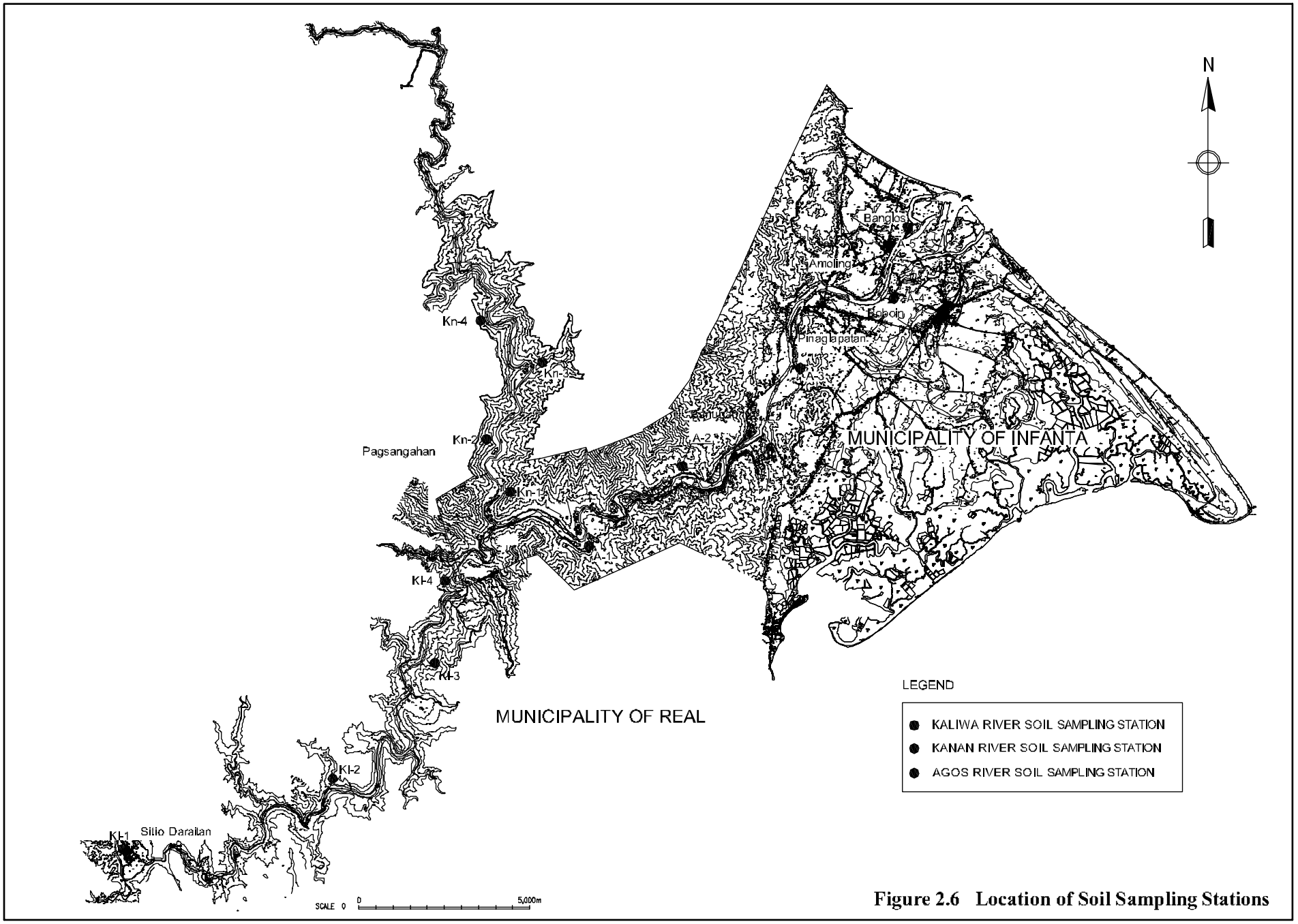

Figure 2.6 Location of Soil Sampling Stations

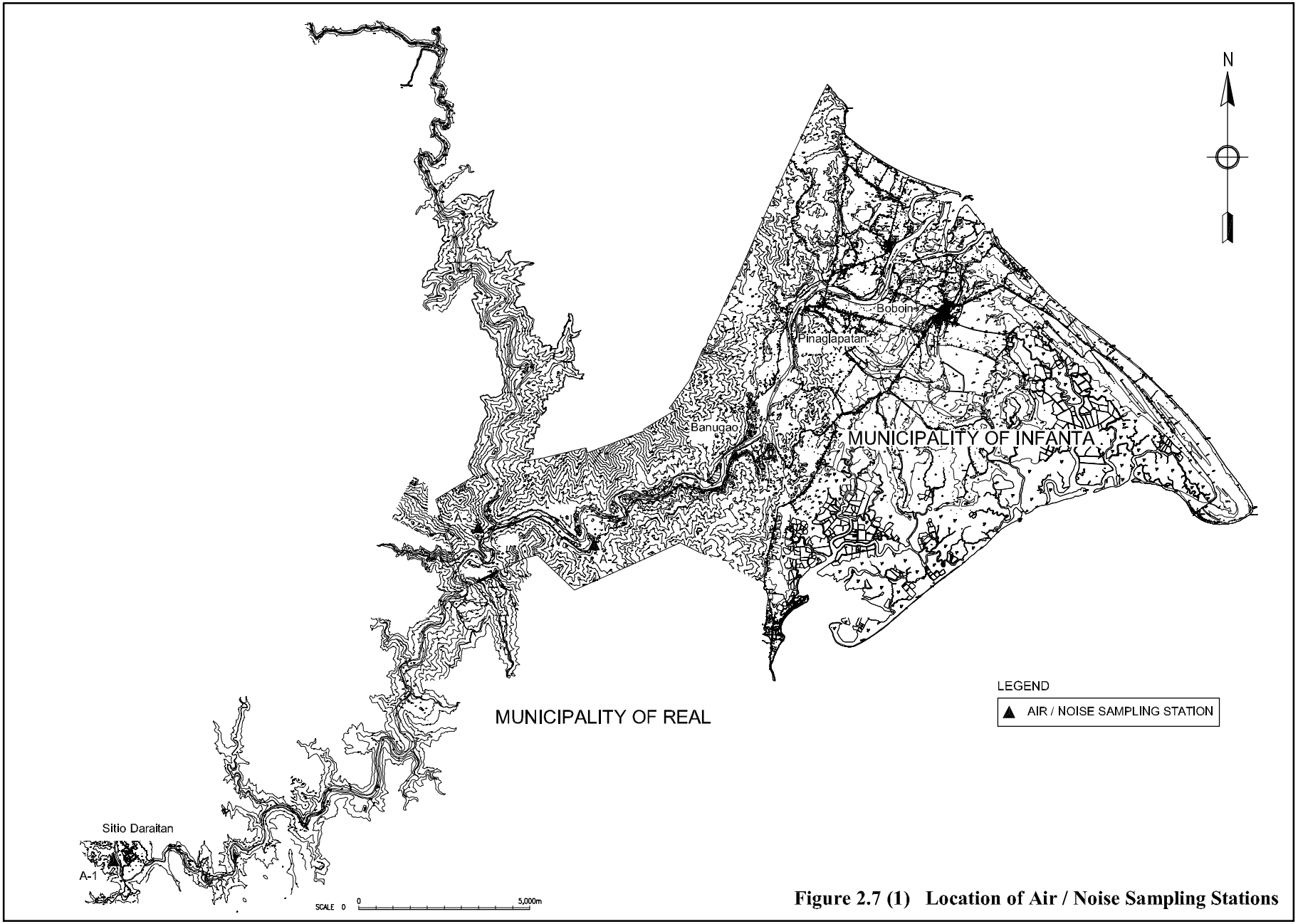

Figure 2.7 (1) Location of Air / Noise Sampling Stations

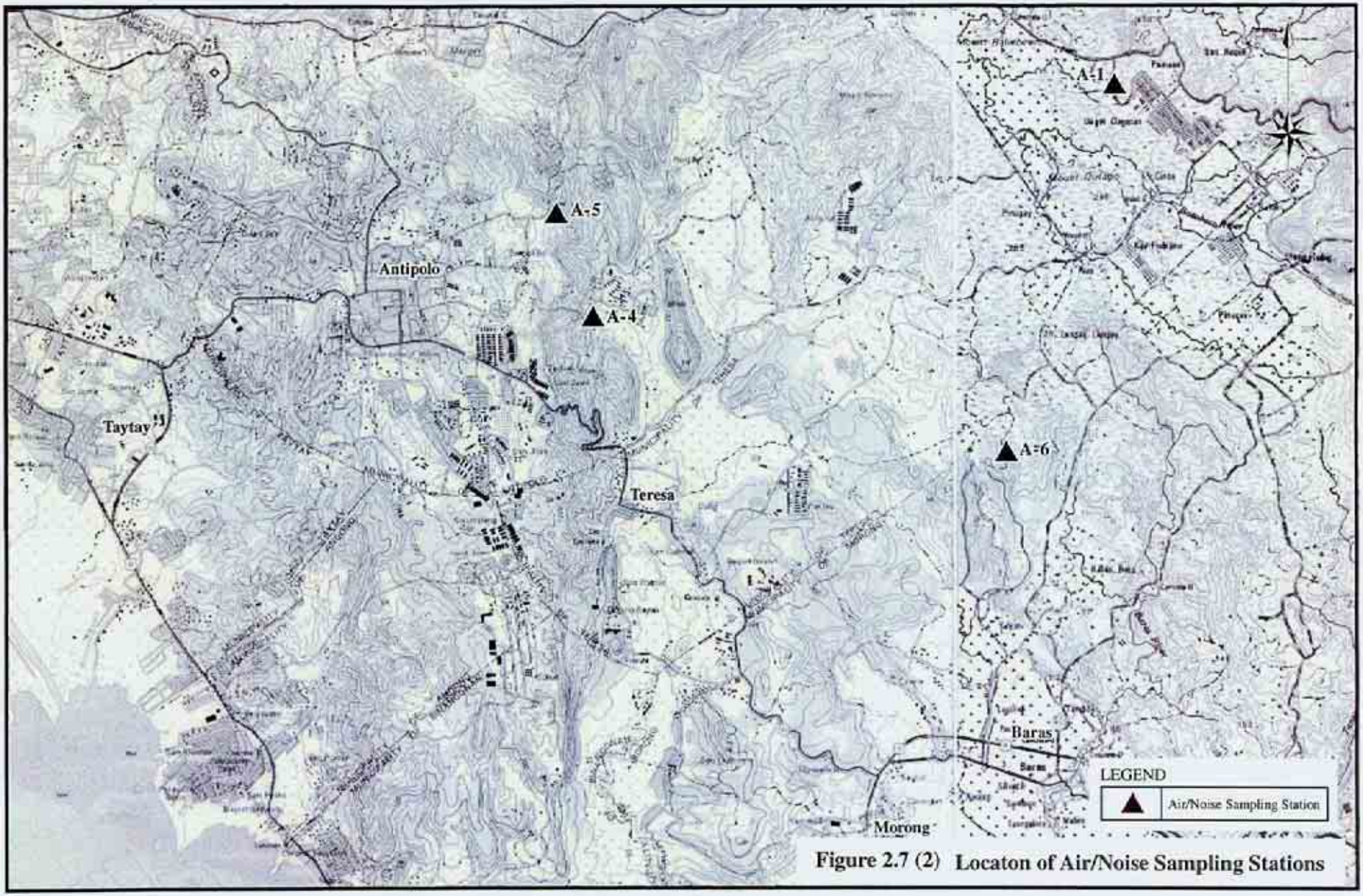

Figure 2.7 (2) Locaton of Air/Noise Sampling Stations

CHAPTER III WATER DEMAND PROJECTION AND WATER SUPPLY PLAN FOR METRO MANILA

3.1 Overview of Socio-Economic and Water Demand Projection in Master Plan Stage (Phase I)

3.1.1 Socio-Economic Projection

(1) Population Projection

1) Introduction

In the present Study, the future population in the Study Area covering NCR, Rizal Province and part of the Provinces of Cavite and Quezon was projected up to 2025, the target year of the Study. This projection aims at providing basic data for the estimate of future water demand in the area at the city/municipality level.

2) Method of Projection

Modification of NSO Projection-1[1]

The NSO Projection-1 was the projection at city/municipal level up to 2010, and this was initially used for the study. Once the Census 2000 final count became available, however, the NSO Projection-1 was modified through replacing its data for 2000 by the result of Census 2000.

Population Projection in 2015 and 2020

The population projection at provincial level in 2015 and 2020 was available in the NSO Projection-2. To estimate the population at the city and municipal level in 2015 and 2020, future ratios of city/municipality to region (in case of NCR) and/or to province (in cases of Region IV) were firstly projected by extrapolating the past trend of these ratios. Secondly, these projected ratios were applied to the total population of region and provinces already projected in the NSO Projection-2 to obtain the city and municipal populations in 2015 and 2020.

Population Projection in 2025

Population in 2025 at regional level was projected by applying the average growth rate in the period of 2015 to 2020. These average growth rates were computed at 0.5% per annum for NCR, 1.8% for Cavite, 4.0% for Rizal and 0.7% for Quezon. Thereafter, population at the city and municipality level was projected by applying the same process as that applied to calculate the population in 2015 and 2020.

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[1] NSO Projection-1: "1995 Census-based City/municipal Population Projections" NSO, December 1999
[2] NSO Projection-2: "1995 Census-based National, Regional and Provincial Population Projections" NSO, June 1999

3) Results of the Projection

The results of the population projection are compiled in Table 3.1.

