage projects. MWSS has negotiated with the Philippine National Bank (PNB) and the Union Bank (UB) a loan of P 1,200 million to be disbursed between 1989 and 1990. This loan has an interest of 18% p.a. and is repayable with five-year terms, after five years' grace. Disbursements in each year are considered a separate loan and amortized separately; interest is paid at the end of each year and a sinking fund (paying 8% interest) is required to ensure the payment of this loan. Advances by the Bureau of Treasury, to pay MWSS foreign debt obligations are assumed to be settled in 1989, if needed they would earn interest at 17% per year.

15. MWSS would also receive about P 3.2 billion of government equity contributions, as follows: (a) transfer as equity to MWSS about US$80 million from a loan being appraised by OECF; (b) exemption of payments of franchise tax (2% of gross revenues) and income taxes (35% on net income) between 1989-91; and (c) provision of other equity contributions (P 179 million budgeted for 1989) for other projects, particularly for sewerage. The financial plan includes about P 400 million (2.3% of the financial plan requirements for 1989-94) of other local funds, which could be partially financed by PNB/UB, a faster recovery of the accounts receivable, additional equity contributions or by reducing some of the other less-priority investments.

16. Debt Revaluation. Most of MWSS's debt is with ADB and the Bank. During the period 1985-88 these debts were revalued up to 40% in dollars, which combined with the devaluation of the peso increased substantially MWSS's debt service. Although it is impossible to forecast the revaluation or depreciation of the dollar versus the currency pooling used by ADB and the Bank, it is expected that any changes would be gradual and would not materially affect the financial projections. Foreign debt is revalued with the expected changes in the peso to maintain "purchasing power parity" (para. 1).

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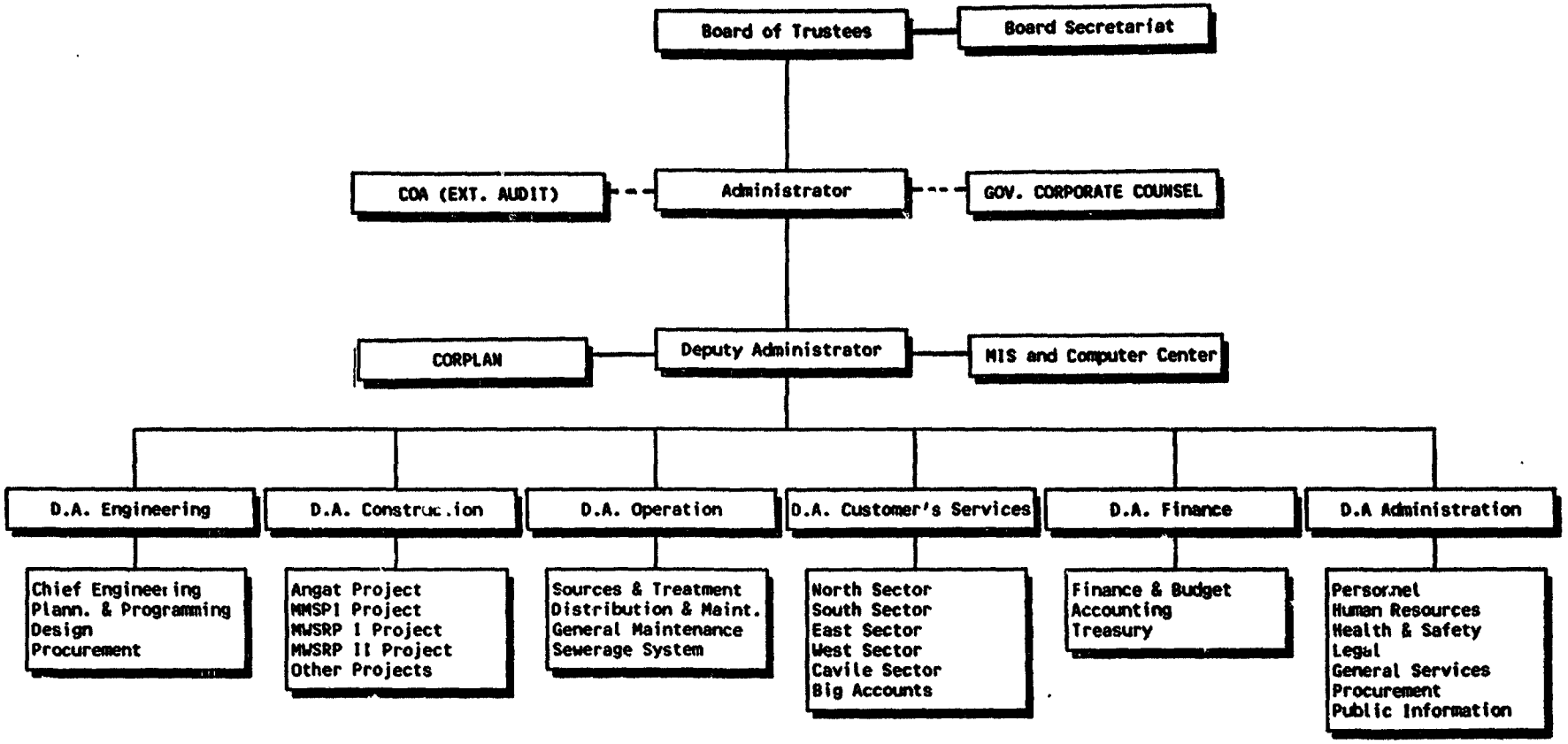
DOCUMENTS AVAILABLE IN PROJECT FILES

