TEACHING NOTE

A SUMMARY OF THE INTEGRATED PROJECT APPRAISAL METHODOLOGY

Manila South Water Distribution Project Case

1 INTRODUCTION

This teaching note provides step by step outline of how an integrated analysis of an investment project is carried out. We illustrate the integrated approach to project appraisal by applying it to a Manila South Water Distribution Project located in the Philippines. In 1990, the southern region of metropolitan Manila had faced a water supply problem, with only 30 percent of the region's households having access to piped water. Moreover, these households often faced water shortages and cut-offs due to an inadequate water supply and distribution system. The other 70 percent of the households obtained their water demand from private water vendors and private wells. The water from both of these sources was in poor quality, while purchasing water from private sector was also very expensive. The government of Philippines established an inter-agency task force which prepared a Water Supply, Sewerage and Sanitation master plan for the Philippines for the period 1988-2000. The objective was to improve the water supply by extending the coverage of its distribution system in the southern part of Manila. The main objective of this project is to improve the water distribution service of MWSS in the South Manila area, increasing distribution coverage from the current 30% of the population to 85% by the year 2004.

This analysis was carried out prior to the privatization of the Manila Water System. It is illustration of the situation facing the utility prior to privatization. The spreadsheet tables for this case are presented in the Appendix to this note.

The analysis is expressed in domestic prices at the domestic price level. The note begins with a discussion of the presentation of the financial appraisal. This is followed by a

systematic discussion of the economic and distributive analysis. The final section provides an overview of the risk aspects of the analysis.

2 THE INTEGRATED PROJECT APPRAISAL

The central tool of the analysis is the pro forma cash flow, net financial and economic benefit statements, which contain projections of the annual inflows and outflows over the life of the project. There are two goals of the appraisal. First, the appraisal seeks to determine if the project will be financially sustainable. In the case of a private sector project, in order for the equity holders or any other financial stakeholders to be willing to undertake a project, the net present value of project's predicted stream of annual net cash flows (NPV) should be positive. Other measures of financial performance such as the debt service coverage ratios are also important indicators of financial sustainability The pro forma net economic benefit statement constructed from financial appraisal serves as the basis for determining the project's economic feasibility.

2.1 The Financial Evaluation

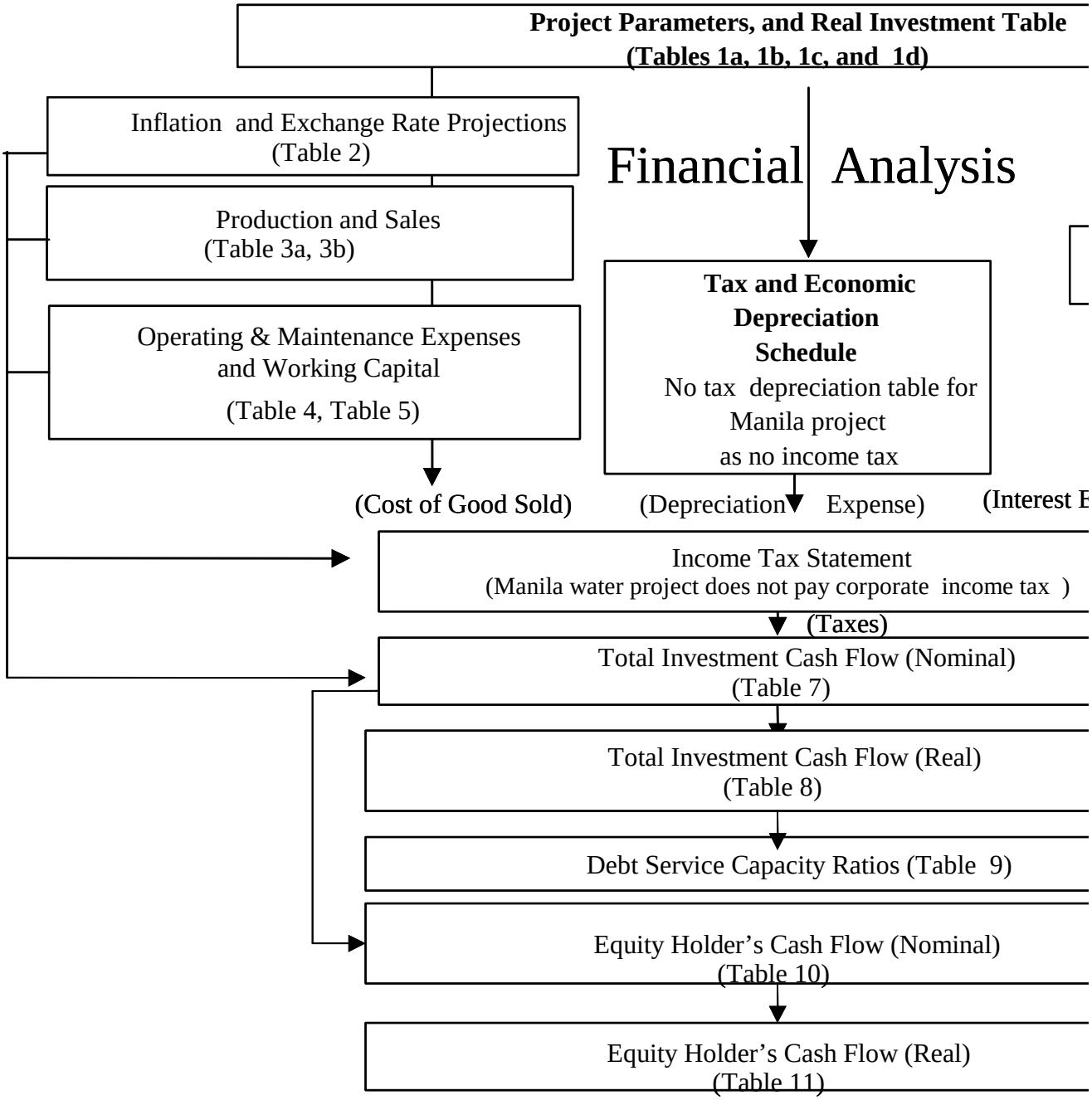
This section describes the step by step construction of the financial pro forma cash flow statement, using the Manila South Water Distribution project as an example. It is important to note that some project appraisals may not require every table that is presented in this note. For example, the appraisal of a public sector project that does not pay taxes will not need to include the tax-related analysis. The Manila South Water case is a project of this type as it is not subject to income taxes. Now we present steps in financial appraisal of a typical project. The schematic organization of the initial stages in the analysis of the project is shown in Figure 1. Figure 1 shows the list of preliminary tables necessary for the development of the financial cash flow statement.

Step 1: Table of Parameters

All of the basic information about the project should be included in the table of parameters. This table should contain all the information about the project that is exogenous to the analysis. The Manila South Water Distribution Project's table of parameters (Table 1a, 1b, 1c, 1d) reveals items such as the number of existing and new connections to the water system, the price of the output (i.e. water tariff rate), working capital requirements, the cost and quantity of required inputs, relevant interest rates, grants, expected inflation rates, exchange rates, discount rates, and the investment and financing plan. The investment costs tables in the various components of the project are shown in Table 1c, and 1d. These tables will present a yearly breakdown of initial and additional investments of the project in real terms.

These are all the important variables needed to carry out a good project appraisal. Anticipated changes, such as annual real wage increases, should also be included. All parameters should be expressed in terms of clearly labeled units, with prices expressed in terms of a given year, usually "Year 0". A complete parameter table is especially important in order to take advantage of the analytical tools available in computerized spreadsheet and risk analysis programs. On the spreadsheet, all subsequent tables of the financial analysis should contain only formulas that refer to the information provided in the table of parameters.

Figure 1: Project Parameters



Step 2: Inflation and Exchange Rates Projections

Since inflation affects a project's cash flows and net economic benefits profile, through impacts on working capital and tax liabilities, nominal prices should be used throughout the financial analysis. The domestic inflation index allows us to estimate the nominal prices of items in any year, and can be easily calculated using the inflation rates provided in the table of parameters. If the project involves internationally traded goods or loans denominated in a foreign currency, we will also need to consider foreign inflation. The expected nominal exchange rate is based on the 'Year 0' real exchange rate and the relative inflation of the two. These calculations are shown in Table 2 of the Manila South Water Distribution Project.

Step 3: Production, Sales Revenue, and Costs

Table 3a of the Manila South Water Distribution project presents the water demand and supply projections over the life of the project. The nominal water tariff rate projections that are used for the calculations of costs and revenues will be adjusted annually to reflect inflation, for various political and administrative reasons it is likely that this adjustment will not be made immediately in step with inflation. In the analysis it is assumed a lag in the adjustment of the tariff, which would have the ultimate effect of lowering the effective tariff throughout the life of the project. The lag was modeled by reducing the tariff to approximately 91% of its real value for every year of the project.

Tables 3b of the project estimates the future sales revenues from the project based on the water demand and supply projections that are given in table 3a. Once we have estimated the real prices in each year, nominal price estimations can be made by simply multiplying the real price in a given year by the domestic inflation index for that year. Table 3b shows the estimates the amount of water services demanded and sales revenue generated.

In order to provide water services, operating and maintenance costs for each year are estimated in Table 4. These costs are based on the production levels estimated and costs described in the table of parameters (Table 1). The figures in table 4 present operating and maintenance costs in nominal as well as is in real terms.

Step 4: Tax and Economic Depreciation Schedule

Depreciation expenses are calculated for income tax purposes and for the estimation of the residual values for the final year of the analysis of the project and should not be mistaken for a cash outflow in the project cash flow statement. The depreciation expenses for the tax purposes is usually estimated based on nominal investment expenses, and the useful life of the project as it is specified by law for tax purposes. As tax laws vary from country to country, the precise amount of depreciation expense allowed for tax purposes can also vary. It is the rates of economic depreciation that should be used for the estimation of the residual values of the project.