NCR

Municipalities of Las Pinas and Taguig that constitute the periphery of expanding Metro Manila are anticipated to grow faster than other areas and exceed more than one million in 2025. Their population density will be over 30 thousands persons per km^2. The population growth is expected to become sluggish or decrease in municipalities with population currently exceeding one million, such as Manila, Caloocan and Quezon in the near future. (The population growth has shown a negative value of -0.9% per annum in Manila during the period of 1995 to 2000). This was the second period of negative growth for Manila in the 25 years since the 1975 Population Census. As a result, the population of Manila is projected to be 1.0 million in 2025 reducing from the present 1.7 million. The population density of Manila, however, will be still as high as 26,400 persons per km^2 in 2025.

Rizal Province

What is peculiar to Rizal is the rapid growth of Antipolo City. The population of Antipolo, currently occupying 28% of the total province, is expected to increase up to nearly 48% in 2025. High growth rates of 7.6% and 6.3% are anticipated to take place in the period of 2000-2010 and 2010-2025, respectively. The population density in 2025 with a population of 2.5 million, however, is computed to be as low as 8,000 persons per km^2 due to the fact that its land area is relatively wide enough (306 km^2) to accommodate this large population. Being situated at the edge of the Metro Manila area with gradual hilly undulation, development of residential complexes has already begun. Antipolo is expected to absorb a growing population in the capital zone in the future.

Cavite Province

The area currently accommodates more than one-third of the total population of the province with a land area of only 11% of the total provincial land. As the result, the population density in the area (5,200 persons per km^2) is more than three times the provincial average (1,600 persons per km^2). It is one of the most urbanized areas in the province due to its proximity to Metro Manila. Along with a growing trend of industrial development in this area, the population is anticipated to grow by more than the average growth of the whole province bringing its population share from the current 37% to 43% of the total provincial population in 2025. The expected population density in the area is 9,300 persons per km^2 in 2025.

Quezon Province

In Quezon Province, the impact on the Study is limited to Infanta City and General Nakar municipalities that lie within the catchment area of the Agos River. The average population growth in Infanta was as high as 5% per

annum in the period of 1995 to 2000. It is also anticipated to grow at rates higher than the national average in the future. General Nakar is also expected to grow faster than the national average in the future and a bridge crossing the Agos River that is now under construction will bring big demographic changes to this area. The future construction of Marikina-Infanta Road would also give impact to the population enhancement in this region. The present projection does not consider this infrastructure change in the future.

(2) GRDP Projection

1) Introduction

In this Study, the gross regional domestic products (GRDP) in the Study Area, namely NCR and Region IV, was projected for the three major sectors of agriculture, industry and services up to 2025. This projection was needed to provide basic data for the estimate of future municipal and industrial water demands in the Study Area. The gross domestic products (GDP) were projected not for its own purpose but to facilitate the GRDP projection.

In projecting GDP/GRDP, the existing government's projections were esteemed as far as possible since the economic activities of the country are largely dependent on the government policy. The government's projection is usually more reliable since it can collect more data and information that contribute to improve the accuracy of the projection.

2) Method of GDP/GRDP Projection

Historical Data of 1993-1999

The GDP/GRDP data for the period of 1993-1999 were collected from the statistics of PSY 2000. The statistics at the constant price level of 1985 were available by major sectors of agriculture, industry and services in each region of NCR and Region IV.

Projection for 2000-2004

The GDP/GRDP were projected for 2000-2004 based on 1999 figures by applying annual growth rates planned in the MTPDP by sector in each region for the respective years. For the GDP projection, the low growth scenario was adopted taking into consideration the worldwide trend of low growth economy to predominate in the medium term.

Projection for 2005-2025

For the period of 2005-2025, the LTPDP planned 10.0% p.a. growth of GDP for high growth scenario and 8.0% p.a. for low growth scenario. Since the LTPDP did not seem, judging from the time of its preparation, to have fully incorporated the influence of the Asian financial crisis, it was considered that the MTPDP was better than LTPDP to be used for the current projection. The projection presented in the MTPDP seems to have been prepared taking account of the post-economic conditions of the Asian financial crisis and

therefore these growth rates have been adopted for the final stage of the medium term plan, namely those in the year 2004, and applied to derive the GDP for the period of 2005 to 2025 for each sector.

The GRDP projection was carried out noting that the historical statistics of the sector GRDP at the regional level had a very stable share in GDP. Therefore, these GRDP shares in each sector were extrapolated and applied to the corresponding sector GDP to obtain the GRDP of each sector as shown in Table 3.2.

3) Review of the Result of GDP/GRDP Projections

i) Fundamentally, the projection relied on the MTPDP. The GDP growth rates stipulated in the MTPDP for the plan period were incorporated, and the growth rates planned at the final stage of the plan period were adopted and applied to derive the future GDP growth after 2005.

ii) In the current Study, GDP was projected to grow at the average annual growth rate of 5.5% for the period up to 2025. Although the agriculture sector may not achieve this rate, the industrial sector (6.5% p.a.) as well as service sector (5.8% p.a.) will lead the economy.

iii) The GRDP of NCR and Region IV is projected to grow at 6.0% per annum and 5.6% per annum, respectively, for the period of 2000 to 2025, which are both higher than the GDP growth of 5.5%. In the Study period up to 2025, the industrial sector of NCR is projected to reduce its share in the industrial sector GDP. This is based on the current high concentration of the industry into NCR with almost one third of the nation's industrial production in this area. A rapid expansion of industry is also expected in Region IV with a high growth rate of 6.5% per annum in this period. The accumulation of GRDP in these two regions of NCR and Region IV will increase from 45.9% of the whole nation in 1999 to 50.1% in 2025.

3.1.2 Water Demand Projection

There is no change in the water demand projected in the Master Plan Study stage. The table below presents comparison of the future water demand projected by this Study and the MWSS. From the table, it is considered that there is no significant difference between these two projections in long term.

Maximum Daily Water Demand Projection (Unit: MLD)

	2000	2005	2010	2015	2020	2025
This Study's Projection	4,090	4,577	5,143	6,090	7,097	8,446
MWSS's Projection	3,600	4,000	5,000	6,000	7,000	8,200

In considering the insufficient scale of water source development in interim schemes and the uncertainty of implementation of the projects including Laiban

Dam, the demand-supply balance will continue to be critical until the water source from the Agos River Basin becomes available. This means that water demand growth may be delayed. The concept of suppressed water demand has been examined and as a result, some 300 - 500 MLD of water volume on the maximum daily water demand base is assumed to be held back in medium term. This will delay the growth of service coverage and improvement of water availability in the water supply plan for Metro Manila. The details are presented in Annex G of Volume V.