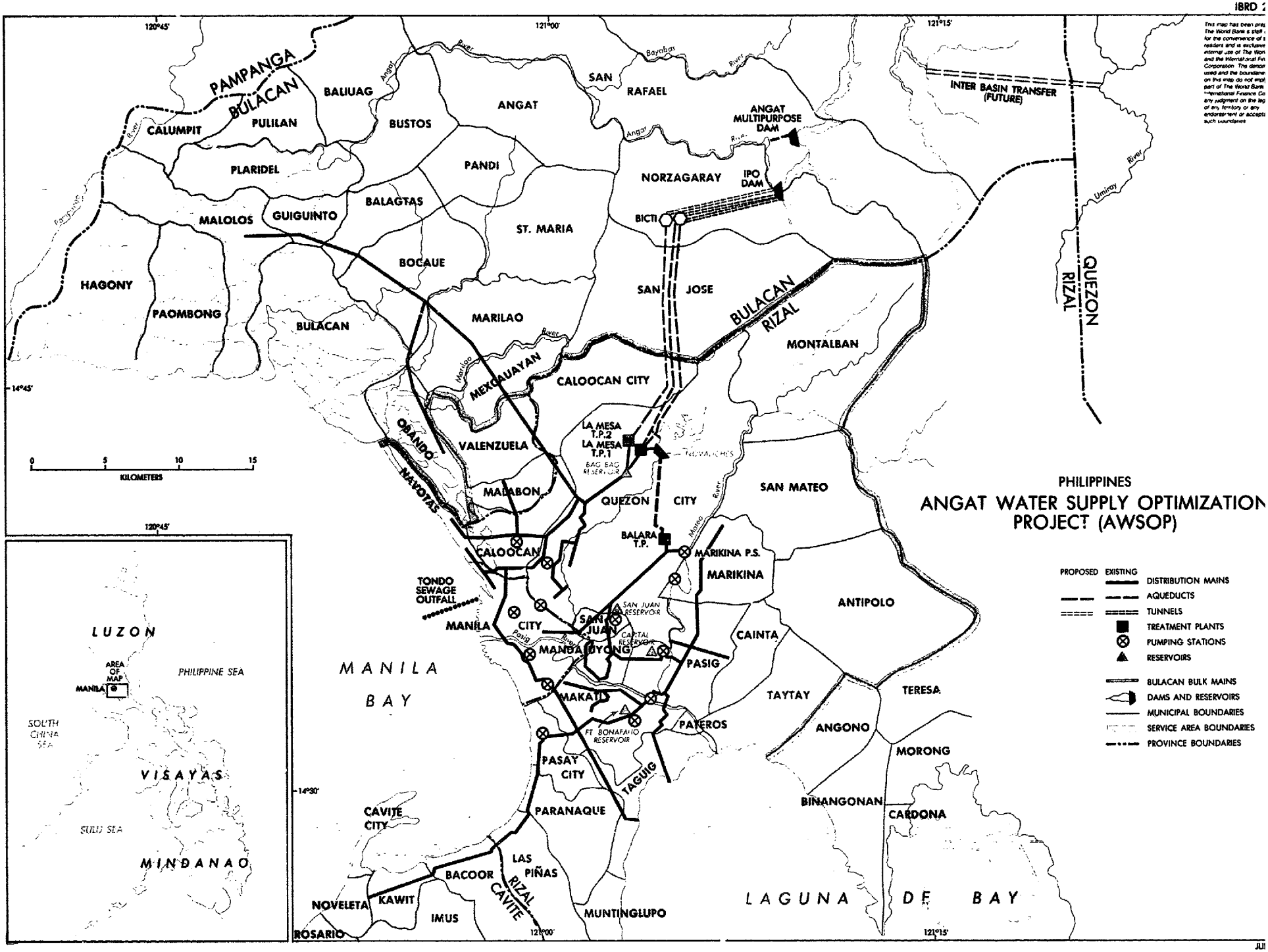
	Name of Document	Prepared by	Date
1.	Angat Water Supply Optimization Project, Feasibility Study (Stage 2). Final Report and Appendices	DCCD, Engineering and Development Corporation of the Philippines in Coop with National Hydraulic Research Center	Jun.88
2.	Angat Water Supply Optimization Project, (AWSOP) Summary, Engineering Report	AWSOP Engineering Group Engineering Area	Apr.89
3.	AWSOP, Report on Preliminary Design of Auxiliary Power Plant, No. 5.	SINOTECH Eng. Consultant Inc., Taipei, Taiwan	
4.	AWSOP, Report on Review of Feasibility and Preliminary Design Studies to the ADB, Contract CAS/A/88-258	Snowy Mountain Engineering Corporation	Sep.88
5.	AWSOP, Memorandum of Understanding, MOU, for the Fact-finding Mission of the Proposed AWSOP MWSS	ADB/MWSS	Mar.89
6.	AWSOP. Review of Hydraulical Aspects	Mogens Dyhr-Nielsen, Danish Hydraulic Institute	May.88
7.	AWSOP, Optimization of the Existing Balara and La Mesa Water Filtration Plants	Ken Waterhouse, Montgomery Hosking Stone Pty. Ltd.	Jun.88
8.	Umiray-Angat River Transbasin Project, Project Profile	MWSS, Planning and Programming Dept.	Feb.89
9.	Manila Water Supply III Water Demand and Tariff Study Volume 1, Report Volume 2, Appendices	Electrowatt Engineering Services, Renardet Engineering Technoshpere Consultant Group Philippine Technical Consultants F.F. Cruz & Co	Jan.88
10.	Water Supply , Sewerage and Sanitation Master Plan of the Philippines 1988 - 2000	Dept. Local Gvt., DoH, NEDA and DPWH	Apr.88