Step 5: Working Capital

Working capital generally includes inventories, accounts receivable[1], accounts payable, and cash balances.[2] As indicated in the table of parameters (Table 1) accounts receivable for the Manila Water Distribution Project are assumed to be three months of revenues. Accounts payables are assumed to be three months of operating expenses except labor, while cash balances are assumed to be one month of all operating expenses. These calculations are shown in Table 5.

[1] It is the change in accounts receivable that affects the cash flow. An increase in accounts receivable indicates an increase in the amount that the patients owe the hospital. An increase in accounts receivable must be included in the cash flow statement as a negative inflow since it decreases the amount of inflows.
[2] As with accounts receivable, it is the changes in accounts payable and cash balances that must be included in the cash flow. An increase in accounts payable means that the project receives an input without paying out cash; therefore it is an inflow to the project. An increase in the cash balance on the other hand means that more cash is tied up in the day to day operations of the project, and is considered an outflow.

Step 6: Loan Schedule

The loan schedule is constructed using the information on investment costs, financing and interest rates included in the table of parameters. The purpose of this schedule is to determine the net debt cash flow (loans borrowed minus any repayments) during the life of the project. The loan schedule also provides the amount of interest paid by the project, which is included as an expense in the income statement and thus affects the project's tax liability (Table 6).

Step 7: Tax-Related Analysis

If the project under appraisal is subject to business income tax, then the tax-related analysis described on the following page must be included in the appraisal, in order to estimate the amount of income taxes that the project will pay each year. In the appraisal of projects that do not pay taxes, these tables do not have to be included, and the analysis can proceed directly to the nominal net cash flow statement.

Step 7.a: The Income Statement

The only purpose of the income statement in the financial analysis is to estimate the project's tax liability. The taxable income of any project in any given year are equal to the total revenues minus the cost of goods/services sold, administration overhead, tax depreciation expenses, assets out by the tax laws, and interest expenses. Multiplying the taxable income by corporate tax rate from the table of parameters gives us an estimate the project's tax liability in each year.

Step 8: Nominal Net Benefit Statement: Total Investment (Banker's) Point of View

The nominal cash flow, or net benefit statement, from total investment (Banker's) point of view is given in Table 7 of the Water Distribution Project. The total investment point of view, evaluates the project on its own merits, without considering the impact of any financing loans. The cash flow (or net benefit) statement, simply put, includes all benefits that create inflows into a project and costs that create outflows. And we include salvage values if they are calculated. Note that the salvage values are based on the liquidation values calculated using economic depreciation rates which are usually indicated in the table of parameters, and not on the rates of depreciation used for tax purposes. Looking at Table 7, on the inflow side is total income, plus the changes in accounts receivables. On the outflow side of Table 7 are investment costs, operation costs, changes in accounts payable, and changes in cash balances. In general, in the project's final year, all outstanding accounts (payables, and cash balance) are settled and salvage values are estimated. Cost outflows are subtracted from benefit inflows to reach the nominal net benefits in each year.

Step 9: Real Net Benefit Statement: Total Investment (Banker's) Point of View

Shown in Table 8, the real net cash flow statement from the total investment point of view is simply the nominal cash flow statement divided by the inflation index. For analysis of the operations of the project, it is preferable to deflate each line of the nominal cash flow separately, rather than deflating only the bottom line of the net cash flow. The net present value of the project can then be estimated by discounting the real net cash flow stream by the overall cost of capital noted in the table of parameters.

Step 10: Debt Service Capacity (Table 9)

The annual net cash flow from the total investment (Banker's) point of view are the basis for evaluating the capacity of the project to service the debt for the alternative financing scenarios. The calculations of Debt service capacity ratio is explained below. We calculate annual debt service capacity ratio (ADSCR) on a year to year basis and a summary ratio of PV of Net Cash flows over PV of loan repayments during the period of the loan repayment. In other words, first of all, we calculate Annual Debt service capacity Ratio (ADSCR) as follows;

Annual Debt Service Capacity Ratio (ADSCR) = [$ANCF_{real}$/(Annual Debt repayment $_{real}$)]

Where:

ANCF: Annual Net Cash Flow of the project before financing
Annual Debt repayment: It includes annual debt installments (interest + principal) during the period of the loan repayment

Then, we calculate Debt service capacity Ratio (DSCR) as

DSCR = (PVNCF $_{end\ of\ debt}$) /(PV Annual debt repayment $_{end\ of\ debt}$)

(Note: Discount rate: use real interest rate on loan financing)

Step 11: Nominal Net Benefit Statement: Equity Holder's Point of View

As it is shown in Table 10, the net cash flow from the equity holder's point of view is identical to that of the investment point of view, except that the equity holder also considers the impact of financing on the project.

Step 12. Real Net Benefit Statement (Equity Holder's Point of View)

Table 11 shows the equity holder's real net cash flow, which is simply the real net cash flow from the investment point of view, plus the real debt inflows (or, the equity holder's nominal cash flow deflated by the inflation index). The net present value from the equity holder's point of view can be estimated by discounting the equity holder's real net cash flow by the equity discount rate, 10 percent in the case of Manila Water Distribution

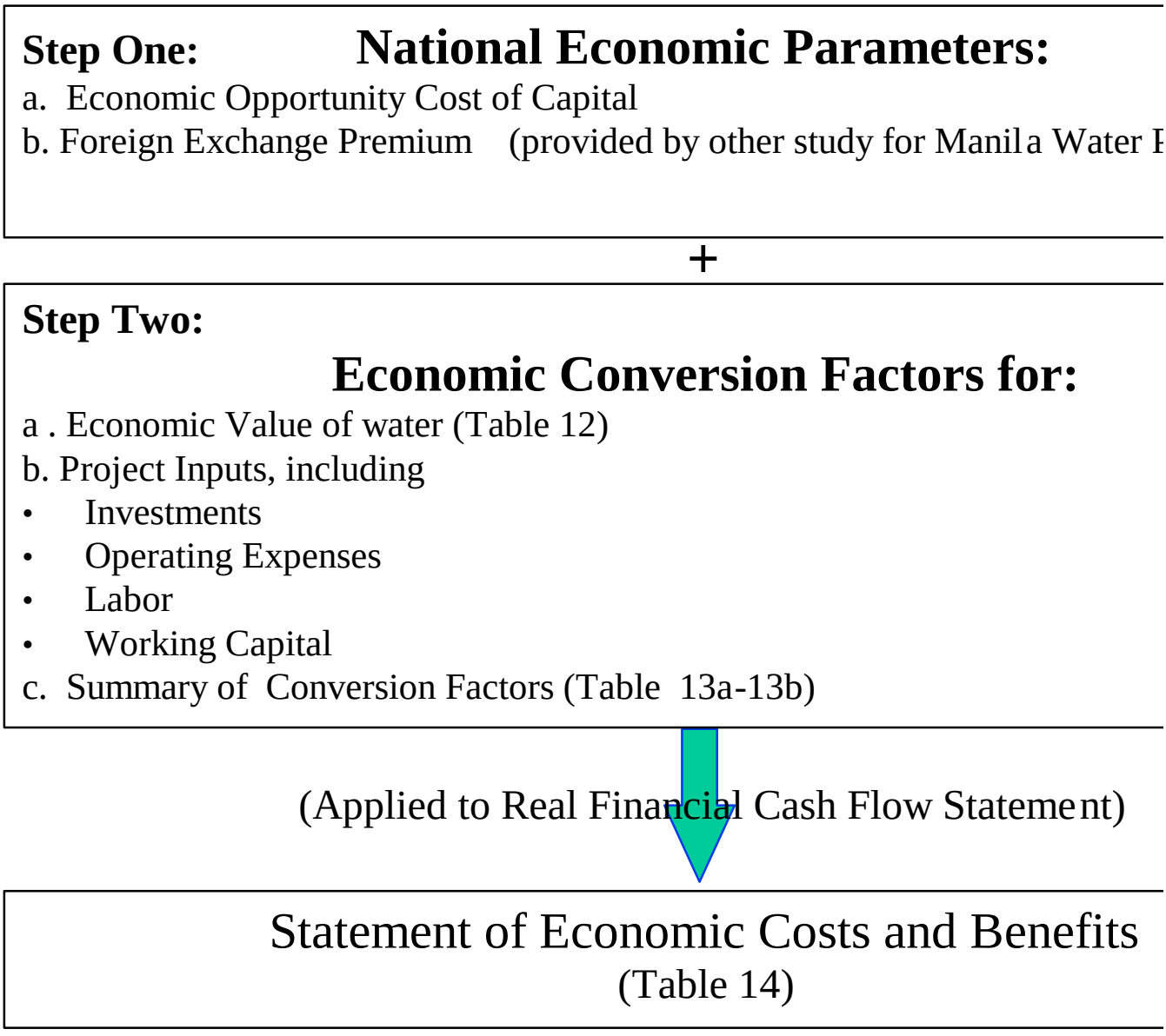
project. The government, however, is more interested in the project's impact on the overall economy, and so using the real financial net benefit statement as a base, can proceed to evaluate the economic costs and benefits of the project.