Comparison of Water Demand Growth (Maximum daily demand base)

(Unit: MLD)

Year	2000	2005	2010	2015	2020	2025
Water Demand in M/P	4,090	4,577	5,143	6,090	7,097	8,446
Suppressed Water Demand	4,090	4,140	4,640	5,760	7,097	8,446
Difference	-	440	500	330	-	-

3.2 Review of Targeted NRW Ratio in 2025 for Metro Manila

3.2.1 Adequacy of Targeted NRW Ratios in Year 2025

In this Study, the final target of NRW ratio was set at 30% consisting of 20% of physical losses and 10% of commercial losses with the targets in the intervening years as shown below:

Proposed NRW Reduction Target

Year	2000	2005	2010	2015	2020	2025
NRW Ratio	60.9%	54%	48%	42%	36%	30%
Physical Loss	33.5%	30%	28%	26%	23%	20%
Commercial Loss	27.4%	24%	20%	16%	13%	10%

In setting up such target of NRW ratios, the following matters were considered:

(1) Past NRW reduction projects by MWSS

MWSS has spent a total of 3 billion Pesos for two rehabilitation projects with about 80% of the geographical service area of MWSS in the past. The actual practices experienced through Manila Water Supply Rehabilitation Project I (1984-1993) and II (1991-1994), both of which were financially assisted by ADB, led to the importance of intensive rehabilitation projects. As a result of the projects, a NRW ratio reduction of approximately 10% was achieved between 1985 and 1992.

Based on the assessment of estimated zonal demand for the 56 zones, composition of NRW was assumed as 70% of water leakage (physical loss) and 30% of commercial loss (illegal use, unbilled water supply and meter error). Such composition of NRW was adopted in the Study to analyze the existing NRW, and the past performance of approximately 1% of reduction per year was adopted as the target NRW.

(2) Targeted NRW ratios of the Concessionaires

In order to improve current higher NRW ratio, the two Concessionaires set targets in the termination year (2022) at 30% and 32% for the MWCI's and MWSI's

service areas, respectively. Various countermeasures such as the replacement of deteriorated/improperly installed pipes, leakage repair, implementation of the programs/activities to reduce illegal connections and zone metering have been carried out to achieve NRW reduction since 1998.

(3) NRW ratios in major cities in Asian countries

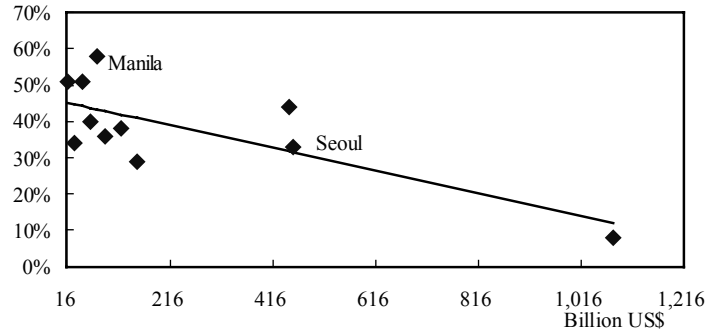
Another reference for assuming the target NRW ratio was comparison of NRW ratios in major cities in Asian countries by using economic indices. The table and figures below present the recent NRW ratio to GDP and per capita GDP of major cities in Asian countries.

NRW Ratio and GDP in Asian Countries

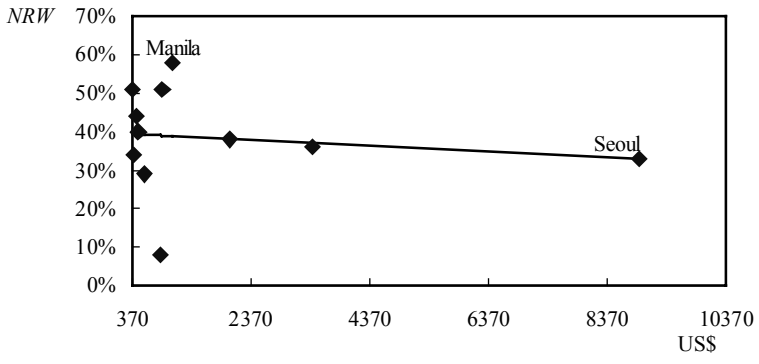
City	NRW (%) in 1995[1)]	GDP in 2000 (Billion US$)[2)]	Per Capita GDP in 2000 (US$)[2)]
Phnom Penh	61%	3.2	260
Beijing	8%	1,080.0	840
Jakarta	29%	153.3	570
Seoul	33%	457.2	8,910
Kuala Lumpur	36%	89.3	3,400
Manila	58%	75.2	1,040
Bangkok	38%	121.9	2,010
Ho Chi Minh	34%	31.3	390
Dhaka	51%	46.0	370
Delhi	44%	447.3	440
Karachi	40%	61.7	470
Colombo	51%	16.4	870

Source: [1)] Water Utilities Data Book, Asian and Pacific Region, ADB, 1997

NRW Ratio and GDP



NRW Ratio and Per Capita GDP



There is some correlation between NRW ratio and GDP (correlation coefficient of -0.75), while there is little correlation between NRW ratio and per Capita GDP (correlation coefficient of -0.21). NRW ratios in the countries having higher per capita GDP are found to be in the range of 30 to 40%. The Per capita GDP of the Philippines was projected at US$ 9,660 in 2025, the same level as Korea in 1997(US$ 9,670). On the basis of this hypothesis, the NRW ratio in Metro Manila may attain the current level (33%) in Seoul.

Base on the three evaluations mentioned above, a target NRW ratio of 30% is considered achievable.

With regard to composition of NRW, a ratio of about 55% is assumed as the current physical loss ratio referring to the latest reports (Technical Annex of Business Plan both of the MWCI and MWSI). After considering the on-going and planned NRW reduction activities of the concessionaires, it is forecasted that reduction of commercial losses will be accelerated as compared with that of physical losses. The current commercial loss is assumed to decrease from 27.4% to about 10% comprising some 5% of meter error and some 5% of illegal use at the final stage. In this Study, the composition of NRW in intervening years is set up to reach 70% of physical loss and 30% of commercial loss in the target year of 2025.

3.2.2 Effective Measures to Attain Targeted NRW Ratio in 2025

The initial NRW reduction activities were to repair all visible leaks and to address commercial losses, particularly illegal connections and metering problems. In parallel, formation of Demand Monitoring Zone (DMZ)/District Metering Area (DMA) aiming at monitor NRW was introduced, and urban poor projects were developed to help address the commercial losses. To improve the present situation of high NRW ratio (61% as of end of 2000), the Concessionaires are required to make increased efforts to reduce it by 1% to 2% yearly until the 30% target is achieved by year 2025. Effective measures including those now carried out by the Concessionaires to attain the targeted NRW ratio are considered below. All of these activities should be done simultaneously.