11.	Bulacan Central Water Supply Project. Detailed Design. Inception Report Vol. 1	C. Lotti & Assoc. SpA, DCCD Eng. Corp., Developm. of Environmental Systems, TCGI Engineers	Aug.88
12.	Metropolitan Waterworks and Sewerage System, Plans and Program	MWSS	Sep.80
13.	Proposed Second Manila Sewerage Project, Project Report	Mr. Senon of J.M. Montgomery	Dec.87
14.	Health Monitoring Component of the MWSS Sanitation Project (1981-1985), Final Report (only parts on Sanitation Survey and Bacterial Analysis of Drinking Water).	College of Public Health, University of the Philippines, Manila	May 87
15.	MMSSP, IBRD Loan 1814-PH, Actual Physical Construction by Projects per Schedule 2	MWSS	Apr.89
16.	Accomplishment Report (i) for CY 1987 (ii) for CY 1988 (iii) Activities for the Month of Feb.89,	MWSS, Sewerage System Dept., Operation and Maintenance Div., Sewage Pumping Section	 Feb.88 Feb.89 Mar.89
17.	Metro Manila Sewerage and Sanitation Project-Wastewater Management for Metro Manila, Article in "Asian Environment"	Franciso A. Arellano, Chief, Applied Research and Development Div., MWSS.	1985
18.	Summary of Sewer Mains and Households Served.	Sewerage System Dept., MWSS	
19.	Organizational and Functional Charts and Staffing Position	MWSS, Sewerage System Dept.	Jan.89
20.	Map. Community Imhoff/Septic Tanks under MWSS	MWSS	
21.	Table. Summary of MWSS Existing Watermain Based on 1:2000 map	MWSS	Feb.89
22.	Map. Serviced Areas, Water, by years 1974, 1978, 1988	MWSS	
23.	Map. Primary Water Supply System. Location of Gauging Points	Hydraulic Surveys and Analysis Division, MWSS	1984
24.	Map. Existing Central Wastewater System and Pump/Lift Stations Catchment Basins, Fig.5-1	Sewerage and Sanitation Master Plan, Montgomery, DCCD, Kampsax Kruger, MDKK	1979

METROPOLITAN WATERWORKS AND
SEWERAGE SYSTEM (MWSS)
ORGANIZATION CHART



MAP SECTION


PHILIPPINES
ANGAT WATER SUPPLY OPTIMIZATION PROJECT (AWSOP)
PROPOSED EXISTING
DISTRIBUTION MAINS
AQUEDUCTS
TUNNELS
TREATMENT PLANTS
PUMPING STATIONS
RESERVOIRS
BULACAN BULK MAINS
DAMS AND RESERVOIRS
MUNICIPAL BOUNDARIES
SERVICE AREA BOUNDARIES
PROVINCE BOUNDARIES
INTER BASIN TRANSFER (FUTURE)
ANGAT MULTIPURPOSE DAM
IPO DAM
BICTI
LA MESA T.P.2
LA MESA T.P.1
BAG BAG RESERVOIR
BALARA T.P.
MARIKINA P.S.
SAN JUAN RESERVOIR
CAPITAL RESERVOIR
FT. BONAFACIO RESERVOIR
TONDO SEWAGE OUTFALL
MANILA BAY
LAGUNA DE BAY
PAMPANGA
BULACAN
RIZAL
QUEZON
CAVITE
KILOMETERS
LUZON
VISAYAS
MINDANAO
PHILIPPINE SEA
SOUTH CHINA SEA
SULU SEA
AREA OF MAP
MANILA