2.2 THE ECONOMIC EVALUATION OF THE PROJECTS

The economic evaluation of a project estimates the real economic value of the project's net benefits to the society as a whole. This evaluation is important for policy makers faced with a decision of whether or not to implement a particular project, or in the analysis of policies that affect the private sector's decision to undertake investments. It is also important to private decision-makers that are concerned with the effects of changes in economic policies. Such changes in policies have their primary impact on the financial performance of the project. It is the economic analysis that identifies the critical policy variables and the fundamental productivity of the project. The central tool of the economic analysis is the projects Statement of Economic Costs and Benefits. Converting the financial values of the project's financial cash flow statement into economic values generates this statement. Therefore, the stream of annual net cash flows on the financial cash flow statement is converted to a stream of annual net economic benefits. This resulting stream of net economic benefits can then be discounted by the economic cost of capital to estimate the net present value of the project to the country's economy as a whole. The schematic organization of the stages in the economic appraisal is shown in figure 2.

We describe the steps involved in estimating a project's economic NPV. Assuming that we have already constructed the real financial cash flow statement, we arrive at the economic statement in three steps: 1) the estimation of national economic parameters; 2) the estimation of economic conversion factors for each line item of the financial cash flow; and 3) the application of the national parameters and conversion factors to the financial cash flow statement. These steps are described in more detail below.

Figure 2 : Economic Analysis



Step 13: National Economic Parameters

Step 13.a: Economic Opportunity Cost of Capital

In the financial cash flow statements the cost of capital was valued at the equity holder's or at total investment's discount rate. However, since the project's use of capital means that this capital will not be available to the rest of the economy, we need to value these funds at a rate that reflects its true value to society. The estimation of an economy's opportunity cost of capital (EOCK) is based on a weighted average that reflects the real economic rate at which different groups of suppliers of funds (savers) value additional consumption, and the real economic rate at which different groups of demanders of funds (investors) value additional investment. Central to the estimation of the EOCK is the adjustment for any taxes or subsidies, which distort supply and demand for funds. Perhaps most importantly, consideration of the EOCK helps policy makers reject wasteful project proposals.

Step 13.b: The Foreign Exchange Premium

If a project generates or uses foreign exchange, the economic, rather than the market exchange rate of the foreign exchange rate must be included in the economic analysis. The market foreign exchange rate (E_m) frequently does not reflect the economic value of foreign exchange. The foreign exchange rate, which is the price of foreign exchange in the economy, is determined by the interaction of supply and demand for foreign exchange like all other prices in a free market system. Since taxes and tariffs affects the supply and demand of exportables and importables, which in turn affects the foreign exchange rate, the economic value of foreign exchange rates (E_e) is estimated by adjusting for these distortions. The foreign exchange premium (FEP) is simply the percentage by which the E_m must be adjusted to reach the E_e. In other words, $((E_e/E_m) - 1) = FEP$. The FEP is used in the calculation of the economic conversion factors, described below. However,

the values for EOCK and FEP for this project were taken from the study done by Jenkins, Glenn P. and El-Hifnawi, Baher.[3]

Step 14: Economic Conversion Factors

Below is a general overview of how to estimate the economic value of a good or service. Once the economic value is estimated, it is divided by the financial price to arrive at the economic conversion factor. In the case of project outputs, the relevant financial price used to calculate the conversion factor is the supply price (P_s) that the project receives. If the item is an input to a project, the relevant price is the demand price (P_d) that the project must pay. Multiplying an entire line of the financial cash flow statement by the economic conversion factor for that particular good or service will result in the stream of economic costs or benefits due to that good. Conversion factors must be estimated for every item in the financial cash flow. The commodity specific conversion factors for the Manila water distribution project are presented and economic values calculated in (Tables 13a-13d).

Step 14.a: Project Outputs

A project's output may be either a tradable or a non-tradable good. If it is a tradable good, its economic value depends on the world price for the good, plus the foreign exchange premium. In order to estimate the economic benefit of the tradable good, adjustments must be made to the financial price so that the FEP is included and any distortions created by taxes, subsidies or tariffs excluded.

If the project produces a non-tradable good, its economic value depends on the interaction of supply and demand for the good. In a free market system, the additional supply produced by the project, will lead to lower prices. Generally speaking, the economic value of the goods produced will equal the value of additional consumption, plus the

[3] Jenkins, Glenn P. and El-Hifnawi, Mostafa Baher, "Economic Parameters for the Appraisal of Investment Projects: Bangladesh, Indonesia, and the Philippines," *Report for the Economics and Development Resource Center*, Asian Development Bank, 1994.

value of resources released as original suppliers reduce production. Once again, adjustments must be made for the distorting effect of any taxes or subsidies.

For the analysis of this project, the economic value of water for drinking and washing has been calculated and used in the estimation of economic benefits of water. The economic benefits of drinking and washing water is calculated for paying and non-paying customers.

Below we discuss the methodology used in the estimation of these benefits and demand model for water that is being utilized.

Demand Model for Manila Water System

While there is shortage of water, the Metropolitan Water and Sewerage System (MWSS) was not be able to provide clean drinkable water. Many people were using alternative sources. The government decided to privatize the water system for the purpose of supplying good and clean drinkable water to its consumers. While private institutions are always willing to provide a service to earn profits, they didn't automatically have any social obligation. For those who receive an improved service, at the same or lower price will be better off but for some who were before receiving water free of charge, and will now have to pay for it after, they are likely to be worse off.

Demand for Washing Water:

Let's examine a demand and supply model of the market for water in the Manila Water and Sewerage System Project separately. We will analyze the demand of drinking and washing water. Most of the people were initially using wells water for washing and buying their drinking water from vendors.

Let's see the demand curve for washing water from the perspective of MWSS Utility when the alternative for the water users is to pump water from private wells.

Demand for Washing Water

Figure A: Demand for Water from MWSS

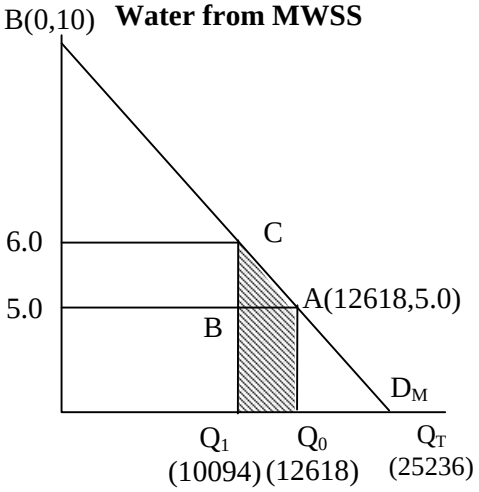
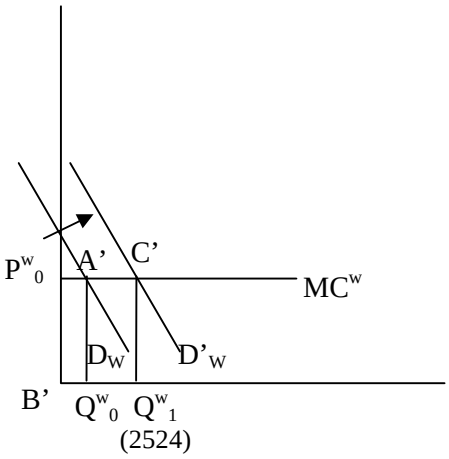


Figure B: Demand for Water from Wells



In figure A, it is assumed that the maximum real price anyone will pay for MWSS water for washing is 10 pesos/m^3. When well water is available at a cost of $P^w_0 = MC^w$. As MWSS raises price from 5 to 6 pesos per m^3 the quantity demanded for MWSS water falls from 12618 to 10094. The demand for well water shifts from Q^w_0 to Q^w_1.

The elasticity of the point A on demand curve BD_M is assumed to be equal to –1.0,

$$\text{Demand elasticity} = \frac{?Q}{?P} \cdot \frac{P}{Q}$$

$$= \frac{0 ? 12618}{10 ? 5} \cdot \frac{5}{12618}$$

$$= ? \frac{5}{5} = -1$$

We assume that the demand curves are all straight lines. The elasticity along a straight line demand curve is always changing as the quantity is changing; the equation for the slope for the changing quantity is equal to:

$$m\,(Q_0 - Q_1) = P_0 - P \quad \text{or,} \qquad m = \frac{P_0 - P_1}{Q_0 - Q_1}$$

Where, Q_0 is equal to the initial quantity, Q_1 is equal to the increase quantity, P_0 is equal to the initial price and P_1 is equal to the increase in price. For this demand curve when Q_0 is equal to 0, then price (P_0) is equal to 10 and while Q_1 is equal to 12618, then price (P_1) is equal to 5.

The equation for the demand curve is equal to

$$m\,(Q - Q_1) = P - P_1 \quad \text{or,} \qquad Q = \frac{1}{m}[P - P_1] + Q_1$$

Where

Q = quantity of demand water

P = price of water

Q_1 = Quantity of water while price is 5

P_1 = Price of water whatever quantity demand

When Q_1 and P_1 were given, we are able to find the equation for straight line.

The slope (m) of the line AB is equal to,

$$m\,(Q - Q_1) = P - P_1 \quad \text{or,} \quad m\,(25236 - 0) = 0 - 10$$

$$\text{or,} \quad m = -\frac{1}{2523.6}$$

The demand curve AB at the point (5, 60) is written as,

$$m\,(Q - Q_1) = P - P_1$$

Substituting values for m, Q_1 and P, we have,

$$= -\frac{1}{2523.6}\,(Q - 12618) = Y - 5 \quad \text{Or, } Q = 25236 - 2523.6P$$

Where, Q is the Quantity demanded of water and P is the price of water.