(1) Full operation of territory management

Formation of DMZs/DMAs as territory management is effective to monitor NRW and carry out countermeasures. DMZs are divided into smaller and manageable areas with around 10,000 water service connections to monitor NRW. Through DMZs, losses can be monitored and quantified in large secondary and primary mains. The DMZs are further divided into DMAs which are smaller metered areas within a DMZ. In the respective DMAs, supply and billed volume are measured, and the level of commercial and technical losses are derived from night flow rate. From the information in these DMAs, the Concessionaires can determine a strategy to reduce both physical and commercial losses.

The preparation of a DMA-NRW Matrix makes it possible to forecast the potential recoverable volume in specific metered area in terms of potential leakage volume. This may include physical losses, illegal connections and/or metering errors or

commercial losses. The DMA-NRW Matrix will imply that high NRW and high night flow rate means losses through physical leaks and high NRW and low night flow rate means commercial losses. The subsequent major activities to be taken are follows:

- Leak repairs in DMAs where detected;
- Leak detection in DMAs where the problem is diagnosed to be more of physical leaks;
- Step testing of commissioned DMAs to localize underground leaks;
- Reduction of illegal connections;
- Pressure management by installing pressure reducing valves (PRV);
- Meter replacement;
- Pipe replacement; and
- Decommissioning of mains

(2) Pipe replacement program

The physical leaks will be addressed by pipe replacement programs which will replace old and breakage prone ACP and GI pipes. Most of these pipes were laid many years ago and contribute significantly to NRW. ACP pipes, in particular, are estimated to comprise about 20% of the whole installed length of distribution pipe.

(3) Service connection rehabilitation program

Galvanized iron (GI) and Polybuthylene (Pb) pipes tapped to the main line need to be replaced with polyethylene (Pe) pipes. In the long term, replacing the service connections will be more economical than repairing as there will be a significant reduction of NRW.

(4) Reduction of illegal connections

Illegal connections will be addressed through the current activity such as "Tubig para sa Barangay" or urban poor projects. People living in depressed communities usually get their water from contaminated sources or pay a high price of P200 per m^3 to the water vendors. The "Tubig para sa Barangay" program has enabled the socially disadvantaged sectors of society to obtain water connections at affordable rates, reducing the cost per cubic meter of water by as much as 97%. Through the program, the Concessionaire has minimized illegal connections, water leaks and the incidence of water contamination. Continuous implementation of these programs will contribute further to the NRW reduction.

(5) Installation of pressure reducing valves

District metering will be done by the pressure management. Once the target NRW has been attained in the commissioned DMAs, pressure should be evaluated using flow modulating pressure reducing valves (PRV). In most of the DMAs, PRVs are best applied during periods of low demand rather then on a 24-hour basis. The objective is to control the occurrence of leaks when water is not being used causing pressure build-up. Thus, the PRV will prevent pipe bursts especially in pump-fed areas.

PRVs can also be used to control water losses in areas where NRW and water pressure are high or when leak repair cannot be immediately effected. Finally, PRVs will help balance system pressure by diverting water from high to low pressure areas.

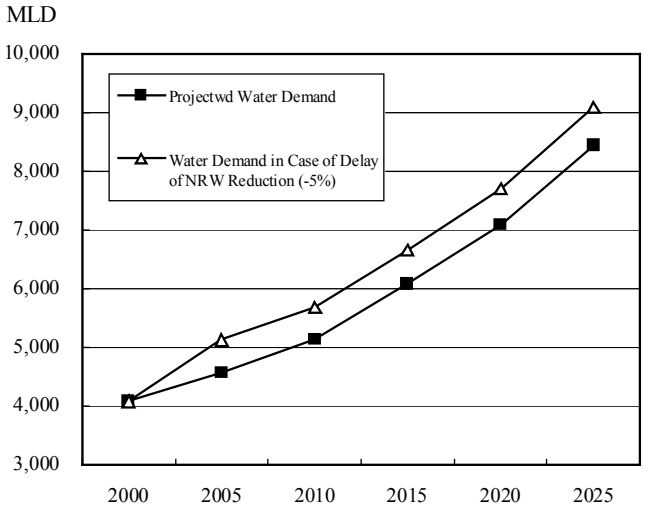
(6) Meter replacement program

Meter management will be another focus areas in the NRW reduction effort. The water meter is considered as the cash register in the Concessionaires' business. Since the meter records how much customers consume, the concessionaires have the responsibility to install accurate meters.

The meter replacement program is selective in nature. Meters that have deteriorated with age and register erroneous readings will be prioritized. On-site meter testing and replacement will be effective in DMAs where problems are due to commercial losses.

3.2.3 Conceivable Issues and Problems Encountered in Case of Delay of NRW Reduction

If there is a delay in NRW reduction, water demand will increase in accordance with the extent of delay. For instance, if the target slips by 5 years, water demand will increase by 560 MLD (in 2005) to 650 MLD (in 2025) as shown in the figure below. This unnecessary water demand is larger than additional water sources to be exploited under the proposed 50 MLD Wawa River Project and 300 MLD Bulk Water Supply Project.



If the implementation schedule of new water source projects is delayed, for whatever reason, it is anticipated that the billed water volume together with per capita consumption will be suppressed and problems such as intermittent supply will not be improved.

3.3 Alternative Water Demand Projection in Case of Lower Population Increase in Antipolo Area (Low Case)

3.3.1 Alternative Population Projection for Antipolo (Low Case)

(1) Objective

The population of Antipolo was projected to be 2,453 thousands in 2025 in the Master Plan Study. This was the consequence of incorporating the population projection made by NSO, which followed the high growth rates of Antipolo population during the period of 1975 to 1990. The annual population of Antipolo in the period that included three population censuses grew by more than 10% per year. The population of 2,453 thousands projected for the year 2025 will exceed the current population of Quezon City (2,174 thousands) in 2000, which was the largest among all the city and municipalities in NCR.

In this subsection, an alternative population projection of Antipolo was sought. It does not intend to revise the former population projection but aims to show an alternative only for reference purposes.

(2) Assumptions

The characteristic of Antipolo in connection with population is that it is located at the periphery of Metro Manila. That was the reason of its rapid increase in population growth in the period of 1975 to 1990. Taking this into account, eight cities/municipalities were selected from those located on the periphery of Metro Manila as shown in Table 3.3. It includes three cities of Las Pinas, Marikina and Pasig, and one municipality of Taguig in NCR; four municipalities of Angono, Cainta, San Mateo and Taytay in Rizal Province. The historical census figures show that, while the population densities of these eight cities and municipalities have been increasing up to the year 2000, their annual average growth rates have already passed their peak points with the exception of only Taytay and San Mateo. Antipolo has had the same peculiarity as those cities and municipalities in the past, so the alternative projection assumes that Antipolo will follow similar growth trends.