In figure A, if the price of water is increased by 20% i.e. from 5 to 6 then the quantity demanded of water will decrease by 20% i.e. means from 12618 to 10094 because the

demand elasticity of water is –1. The shaded area Q_1CAQ_0 is the decrease economic value of the water demanded because of the increase the price. When the price is equal to 5.0, people use only a small amount of well water (Q^w_0). When the price of MWSS water is increased by 20% to 6.0 pesos then 20% less of MWSS water will be consumed and more well water Q^w_1 will be demanded.

Because we assume that well water is provided in perfectly elastic supply at P^w_0 there will be no change in economic welfare from an increase in the demand for well water used for washing when MWSS increases its price from 5 to 6 pesos.

Demand for Drinking Water:

Now, the utility couldn't provide sufficient clean water for drinking and cooking consumption. People have to by water from the vendors. The price vendors currently sell is 37 pesos. The utility could provide water at a price of 5 pesos. We assume that MWSS will supply water at 5. Hence, non of the private vendors will continue supplying water because their minimum marginal cost of supply is 20 pesos. AP_2OB is the value of resources saved by eliminating the need for private vendors. Q^TBAC is the value of the additional consumption of water because of the decrease of the price. P_1P_2AC is the increase in the value of consumer surplus because of the decrease price.

Let's see in the figure for the demand curve of drinking water,

Figure C: Demand and Supply of Drinking Water from vendors with no MWSS Supply

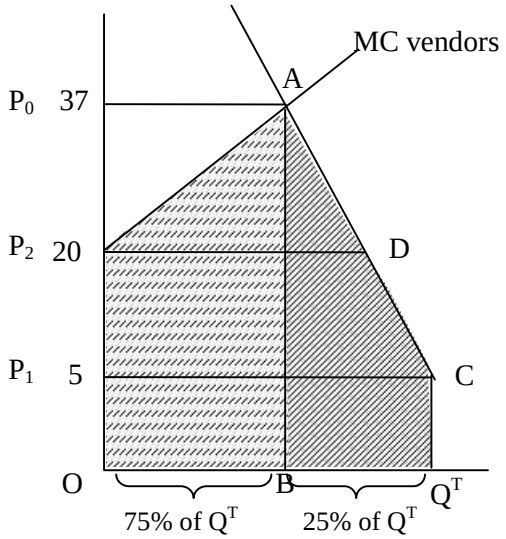
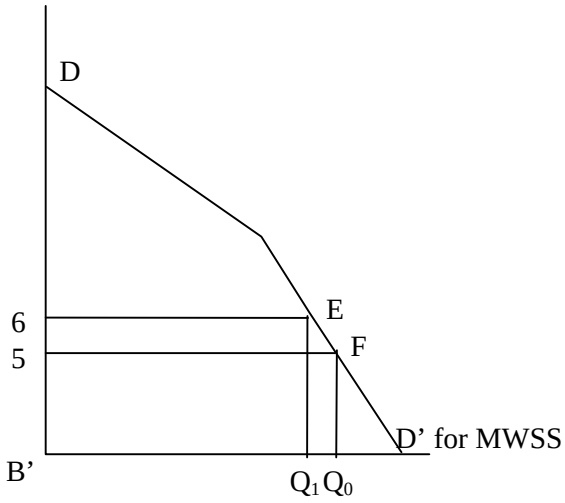


Figure D: Demand facing MWSS for Drinking Water



When the price is increased from 5 to 6 pesos, the demand from drinking water from MWSS will decrease from Q_0 to Q_1, this is shown in figure D. That means more people will use alternative water sources for drinking i.e. use well water with boiling, or use bottled water.

Figure E: Use of boiled well water for drinking

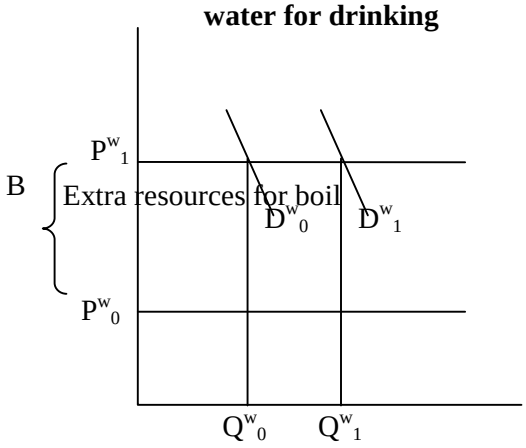
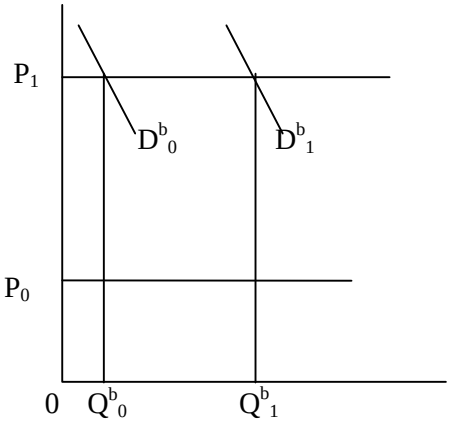


Figure F: Use of Bottle Water



In figure E, the price of well water is P^w_0 which they were using for washing water. Because of price increase of MWSS water, more people would like to use well water and then boil it for drinking and cooking. Of course, they have to use extra resources to boil the water. The cost of drinkable water will be $P^w_1 = (P^w_0 + B)$, where B is the cost of boiling water. With the higher price of tap water from MWSS, the quantity demanded of boiled water shifts from Q^w_0 to Q^w_1. The economic loss value of the water now not purchased for drinking from MWSS, is shown by the area Q_1EFQ_0 in figure D.

In figure F, we can see the demand for bottle water was Q^b_0 while price of drinking water was P_0. When the price of MWSS water becomes P_1=6 pesos the demand for bottled water will increase from Q^b_0 to Q^b_1. Because we assume that both boiled well water and bottled water are provided in perfectly elastic supply conditions, there will be no economic loss or gain from the change in demand in this market due to the increased in MWSS's price. All the change in economic welfare is measured by total demand curve for MWSS water or DD's in figure D.

Step 14.b: Projects Inputs

Project inputs, including investment costs and operating costs can be either tradables or non-tradables, and the economic cost of using the good in the project can be estimated in the same manner described above. Special mention should be made, however, of the appropriate estimation of the conversion factor for labor. Adjustments made to the financial price of labor in estimating its true economic value can vary depending on the specific context of the project and on the specific type of labor used.[4]

Step 14.c: Working Capital

The financial cash flows of most projects include Changes in Accounts Receivable, Changes in Accounts Payable, and Changes in Cash Balance. The appropriate conversion factors for Changes in Accounts Receivable and Accounts Payable are a weighted average of the components that determine the accounts.

[4] For a more complete discussion, see *Program on Investment Appraisal and Management Manual*, Glenn P. Jenkins and Arnold Harberger, Harvard Institute for International Development, Chapter 13.

Step 14.d: Taxes, Tariffs, Subsidies, and Loans

These items are considered merely transfers within the economy and, as such; do not reflect any real economic resources. The relevant conversion factor is zero.

Step 15: The Statement of Economic Costs and Benefits

Once the above two steps are completed, the construction of the Statement of Economic Costs and Benefits is very straightforward. Simply multiple each line of the real financial cash flow statement by the relevant conversion factor. Subtracting economic costs from benefits in the same way that cash outflows are subtracted from cash inflows will produce a stream of annual net economic benefits. Discounting this stream by the Economic Opportunity Cost of Capital, results in the net present value to society of the project's net economic benefits. The economic resource flow table is presented in Table 14, where net economic benefits are discounted at 10.30 % economic cost of capital, which is estimated for Philippines.

2.3 THE DISTRIBUTIVE ANALYSIS OF A PROJECT'S NET BENEFITS

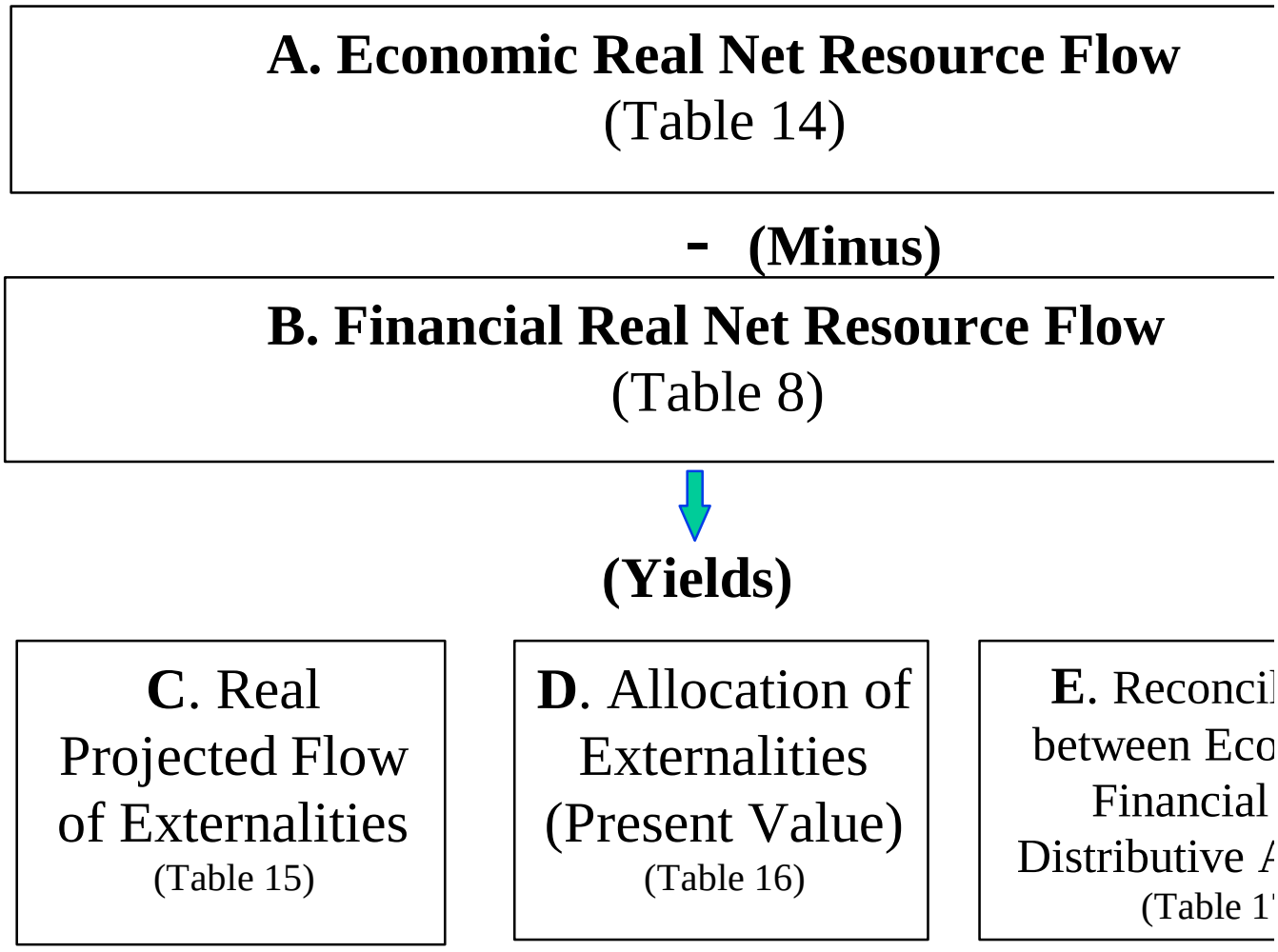
Distributive analysis seeks to allocate to the various parties involved the benefits and costs generated by a project. This analysis is important to policy makers, as it lets them estimate the impact of particular policies (often pricing policies) or projects on segments of society, and to predict which groups would reap off the greatest benefits and which groups, if any, would suffer from the project.

We illustrate how to estimate the net benefits[5] of externalities generated by different items in a project, and how to allocate these benefits to different parties. The figure 3 provides an example of the steps involved in the analysis of the distribution of a project's net benefits when project is undertaken.

[5] Net benefits may of course be negative (i.e., losses), as well as positive (gains).

All projects generate two types of net benefits. First, there are the financial net benefits, which accrue directly to the equity holder (the financial stakeholder). Second, there are externalities that may accrue to various other groups in society. The project's direct net financial benefits, allocated simply to the equity holder, are represented by the equity holder's financial NPV (discounted at the equity holder's opportunity cost of capital). The net benefits of the externalities, on the other hand, are allocated item by item to the respective party involved. Who benefits and who suffers as a consequence of a project is very much determined by the nature of the project. However, most projects will have a financial impact on one or more levels of government. The allocation of a project's externalities can be completed in three following steps.

Figure 3: Distribution Analysis



Step 16: The Real Economic Statement minus the Real Financial Statement

A distributive analysis begins with a project's financial and economic net resource flow statements.[6] The financial net resource flow (or cash flow) statement estimates the net financial benefit of a project to the equity holder, while the economic statement predicts the project's effect on the overall economy of a country. The difference between these two net resource flows is externalities, net benefits or costs which are not captured by the equity holder. Subtracting the real financial net resource statement from the real economic statement is the first step in estimating a project's externalities. The particular stakeholder that is to be identified will be a function of the characteristics of the project. As it is shown in the Figure 3, Table 14 (the economic statement) minus Table 8 (the financial statement: Real investment point of view) results in Table 15 (the net benefits flows of externalities).

Step 17: The Present Value of the Externalities

The next step is to calculate the present value of each line item in the table of externalities (Table 16), using the economic discount rate.[7] An alternative method, which you may encounter, of estimating the present value of the externalities is to first calculate the present value of each line of both the economic and financial statement, and then subtract the financial present values from the economic ones. The disadvantage of this alternative however, is that it doesn't generate a table such as Table 16 that provides information about trends in externalities over the life of the project.

[6] See earlier notes for a discussion of these two statements.
[7] The present value is most easily calculated using a spreadsheet's NPV function.

Step 18: Allocating the Externalities (Stakeholder Analysis)

The final step is to identify the parties to whom the externalities accrue. In many projects, much of the externalities accrue to government, due to taxes, subsidies, tariffs, the foreign exchange premium, etc. In Table 16, the externalities are allocated to government, paying and non-paying users of water, water vendors, and engineering services providers. The largest share of the externalities goes to paying users of water in the form of consumer surplus. The positive externality to consumer implies that they are willingness to pay is higher than what they actually pay for the service that will provided to them.

Step 19: Summary of the Distribution of the Project's net Benefits

At the end of table 16 we present a summary of the allocation of the project's net benefits. In this example it is very simple, but in many cases it is a helpful tool. Especially if the equity holder is a government agency, or a similar entity to whom externalities may accrue, it is useful to look at the total impact of the project on the equity holder (that is, the financial NPV plus any externalities).

Step 20: Reconciliation of the Economic and Financial Statements

The reconciliation demonstrated in Table 17 serves as a check to verify that all of the externalities have been accounted for and that, indeed, the difference between the Economic and the financial statements is due solely to externalities whose origins have been identified.

Figure 4: Risk Analysis

A. Sensitivity Analysis of Financial Economic Outcome
(Tables 18, 19)

B. Risk Variables, Probability Distribut Range Values
(Table 20)

C. Risk Analysis Results
(Table 21 and Figure 1 & 2)

2.4 SENSITIVITY AND RISK ANALYSIS OF THE PROJECT

Risk Analysis is important for number of reasons. First, we need to reduce the likelihood of undertaking a "bad" project while not failing to accept a "good" project. Second, one way to reduce uncertainty is to gather more data and information, to the extent feasible, about the key project variables in order to narrow their likely range and to determine precisely the appropriate probability distribution .

First of all, we need to identify the variables that are critical determinants of a project NPV. Sensitivity analysis is the first step that helps to identify the key variables. Figure 4 demonstrates the steps are taken in the Sensitivity and Risk Analysis.

Step 21: Sensitivity Analysis

A sensitivity analysis in Manila Water Supply project was conducted on the financial net present value (NPV) to help identify the variables that have a relatively large impact on the project financial returns and to assess the magnitude of these impacts. The following key variables were used in the analysis: water tariff rate, installation efficiency for connections, the percentage of non-revenue water, the number of months of accounts receivable, the real increase in the wage rate, a real investment cost overrun, and the domestic inflation rate.

A sensitivity analysis on economic net present value was conducted to see how it would change if the true economic benefit of water varied considerably from our estimated value. The key variables were tested on effect of variations in the economic benefit of water to paying users, while the second varies the benefits to non-paying users. Table 18 and 19 presents the results of the sensitivity analysis for the variables that were tested both on financial and economic NPV.

Step 22: Risk Analysis

The following variables, which were identified in the sensitivity analysis, were used to conduct a risk analysis. The assigned probability distribution and range limits of the changes in the values of the selected variables are shown in Table 20.

Table 1: Risk Variables, Probability Distributions, and Range values

Risk variable	Base value	Probability distribution	Minimum value	Maximum value	
Ability of MWSS to meet Non-Revenue water targets	100%	normal	-25%	+25%	
Investment Cost overrun factor	0	normal	-20%	+20%	
			Range value		Probability
Installation Efficiency factor			.60 - .80		0.30
For connections	.84	step	.80 - 1.00		0.70
Average accounts receivable period, months[8]	3	step	1 - 2		0.10
			2 - 3		0.45
			3 - 4		0.30
			4 - 5		0.15

Step 23: Results of Risk Analysis

The results of risk analysis are presented in table 21 and figure 1, and 2.

3. CONCLUSION

People using this methodology may apply different levels of sophistication in their analysis as called for by the nature of the proposed investments. However the framework as summarized in this study should be followed closely.

[8]The probability distribution is based on MWSS' current record and on its program for reducing its level of accounts receivables.

A Major feature of this methodology is the complementary between the development of the computer spreadsheets and the financial-economic-distributive and risk analysis that is carried out using this tool.

If Case is not taken in the organization of the spreadsheets and the specifications of the interactions between the various analytical modules, then the quality and the nature of the output of such study will be greatly compromised. Each of these aspects of the analysis is codependent. In order for decision-makers to make the right selection of investment projects, each of the aspects of the project needs to be considered as part of the overall personality of the project.