(3) The Low Case of Antipolo Population Projection

The alternative population of Antipolo in 2025 was projected applying the annual average growth rate of 5.3% that was derived based on the population growth of the eight cities/municipalities for the period of 1975 to 2000. The resulted population of Antipolo in 2025 is 1,713 thousands as shown in Table 3.3.

3.3.2 Alternative Water Demand Projection (Low Case)

Based on the above population forecast, the alternative water demand projection for low case was made. In projecting the alternative water demand, targeted service coverage set up in the original projection was kept, and original water demands in respective years were modified in accordance with ratio of population to be served in original and low case.

As a result, maximum daily water demand in 2025 for low case decreases to about 600 MLD, which corresponds to 70% of the original water demand.

Comparison of Water Demand between Original and Low Case

Item		2000	2005	2010	2015	2020	2025
Projected Pop.	Origina	471,000	692,054	984,324	1,376,35	1,860,42	2,453,28
	Low	471,000	610,000	789,000	1,022,00	1,323,00	1,713,00
Service Coverage		15%	20%	25%	49%	73%	97%
Pop. Served	Origina	71,000	138,000	246,000	674,000	1,358,00	2,379,00
	Low	122,000	197,250	500,780	965,790	1,661,61	122,000
Max. Daily Water Demand (MLD)	Origina	36.7	48.9	84.0	226.4	459.3	824.0
	Low	36.7	43.2	67.3	168.2	326.6	575.5
Low case/Original		-	88%	80%	74%	71%	70%

3.4 Assessment of Realization of Small-Scale Water Supply Schemes for Metro Manila

3.4.1 Interim Schemes

To mitigate the critical situation of water shortage in Metro Manila, the MWSS is committed to proceed with the 50 MLD Wawa River Project and 300 MLD Bulk Water Supply Project.

50 MLD Wawa River Project

The project aims at extracting 50 MLD of surface water from the Wawa River. Treated water will be delivered to San Mateo and west zone of Rodriguez via ERAP City. The MWSS is seeking financial source through ADB and expects the completion of the project by 2005.

300 MLD Bulk Water Supply Project

The project aims at exploiting 300 MLD of lake water (Laguna Lake) to supply water for Las Pinas, Muntinlupa, Paranaque and Cavite towns. The MWSS intends to implement the project on BOT basis and to complete by 2007. A feasibility study has already been carried out by a local consulting firm and the MWSS is about to submit the scheme for NEDA-ICC approval.

3.4.2 Regional Water Supply Schemes

The municipalities other than those served by the Concessionaire exist in the province of Rizal. They are Angono, Baras, Binangonan, Cardona, Jala-Jala, Morong, Pililla, Tanay and Teresa. Among them, Jala-Jala, Morong, Pililla, Tanay and Teresa are served by Water Districts (WDs). The inhabitants in remaining municipalities are served by community water supply such as municipal, Barangay waterworks or cooperative/private waterworks exclusive in the concerned subdivisions. In the course of the Study, the direction of future water supply was examined by interviewing the respective WDs and municipal government of the concerned municipalities.

Baras, Jala-Jala, Morong, Pililla, Tanay and Teresa

The existing WDs of the municipalities are organized into the "Rizal Water Districts Association (RIZWADA)". The municipality of Baras is also a member of RIZWADA, although it has no WD. At present, system expansion together with developing additional groundwater sources is carried out in Tanay under JBIC

assisted Provincial Cities Water Supply Project V. Likewise, ADB assisted the Small Towns Water Supply Project that is underway in Morong and Teresa.

The WDs represented by the RIZWADA will continue to manage and operate their respective waterworks and sewerage system, subject to the exclusive rights of MWCI under the MWSS-MWCI Concession Agreement to provide bulk water, sewer and sanitation services through the RIZWADA and its member local water districts to the municipalities covered by the RIZWADA, even after the Laiban Dam Project and/or other similar source of water supply are available and implemented by MWSS. The details are presented in Annex G of volume V.

Angono, Binangonan and Cardona

These municipalities resort to water service by community or privately owned waterworks at present. The current water supply situation is commonly critical due to insufficient water source and capacity of water supply facility to meet increasing water demand. However, there are no plans for expansion of existing systems due to lack of technical, institutional and financial capability and they will rely on water supply to be extended by the MWCI. The construction of distribution lines in Angono is now underway on this basis. Bulk water supply from the MWCI is recommended for future water supply to the municipalities of Binangonan and Cardona in consideration of higher water pressure from the proposed service reservoir and utilization of the existing facility.

Water demand for the concerned municipalities

Water demand projection for the concerned municipalities has been considered in this Study. A total of 220 MLD (77 MLD for existing WDs and 149 MLD for other municipalities) was assumed in 2025, which corresponds to 6% of total water demand (3,640 MLD) to be supplied from new water source. In particular, the water demand in Angono and Binangonan is assumed to be 140 MLD, which will be more than half of total water demand in the concerned municipalities.

3.5 Necessity of Development of Sewerage System in Connection with Augmentation of Water Supply for Metro Manila

3.5.1 Present Situation of Sewerage System in Metro Manila

Presently, there are four (4) sewerage systems in operation in Metro Manila, which are all separate collection systems under MWCI or MWSI based on the Concessions Agreement. These are the Central System, Ayala System, Dagat-Dagatan System and Quezon City Separate System. Aside from these systems, there are communal septic tanks under the National Housing Authority (NHA). Outline of each system under MWCI and MWSI is summarized in the table below:

Existing Sewerage System in Metro Manila

System		Manila Central Sewerage System	Ayala System	Dagat-Dagatan System	Quezon City Separate System	Total
Service Area	Area	2,620 ha	600 ha	332 ha	1,000 ha	4,600 ha
	City/ Municipality	Manila City (MWSI)	Makati (MWCI)	Malabon, Navotas, Caloocan (MWSI)	Quezon City (MWCI/MWSI)	-
Service Population		700,000	120,000	43,000	190,000	1,053,000
Sewage Treatment	Capacity	432,000 m^3/d	40,000m^3/d	13,000m^3/d	(N.A.)	485.000 m^3/d
	Collection System	7 lift stations, 305 km sanitary sewer pipe	73 km-long sanitary sewer pipe, No lift station	18 km-long sanitary sewer pipe and 1 pump station	Total 114 km of sanitary sewer pipe	-
	Treatment System	1 Discharge Pump Station without treatment	Activated sludge treatment method	Aerated lagoon	Communal septic tanks	-

Source: MWCI, MWSI Note: N.A. means that the data are not available.

Location of each system together with the NHA's system is shown in Figure 3.1. From the table, only 7% (46 km^2/636 km^2 = 7%) of Metro Manila is covered by sewerage system in the areas.

In terms of service coverage by respective sewerage system, the number of population served is assumed to be 700,000 in the Manila Central Sewerage System, 43,000 in the Dagat-Dagatan System and 120,000 in the Ayala Sewerage System at present. Additional 190,000 persons estimated for Quezon City Separate System increase overall served population up to 1,0530,000 persons. Thus, approximately 10% of total population in east and west concession area is assumed to have access to the sewerage systems. Others are using on-site septic tank.