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A

POTABLE WATER SUPPLY EXPANS

MANILA SOUTH WATER PRO

SPREADSHEET TABLES

Table 1a: Table of Parameters

1. Water tariff rate (1991)			5 pesos/cu m	10. Initial Private Connections
Adjustment to Real tariff rate due to time lag				No. of existing connections
in inflation related rate increases			91.25%	No. of person/existing connection
2. Inflation rate				Aver. Initial consump(liters/day)
Domestic 1990-91			12%	
Domestic 1992 - 2024			8.00%	11. Initial Shared Standpipes
Foreign			4.00%	No. of existing standpipes
3. Foreign exchange rate 1991(peso/dollar)			28.00	No. of persons/standpipe
				Average consump (liters/day)
4. Financing: ADB Loan (In $$)				
	% of Domestic Currency Cost funded by loan		33.3%	
	% of Foreign Currency Cost funded by loan		100%	12. Initial Non-Revenue Water (NF
Real Interest Rate	(Loan and loan repayments all in US$$)		6.09%	a. Of NRW, percent leakage
Nominal Interest rate			10.33%	b. Of NRW, percent non-leakag
Number of years loan repayment			20	
Grace period			5	
Beginning of Payment			1997	
Last date of Payment			2016	
5. Accts. receivable (RISK VARIABLE)		**3**	months	13. Operating & Maint. 1990 pesos
6. Accts. payable		3	months of direct expenses	Wage
			(O&M excluding labor)	Chemi
7. Cash		1	months of direct expenses	Power
8. Income tax rate		0		Maint
(MWSS as a government corporation is supposed to pay				
but has been exempt up to the time the project was being appraised)				
9. Discount Rates:				14. Operating Days/Year
Equity			10.0%	15. Project Life (years)
Economic			10.3%	**16. Inv. Cost Overn Fact (**
				17. Ability to meet NRW t
18. Elasticity for the Drinking and Washing Water				
Paid Drinking Water				
Nd =		-0.22	(Elasticity of Demand for drinking water)	
Fixed Rate for P_0		5.000		
Paid Washing Water				
Nd =		-1.00	(Elasticity of Demand for washing water)	
Maximum Willingness to Pay for Washing Water		10.00		
If price is higher than 10, quantity of washing water		0.00		
Break-even price for water vendors		20.0		
Maximum Willingness to Pay for Drinking Water		37		
Proportion of water used for Drinking		0.05		
Proportion of water used for Washing		0.95		

Table 1b: Table of Parameters

Manila South Water Distribution Project

	A	B	C	D	E	F	G	H	I	J	K
55					**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1**
56	17. AWSOP treated water production										
57	capacity cu. m/day(Incl. NRW)			401227							
58	18. Number of new connections proposed by MWSS each year				11229	19999	19706	19193	17493	12134	7
59	**19. New connection (Installation efficiency (RISK VARIABLE)**			**84%**							
60	20. Number of persons/connection				8	7.5	7.5	7.5	7.5	7.5	
61	21. Average consumption/person(liters/day)				160	200	220	220	220	220	
62											
63	22. Number of new standpipes each year				36	74	87	85	77	54	
64	23. No. persons/standpipe			300							
65	24. Average consumption/person (liters/day)			40							
66											
67			**RISK VARIABLE--Ability of MWSS to meet NRW targets:**		**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**1**
68			Percentage of Non Revenue water		**50%**	**46%**	**42%**	**38%**	**35%**	**35%**	
69			Links with Ability to MWSS and % NRW		50%	46%	42%	38%	35%	35%	
70	25. Target Percent Non-Revenue Water (NRW)										
71	a. Of NRW, percent leakage			49%							
72	b. Of NRW, percent non-leakage			51%							
73	(that is, % stolen or authorized free use)										

Table 1c: Investment Table (REAL)

Initial Investment Cost, 1991-1995

	A	B	C	D	E	F	G	H	I
83									
84					(Millions of 1990 pesos)				
85				1991			1992		
86			Local	Foreign	Total	Local	Foreign	Total	Local	Foreign
87	**CIVIL WORKS**								
88	a. Water reservoirs/ pumping stations					13.881	5.949	19.830	33.812	
89	b. Transmission mains					4.722	11.020	15.742	5.982	
90	c. Secondary/Tertiary networks					29.039	9.680	38.719	67.758	
91	d. Service connections					8.262	1.458	9.720	19.279	
92	CIVIL WORKS TOTAL					55.904	28.107	84.011	126.831	
93									
94	**EQUIPMENT AND MATERIALS**								
95	a. Water reservoirs/ pumping stations					1.398	5.594	6.992	4.088	
96	b. Transmission mains					5.848	23.393	29.241	7.406	
97	c. Secondary/Tertiary networks					11.616	46.471	58.087	27.103	
98	d. Service connections					1.944	7.777	9.721	4.536	
99	EQUIPMENT AND MATERIALS TOTAL					20.806	83.235	104.041	43.133	
100									
101	**OFFICE BUILDINGS**					3.670		3.670	3.670	
102	**CONSULTING SERVICES**		1.386		1.386	1.089		1.089	0.528	
103	**LAND COST**		25.000		25.000					
104	**IN-HOUSE ENGINEERING SERVICES**		32.560		32.560	16.280		16.280	16.280	
105	**TAXES AND DUTIES**					32.160		32.160	66.670	
106									
107	**TOTAL INVESTMENT COST**		**58.946**		**58.946**	**129.909**	**111.342**	**241.251**	**257.112**	
108									
109				**1994**			**1995**		**TOTAL INVE**
110			Local	Foreign	Total	Local	Foreign	Total	Local	Foreign
111	**CIVIL WORKS**								
112	a. Water reservoirs		23.009	9.860	32.869	3.099	1.319	4.418	73.801	
113	b. Transmission mains		4.250	9.918	14.168	0.788	1.837	2.625	15.742	
114	c. Secondary/Tertiary networks		77.438	25.812	103.250	19.360	6.454	25.814	193.595	
115	d. Service connections		22.033	3.888	25.921	5.508	0.972	6.480	55.082	
116	CIVIL WORKS TOTAL		126.730	49.478	176.208	28.755	10.582	39.337	338.22	
117									
118	**EQUIPMENT AND MATERIALS**								
119	a. Water reservoirs		1.927	7.710	9.637	0.564	2.259	2.823	7.977	
120	b. Transmission mains		5.262	21.054	26.316	0.975	3.898	4.873	19.491	
121	c. Secondary/Tertiary networks		30.975	123.922	154.897	7.744	30.980	38.724	77.438	
122	d. Service connections		5.184	20.774	25.958	1.296	5.185	6.481	12.96	
123	EQUIP & MAT TOTAL		43.348	173.460	216.808	10.579	42.322	52.901	117.866	
124									
125	**OFFICE BUILDINGS**								7.34	
126	**CONSULTING SERVICES**		0.297		0.297				3.3	
127	**LAND COST**								25	
128	**IN-HOUSE ENGINEERING SERVICES**		12.210		12.210	4.070		4.070	81.4	
129	**TAXES AND DUTIES**		67.000		67.000	16.350		16.350	182.18	
130									
131	**TOTAL INVESTMENT COST**		**249.585**	**222.938**	**472.523**	**59.754**	**52.904**	**112.658**	**755.306**	

Table 1d: Additional Investment Table (REAL)

Between 1996-2004

Manila South Water Distribution Project

	A	B	C	D	E	F	G	H
148	**ADDITIONAL INVESTMENT IN TERTIARY DISTRIBUTION NETWORKS & CONNECTIONS, 1996-2004 (millions of 1990 pesos)**							
149								
150	Note that the investment cost shown above does not include connections and tertiary networks from 1996 onward.							
151	The cost for each of these items was estimated based on the average cost for the period 1992-1995. These costs							
152	were then used to estimate the costs of the additional investment in connections and terriary							
153	networks from 1996 to 2004.							
154								
155	**Cost of connections**							
156	Cumulative number of connections			50,934				
157	Cost (million)			130				
158	Cost per connection (pesos)			2,545				
159								
160	**Cost of tiertiary distribution**							
161	Cumulative number of connections			50,934				
162	Cost of secondary/tertiary connections (million)			645				
163	Cost per connection (pesos)			12,671				
164	Cost of tertiary connection (10% of cost per connection)			1,267				
165	[The 10% is based on the length and diameters							
166	used in a previous study (Angat Water Supply Optimiztion Project, 1989)]							
167								
168	**Total Cost per Conn. of tertiary distr. & connections**			**3,812**				
169								
170	(Tertiary dist. and connection investments are allocated between Civil Works and							
171	Equipment using a the same civil works/ equip ratio as in the total investment above)							
172	Civil works	45%						
173	Equipment and materials	55%						
174								
175	**(Millions of Real Pesos)**		**1996**	**1997**	**1998**	**1999**	**2000**	**20**
176	Add. inv. on tert. distrib. & conn.		73.17	66.69	46.26	29.50	31.15	21.8
177	Civil works		32.87	29.96	20.78	13.26	13.99	9.7
178	Equipment and materials		40.30	36.73	25.48	16.25	17.15	12.0
179								
180								
181								

Table 2: Inflation and Exchange Rate Projections

Manila South Water Distribution Project

	A	B	C	D	E	F	G	H	I	J	K	AC
186			**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2**
187												
188	Dom.inf.rate	8.00%										
189	Dom.inflation index		1.000	1.080	1.166	1.260	1.360	1.469	1.587	1.714	1.851	7.3
190												
191	For.inf.rate	4.00%										
192	For.inflation index		1.000	1.040	1.082	1.125	1.170	1.217	1.265	1.316	1.369	2.7
193												
194	Relative infl. index		1.000	1.038	1.078	1.120	1.163	1.208	1.254	1.302	1.352	2.6
195												
196	NOMINAL EXCHANGE RATE		28.00	29.08	30.20	31.36	32.56	33.82	35.12	36.47	37.87	74
197												
198												
199												

Table 3A: Water Demand and Supply

Manila South Water Distribution Project

	A	B	C	D	E	H	K	N
196						**TABLE 3A**		
197								
198						**WATER DEMAND During Connection Expansion Period (1993 to 2004)**		
199								
200	**New installation (connection) efficiency**	**(RISK VARIABLES)**		**0.84**	**0.84**	**0.84**	**0.84**	**0.84**
201								
202	**TOTAL CONSUMPTION DEMANDED**							
203								
204	**1. Paid Consumption Demanded from Private Connections (Estimates for Expansion Years 1993 -2004)**							
205				**1992**	**1993**	**1996**	**1999**	**2002**
206	New Connections Realized				9,432	16,122	6,501	5,025
207	Ending (Total Connections)			38839	48,271	97,746	129,133	145,823
208	Cumulative new connections				9,432	58,907	90,294	106,984
209	No. of persons/connection			8.4	8.0	7.5	7.5	7.5
210	Ave. consumption/person (liters/day)			150	160	220	220	220
211	Total consumption (cu m./day)			48,937	61,787	161,280	213,070	240,608
212								
213	**2. Paid Consumption Demanded from public standpipes (Estimates for Expansion Years 1993 -2004)**							
214	New				36	85	34	26
215	Ending			199	235	481	646	733
216	No. of persons/connection			300	300	300	300	300
217	Ave. consumption/person (liters/day)			40	40	40	40	40
218	Total consumption (cu m/day)			2,388	2,820	5,772	7,752	8,796
219								
220	**3. TOT. CONSUMPTION DEMANDED (1993 -2004)**			**1992**	**1993**	**1996**	**1999**	**2002**
221	**4.** Total Paid Consump. demanded			51,325	64,607	167,052	220,822	249,404
222	Paid Piped water consumption demanded before project (cu. m/day)			51,325	51,325	51,325	51,325	51,325
223	**Tot. incremental paid consumpt. demanded from proj.(cu m/day)**			**0**	**13,282**	**115,727**	**169,497**	**198,079**
224								
225								
226	**Demand for washing water**				12618	109941	161022	188175
227	Slope for the Washing Water (m)				-0.000396	-0.000045	-0.000031	-0.000027
228	Quantity demand of washing water				12618	109941	161022	188175
229	**Change in Quantity demanded do the price change**				**0**	**0**	**0**	**0**
230	**Percentage Change in Quantity demanded do the price change**				**0%**	**0%**	**0%**	**0%**
231								
232	Demand for drinking water at 5 pesos cubic meter				664	5786	8475	9904
233	Slope for the drinking water (m)				-0.19	-0.02	-0.02	-0.01
234	Total demand of drinking water				664	5786	8475	9904
235	**Change in Quantity demanded do the price change**				0	0	0	0
236	**Percentage Change in Quantity demanded do the price change**				0.00%	0.00%	0.00%	0.00%
237								
238	**Slope for the drinking water demand from vendors (m)**				0.0341	0.0039	0.0027	0.0023
239	Quantity supplied by vendors				0	0	0	0
240	Supply from project				664	5786	8475	9904

Table 3B: Total Sales Revenue Schedule

Manila South Water Distribution Project

	A	B	C	D	E	F	H	K	N	P
243						**Table 3B**				
244										
245						**TOTAL DEMAND, SUPPLY, and SALES REVENUE**				
246										
247	**A) TOTAL CONSUMPTION DEMANDED**				**1993**	**1994**	**1996**	**1999**	**2002**	
248	**4.** Total Paid Consump. demanded over life of project (1993 -2024)				64,607	101,314	167,052	220,822	249,404	2
249	Paid Piped water consumption demanded before project (cu. m/day)				51,325	51,325	51,325	51,325	51,325	
250	**Tot. incremental paid consumpt. demanded from proj.(cu m/day)**				**13,282**	**49,989**	**115,727**	**169,497**	**198,079**	**2**
251										
252	**Incremental Paying consumption (cu m.day)**				**13,282**	**49,989**	**115,727**	**169,497**	**198,079**	**2**
253	Incremental water leakage (cu.m/day)				6,508	20,866	34,756	44,721	45,675	
254	Incremental non-paying consumption (theft and giveaway) cu. m/day				6,774	21,717	36,174	46,546	47,539	
255	**Required incremental supply (incremental consumption/1-NRW) in cu.m./day**				**26,564**	**92,572**	**186,657**	**260,764**	**291,293**	**3**
256										
257	**B) TOTAL INCREMENTAL SALES REVENUES**									
258			**1991**	**1992**	**1993**	**1994**	**1996**	**1999**	**2002**	
259	Incremental Sales Volume (cu m/day)				13,282	49,989	115,727	169,497	198,079	
260	Real Water Tariff (pesos/cu.m)				5.00	5.00	5.00	5.00	5.00	
261	Nominal water Tariff (pesos/cu.m)				5.32	5.75	6.70	8.44	10.64	
262										
263	Nominal Revenue of Drinking water				1.29	5.24	14.16	26.12	38.45	
264	Nominal Revenue of of Washing water				24.51	99.61	268.97	496.26	730.56	
265	**Nominal Revenues (mill. pesos)**				**25.80**	**104.85**	**283.13**	**522.38**	**769.01**	

Table 4: Operating and Maintenance Cost Schedule

Manila South Water Distribution Project

	A	D	E	F	H	K
269			**Table 4**			
270			**Operating and Maintenance Expenses**			
271	**Operating and Maintenance Expenses (REAL 1000s of Pesos)**					
272		**1993**	**1994**	**1995**	**1997**	**2000**
273						
274	Wages	7,042	25,029	41,893	62,195	84,906
275	Chemicals	1,267	4,414	7,244	10,336	13,297
276	Power	1,614	5,625	9,231	13,172	16,945
277	Maintenance costs	1,109	3,866	6,344	9,053	11,646
278	**Total**	**11,032**	**38,935**	**64,712**	**94,756**	**126,793**
279						
280	**Operating and Maintenance Expenses (Nominal 1000s of Pesos)**					
281		**1993**	**1994**	**1995**	**1997**	**2000**
282						
283	Wages	8,213	31,529	56,995	98,695	169,727
284	Chemicals	1,477	5,561	9,855	16,402	26,581
285	Power	1,883	7,086	12,558	20,902	33,872
286	Maintenance costs	1,294	4,870	8,631	14,366	23,280
287	**Total**	**12,868**	**49,047**	**88,040**	**150,366**	**253,460**

Table 5: Working Capital Schedule

Manila South Water Distribution Project

	A	D	E	F	H	K	N
290				**Table 5**			
291				**WORKING CAPITAL SCHEDULE**			
292							
293	**(Nominal, Millions of Pesos)**	**1993**	**1994**	**1995**	**1997**	**2000**	**2003**
294							
295	**Number of months accts. rec.**	**3**	**3**	**3**	**3**	**3**	**3**
296	Accounts receivables from drinking water	0.32	1.31	2.49	4.65	7.54	10.85
297	Changes in accounts receivable from DW	(0.32)	(0.99)	(1.18)	(1.11)	(1.01)	(1.24)
298	Accounts receivables from washing water	6.13	24.90	47.40	88.42	143.28	206.14
299	Changes in accounts receivable from WW	(6.13)	(18.78)	(22.50)	(21.17)	(19.22)	(23.50)
300	**Change in accounts rec.**	**(6.45)**	**(19.76)**	**(23.68)**	**(22.29)**	**(20.23)**	**(24.74)**
301							
302	Cash balance	1.07	4.09	7.34	12.53	21.12	30.24
303	Change in cash balance	(1.07)	(3.01)	(3.25)	(2.67)	(3.07)	(3.81)
304							
305	Accounts payable	1.16	4.38	7.76	12.92	20.93	28.79
306	Change in accts. payable	(1.16)	(3.22)	(3.38)	(2.62)	(2.81)	(3.28)

Table 6: Loan Schedule

Manila South Water Distribution Project

In Millions of US dollars (Nominal) **TABLE 6: LOAN SCHEDULE**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2005	2006	2007	2008
Loan Receipts	34.63												
Annual Interest Rate, Nominal ---->	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Repayment installment --->	0.00	4.16	4.59	5.06	5.59	6.16	6.80	6.69	6.56	5.48	5.23	4.95	4.64
Beginning Loan		34.63	38.21	42.15	46.51	51.31	56.61	55.66	54.61	45.59	43.50	41.20	38.65
Interest at 10.33%		3.58	3.95	4.35	4.80	5.30	5.85	5.75	5.64	4.71	4.49	4.26	3.99
Repayment		0.00	0.00	0.00	0.00	0.00	6.80	6.80	6.80	6.80	6.80	6.80	6.80
Interest		0.00	0.00	0.00	0.00	0.00	5.85	5.75	5.64	4.71			
Principal		0.00	0.00	0.00	0.00	0.00	0.95	1.05	1.16	2.09	6.80	6.80	6.80
Ending loan	34.63	38.21	42.15	46.51	51.31	56.61	55.66	54.61	53.45	43.50	41.20	38.65	35.84
	0.00	0.00	0.00	0.00	0.00	0.00	6.80	6.80	6.80	6.80	6.80	6.80	6.80
PV loan receipts	**34.63**												
PV Loan repayments	**34.63**												