In order to improve the current sewerage system situation, the MWCI is now undertaking the following projects:

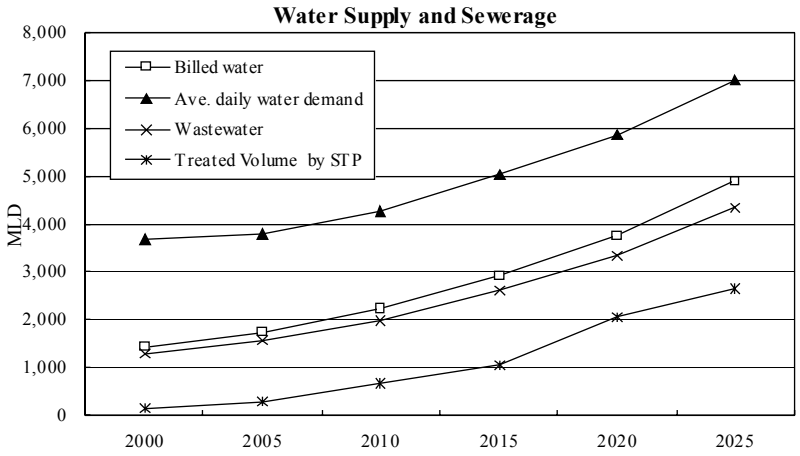
1) WB-assisted "Manila Second Sewerage Project" with 20.5 Million US$
   - Rehabilitation of Magallanes STP
   - Survey and rehabilitation/replacement of sewer network
   - Community sanitation projects: construction of 30 STPs (100-7,000 m^3/day to process effluent of septic tank) to cover 200,000 persons
   - Procurement of equipment
2) ADB-assisted "Pasig River Rehabilitation Project" with 10 Million US$
   - Construction of 600 m^3/day septage treatment plant to benefit 1.0 million people and reduce pollution load to the Pasig River by 16 tons/day
   - Desludging services in Makati, Taguig, Pateros, San Juan, Mandaluyong for emptying average of 37,000 septic tanks per year

Likewise, the MWSI is now ready to avail 48 Million US$ WB loan for "Manila Second Sewerage Project" as follow:

- Rehabilitation of Manila Central Sewerage System to replace existing submergible pumps and install 10,000 new sewer connections
- Provision of sewerage services in low-income areas
- Extension of sewer lines in the infill areas of Tondo

3.5.2 Recommendation for Expansion and Improvement of Existing Sewerage System in Connection with Augmentation of Water Supply for Metro Manila

As the water supply systems are augmented, wastewater volume will increase. Table 3.4 and figure below show the assumed wastewater and treated volume by sewage treatment plant (STP) referring to the projected water demand in this study and targeted sewer coverage (See Table 3.5) stipulated in the Concession Agreement. Total wastewater volume was assumed as combination of wastewater (70% of the billed water) and groundwater infiltration (27% of wastewater), based on the methodology adopted in the previous JICA Master Plan Study (1995).



3.6 Water Tariff in Metro Manila

3.6.1 Present Water Tariff System

The Concessionaires have petitioned the Government for an increase in water tariff. The tables below present the transition of increase in water tariff and connection fee for new water service by the MWCI. The latest water tariff increase brings the price up to 8.52 Pesos/m^3 on average.

Water Tariff Increase (MWCI)

	1997	1999	2000	Jan. 2001	Apr. 2001	Nov. 2001	Jan. 2002
Prev. Basic		2.32	2.61	2.76	2.95	3.22	4.22
CPI		0.25	0.15	0.12			0.21
EPA		0.04		0.07	0.27		0.08
Recovery of Past Forex Losses						1.00	
Total Basic Water	2.32	2.61	2.76	2.95	3.22	4.22	4.51
CERA	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FCDA							2.24
10% EC	0.33	0.36	0.38	0.39	0.42	0.52	0.77
Total	3.65	3.97	4.14	4.34	4.64	5.74	8.52

Source: MWCI

Cost of Connection for New Water Service* (MWCI)

Year	Basic Charge	10% VAT	Guaranty Deposit	Meter Deposit	Total Charges
Aug. '97	3,000	300	200	1,020	4,520
1998	3,000	300	200	1,020	4,520
1999	3,488	349	200	1,020	5,057
2000	3,687	369	200	1,020	5,276
2001	3,882	388	200	1,020	5,490
2002	4,119	412	300	1,020	5,851

Source: MWCI

* 15 mm SP 'within the 1st 25 linear meters

Likewise, the table below shows the transition of increase in water tariff for the MWSI's service area. The latest water tariff is 15.46 Pesos/m^3 on average. There is a large difference in tariff between the two Concessionaires.

Water Tariff Increase (MWSI)

	1997	1999	2000	Jan. 2001	Apr. 2001	Nov. 2001	Jan. 2002
Prev. Basic		4.96	5.80	6.13	6.58	6.58	10.79
CPI		(10.70%)	0.33	0.26			0.45
EPA		(6.24%)		0.19		4.21	0..15
Recovery of Past Forex Losses							
Total Basic Water		5.80	6.13	6.58	6.58	10.79	11.39
CERA							
FCDA							4.07
10% EC							
Total	4.96	5.80	6.13	6.58	6.58	10.79	15.46

Source: MWSI

3.6.2 Water Supply to Urban Poor in Metro Manila

(1) Current Water Supply Conditions for Urban Poor

Residents in major communities in Metro Manila are often squatting illegally in private or public lands left vacant. These people are excluded from the formal

social services including water supply. They get water of low quality often from water vendors who are sourcing legally or illegally from the Concessionaires' main pipelines or from private wells. The majority of low-income households do not have individual piped water connections, but rely on vended water.

The situation that squatters are excluded from piped water connections has led to a high level of non-revenue water (NRW) of MWSS. Upon privatizing in 1997, a special program to supply water for poor communities was included in the Concession Agreement, which contribute to both reductions in NRW and increases in revenues of the Concessionaires.

(2) Measures for the Poor to Get Water

Prior to the MWSS privatization, the poor in depressed areas in Metro Manila obtained water mainly from water vendors and/or public faucets. Nowadays, while vended water and public faucets still remain, group taps, bulk water and individual connections are becoming available.

a. Vended water

This source continues to be important even after privatization. It is, however, the most expensive water and its quality is said to be doubtful as the water may be sourced from illegally tapped mains or pipelines of the Concessionaires or from shallow or deep wells that are often contaminated.

b. Public faucets

Formerly, the old MWSS served depressed areas mainly with public faucets. The Concessionaires continue to serve unconnected households following the provisions of the Concession Agreement for the establishment of public faucets, each with a capacity to serve up to over 50 households. The public faucets are less expensive than vended water. They are managed and operated by either individual and Barangay officials or community associations.

c. Group taps

Group taps are installed by the "Tubig Para sa Barangay" (Water to the Barangay) program of MWCI. Under this program, land title requirements are waived and connection fee installment is allowed up to 3 months. In this program, 2 to 5 households form groups and share one mother meter and may opt to install individual sub-meters with one household acting as the leader doing collection and remittance of payment to MWCI. The water is less expensive than public faucets. The similar program is also available in the areas of MWSI, which is called "Bayan Tubig" (Water to Municipality).

d. Bulk water supply

This is a community-managed water connection as an alternative to group taps. This is a mini water distribution system that serves its members through metered pipes and is billed as a single account with one mother meter for the entire community. The community does meter reading, billing and collection for all its member-households who are each given individual

connections with respective sub-meters. The water is cheaper than vended water but more expensive than group taps.

Another case of bulk water supply is privately managed water distribution. A private sub-contractor provides water infrastructure investments required to distribute the water. It serves areas that are not yet given individual connections and resells water to households at rates a little lower and more convenient than vended water as distribution is made through long hoses.

e. Individual connections

"Bayan Tubig" of MWSI and "Tubig para sa Barangay" of MWCI are the water supply programs for urban poor. They waive land titles and spread connection fees over 3 months to 2 years. This is the most convenient and the water is cheapest among others. There is no more queuing for long hours. Households pay the same price as all the rest in the service area.

(3) Conceivable Benefits of Served Households

Households being served water through various measures as mentioned above may have benefited in terms of the following:

a. Access to and availability of safe and better quality water

b. Much reduced cost of water per cubic meter

c. Increased per capita consumption

d. Freed-up time from queuing which households now utilize for income-earning activities, caring for children and more leisure

e. Regularizing illegal connections in squatter communities which in turn resulted in reduced non-revenue water

f. Contribution to poverty alleviation in terms of improvements in health, education, gender and social inclusion, and income and consumption

g. Regarding social inclusion, the residents in poor communities that now have water connections feel that they have become a legitimate part of the society, receiving the same services that the rest have been enjoying. The water services have given some sense of self-esteem and encourage to pursue further improvements.

(4) Burden Share of Low-Income Households for Water Payment

The fact that the average price of water for low-income households is significantly higher than that for high-income households seems to be proven by a number of survey reports. The table below is that presented in one such literature.[3]

[3] Source: "Policy Notes" No. 2000-09, July 2000, Philippine Institute for Development Studies

Average costs of water by income class in Metro Manila, 1995

Income class (in Peso 1000/year)	Average cost (P/cum)	% of water bill to income
Under 30	36.4	8.2
30-39	15.9	4.4
40-59	15.9	4.2
60-99	15.9	2.9
100-149	13.9	2.2
150-199	9.2	1.6
200-249	5.9	1.4
250-499	8.0	0.8
500-749	6.0	0.8
750-999	9.3	0.8
1000 and over	7.1	0.6

Note: Average cost of water from various sources.

The lowest income group paid 36.4 Pesos for one cubic meter water and the percentage share of water bill to income was 8.2% in 1995. Although this is a survey carried out prior to the MWSS privatization, the water conditions for the urban poor are not likely to improve significantly.

A web-site of ADB presented a case study of water and poverty in Cainta, Metro Manila. A poor household with 7 families whose monthly income is $300 in total (wife and husband) pays $20 per month for water, nearly 7% of their household income. They used to pay $12.50 per month for a metered piped supply from a deep tube-well operated by a private contractor. However, the supply was only for one hour twice a day. So, they paid another $7.50 per month for drinking water purchased by the container from another contractor. The source was purported to be from the concessionaire's piped supply.

The ration of power/water bill is deemed to be a useful proxy for the affordability of water on the one hand, and the appropriate level of water tariff on the other hand. High ratios of greater than 4.0 indicate both affordability and too low water tariff, while low ratios of 2.0 or less indicate that the tariff is reasonably high. The JICA Study Team tested in August 2002 the current water tariff by computing the said ratio through a simplified sampling survey. Survey sheets requesting the amount of power bill and water bill for a period from January to July 2002 were distributed to Filipino households in connection with the Study by such agencies as NWRB, MWSS, NJS Manila Office, Phil. Koei Office (both offices are affiliated firms of Japanese engineering consulting firms), and local staff of the JICA Study Team. Out of the total 42 sheets collected, four were excluded as invalid leaving 38 sheets for analysis. The result showed that the 25 households with a Power/Water Bill Ratio of greater than 4.0, eight with P/W bill ratio of less than 2.0 and five with P/W bill ratio between 4.0 and 2.0. The aggregated P/W Bill Ratio of 38 sheets was computed at 4.9. Although the concessionaires of correspondents of the survey were not identified, both the MWCI and MWSI are deemed to be included. This high P/W bill ratio of greater than 4.0 may be interpreted to imply that the current water tariff is low enough for the consumer's affordability to pay.

(5) Recommendation

It is often mentioned in survey reports on water supply that urban poor have a high willingness to pay for water. Many poor households will prefer individual connections rather than public faucets or vendor type services since the individual connection is more convenient to them. It is also true when the cost they are paying for water is taken into consideration.

In these contexts, it may be recommended that, from the point of view of urban poor water supply, MWSS (Regulatory Office) should allow the Concessionaires to raise water tariffs so that the Concessionaires can invest more for the urban poor living in depressed areas in Metro Manila. The urban poor will pay for the water of individual connections and can obtain more benefits than the cost they pay for the water. Investments in this area will be economically justified and also socially acceptable.

3.6.3 Operation and Maintenance Cost of Water Distribution Facilities

The table below presents cost of water production of the MWSI in December 2000. Of the total direct cost (5.96 Pesos/m^3), distribution facilities cost 0.81 Pesos/m^3 or 13.6%. According to the MWCI, the cost of production, treatment and distribution is 2-3 Pesos/m^3 out of the 6 Pesos/m^3 of total direct cost. Thus, approximately 1 Peso/m^3 is considered the current distribution facilities cost.

Cost of Water Production (December, 2000)

(Unit: Peso)

Item	Purification and Treatment	Transmission Pumping & Distribution	Technical Operation	Total Water Direct Cost
Materials	7,143,111	226,207	1,150,226	8,519,547
Labor Cost	2,926,595	2,918,873	18,931,326	24,776,795
Overhead	185,698,912	53,538,178	142,349,044	381,586,135
Total Production Cost	195,768,620	56,683,259	162,430,598	414,882,478
Cost of Water from East	10,787,932	-	-	10,787,932
Total Cost	206,556,553	56,683,259	162,430,598	425,670,410
Cost Per Cubic Meter				
MWSI	2.81	0.81	2.33	5.96
Water from East	1.86	-	-	1.86
Total	4.68	0.81	2.33	7.82

Source: MWSI