Table 7: Nominal Projected Financial Net Benefit Statement (Investment

Manila South Water Distribution Project

	A	D	E	F	H	K	N
334			**Table 7**				
335			**NOMINAL PROJECTED FINANCIAL NET BENEFIT STATEMENT**				
336			**Investment Point of View, (In million pesos)**				
337		**1993**	**1994**	**1995**	**1997**	**2000**	**200**
338							
339	**INFLOWS**						
340	**Revenue from Drinking Water**	1.29	5.24	9.98	18.61	30.16	43.40
341	**Revenues from Washing Water**	24.51	99.61	189.61	353.67	573.13	824.56
342	Revenues	25.80	104.85	199.59	372.29	603.30	867.96
343	Accounts receivables from drinking water	0.32	1.31	2.49	4.65	7.54	10.8
344	Changes in accounts receivable from DW	-0.32	-0.99	-1.18	-1.11	-1.01	-1.2
345	Accounts receivables from washing water	6.13	24.90	47.40	88.42	143.28	206.1
346	Changes in accounts receivable from WW	-6.13	-18.78	-22.50	-21.17	-19.22	-23.5
347	Change in accts. rec.	(6.45)	(19.76)	(23.68)	(22.29)	(20.23)	(24.74
348	**TOTAL INFLOWS**	**19.35**	**85.09**	**175.90**	**350.00**	**583.07**	**843.2**
349							
350	**OUTFLOWS**						
351	Investments						
352	Civil works	236.80	248.61	59.94	53.25	31.33	29.98
353	Equipment and materials	281.78	305.89	80.61	65.28	38.41	36.75
354	Office buildings	4.79	0.00	0.00	0.00	0.00	0.0
355	Consulting services	0.69	0.42	0.00	0.00	0.00	0.0
356	Land	0.00	0.00	0.00	0.00	0.00	0.0
357	In-house eng. services	21.27	17.23	6.20	0.00	0.00	0.0
358	Taxes and duties	87.10	94.53	24.91	0.00	0.00	0.0
359	Operating and maintenance						
360	Wages	9.20	35.31	63.83	110.54	190.09	277.42
361	Chemicals	1.65	6.23	11.04	18.37	29.77	40.94
362	Power	2.11	7.94	14.07	23.41	37.94	52.17
363	Supplies & other exp.	1.45	5.45	9.67	16.09	26.07	35.86
364	Income tax	0.00	0.00	0.00	0.00	0.00	0.0
365	Change in accts. payable	(1.16)	(3.22)	(3.38)	(2.62)	(2.81)	(3.28
366	Change in cash balance	1.07	3.01	3.25	2.67	3.07	3.81
367	**TOTAL OUTFLOWS**	**646.75**	**721.40**	**270.13**	**286.99**	**353.88**	**473.6**
368							
369	**NET BENEFIT FLOWS**	**(627.40)**	**(636.32)**	**(94.23)**	**63.01**	**229.19**	**369.5**

Table 8: Real Projected Financial Net Benefit Statement:

Total Investment point of view

	A	D	E	F	H	K	N
376		**1993**	**1994**	**1995**	**1997**	**2000**	**2003**
377	**INFLOWS**						
378	**Revenue from drinking water**	1.11	4.16	7.34	11.73	15.09	17.23
379	**Revenue from Washing Water**	21.01	79.07	139.37	222.87	286.71	327.44
380	Revenues	22.12	83.23	146.70	234.60	301.80	344.68
381	Accounts receivables from drinking water	0.28	1.04	1.83	2.93	3.77	4.31
382	Changes in accounts receivable from DW	(0.28)	(0.78)	(0.87)	(0.70)	(0.51)	(0.49)
383	Accounts receivables from washing water	5.25	19.77	34.84	55.72	71.68	81.86
384	Changes in accounts receivable from WW	(5.25)	(14.90)	(16.54)	(13.34)	(9.61)	(9.33)
385	Change in accts. rec.	(5.53)	(15.69)	(17.41)	(14.05)	(10.12)	(9.82)
386	**TOTAL INFLOWS**	**16.59**	**67.55**	**129.29**	**220.56**	**291.68**	**334.85**
387							
388	**OUTFLOWS**						
389	Investments						
390	Civil works	203.02	197.35	44.06	33.56	15.67	11.90
391	Equipment and materials	241.58	242.82	59.25	41.14	19.21	14.59
392	Office buildings	4.11	0.00	0.00	0.00	0.00	0.00
393	Consulting services	0.59	0.33	0.00	0.00	0.00	0.00
394	Land	0.00	0.00	0.00	0.00	0.00	0.00
395	In-house eng. services	18.23	13.68	4.56	0.00	0.00	0.00
396	Taxes and duties	74.67	75.04	18.31	0.00	0.00	0.00
397	Operating and maintenance						
398	Wages	7.89	28.03	46.92	69.66	95.09	110.17
399	Chemicals	1.42	4.94	8.11	11.58	14.89	16.26
400	Power	1.81	6.30	10.34	14.75	18.98	20.72
401	Supplies & other exp.	1.24	4.33	7.11	10.14	13.04	14.24
402	Income tax	0.00	0.00	0.00	0.00	0.00	0.00
403	Change in accts. payable	(1.00)	(2.55)	(2.49)	(1.65)	(1.40)	(1.30)
404	Change in cash balance	0.92	2.39	2.39	1.68	1.54	1.51
405	**TOTAL OUTFLOWS**	**554.48**	**572.67**	**198.56**	**180.85**	**177.03**	**188.09**
406							
407	**NET BENEFIT FLOWS**	**(537.90)**	**(505.13)**	**(69.26)**	**39.70**	**114.65**	**146.76**

Table 9: Debt Service Capacity Ratios

Manila South Water Distribution Project

	A	D	E	F	H	K	N
411				**Table 9:**			
412				**Table: Debt-Service Capacity Ratios**			
413							
414		**1993**	**1994**	**1995**	**1997**	**2000**	**2003**
415	**DEBT CASH FLOW (Millions of Pesos)**						
416	**A. Nominal**						
417	Debt Cash Flow	**0.00**	**0.00**	**0.00**	**(238.78)**	**(267.41)**	**(299.46**
418							
419	**B. Real**						
420	Debt Cash Flow	**0.00**	**0.00**	**0.00**	**(150.47)**	**(133.77)**	**(118.92**
421							
422							
423	**PROJECTED CASH FLOW STATEMENT, INVESTMENT POINT OF VIEW, REAL (In million pesos)**						
424							
425	**NET BENEFIT FLOWS**	**(537.90)**	**(505.13)**	**(69.26)**	**39.70**	**114.65**	**146.76**
426							
427							
428	**Annual Debt Service Coverage Ratio**				**0.26**	**0.86**	**1.2**
429							
430	**Debt Service Capacity Ratio**				**1.19**	**1.48**	**1.6**
431	**Real Interest Rate**						
432	**6%**						

Table 10: Projected Financial Net Benefit Statemen

Total Equity point of view (Nominal)

	A	D	E	F	H	K	N
441		**1993**	**1994**	**1995**	**1997**	**2000**	**2003**
442	**INFLOWS**						
443	**Revenue from Drinking Water**	**1.29**	**5.24**	**9.98**	**18.61**	**30.16**	**43.4**
444	**Revenues from Washing Water**	**24.51**	**99.61**	**189.61**	**353.67**	**573.13**	**824.5**
445	Revenues	25.80	104.85	199.59	372.29	603.30	867.96
446	Change in accts. rec.	(6.45)	(19.76)	(23.68)	(22.29)	(20.23)	(24.74)
447	Loans	0.00	0.00	0.00	0.00	0.00	0.00
448	**TOTAL INFLOWS**	**19.35**	**85.09**	**175.90**	**350.00**	**583.07**	**843.22**
449							
450	**OUTFLOWS**						
451	Investments						
452	Civil works	236.80	248.61	59.94	53.25	31.33	29.98
453	Equipment and materials	281.78	305.89	80.61	65.28	38.41	36.75
454	Office buildings	4.79	0.00	0.00	0.00	0.00	0.00
455	Consulting services	0.69	0.42	0.00	0.00	0.00	0.00
456	Land	0.00	0.00	0.00	0.00	0.00	0.00
457	In-house eng. services	21.27	17.23	6.20	0.00	0.00	0.00
458	Taxes and duties	87.10	94.53	24.91	0.00	0.00	0.00
459	Operating and maintenance	0.00	0.00	0.00	0.00	0.00	0.00
460	Wages	9.20	35.31	63.83	110.54	190.09	277.42
461	Chemicals	1.65	6.23	11.04	18.37	29.77	40.94
462	Power	2.11	7.94	14.07	23.41	37.94	52.17
463	Maintenace	1.45	5.45	9.67	16.09	26.07	35.86
464	Income tax	0.00	0.00	0.00	0.00	0.00	0.00
465	Change in accts. payable	(1.16)	(3.22)	(3.38)	(2.62)	(2.81)	(3.28)
466	Change in cash balance	1.07	3.01	3.25	2.67	3.07	3.81
467	Loan Repayment	0.00	0.00	0.00	238.78	267.41	299.46
468							
469	**TOTAL OUTFLOWS**	**646.75**	**721.40**	**270.13**	**525.77**	**621.28**	**773.11**
470							
471	**NET BENEFIT FLOWS**	**(627.40)**	**(636.32)**	**(94.23)**	**(175.77)**	**(38.22)**	**70.11**

Table 11: Real Projected Financial Net Benefit Statement

Total Equity point of view

	A	B	D	E	F	H	K	N
48		**1991**	**1993**	**1994**	**1995**	**1997**	**2000**	**2**
48	**INFLOWS**							
48	**Revenue from drinking water**	**0.00**	**1.11**	**4.16**	**7.34**	**11.73**	**15.09**	**1**
48	**Revenue from Washing Water**	**0.00**	**21.01**	**79.07**	**139.37**	**222.87**	**286.71**	**3**
48	Revenues	0.00	22.12	83.23	146.70	234.60	301.80	34
48	Change in accts. rec.	0.00	(5.53)	(15.69)	(17.41)	(14.05)	(10.12)	(
48	Loans	969.59	0.00	0.00	0.00	0.00	0.00	
48	**TOTAL INFLOWS**	969.59	16.59	67.55	129.29	220.56	291.68	33
49								
49	**OUTFLOWS**							
49								
49	Civil works	0.00	203.02	197.35	44.06	33.56	15.67	1
49	Equipment and materials	0.00	241.58	242.82	59.25	41.14	19.21	1
49	Office buildings	0.00	4.11	0.00	0.00	0.00	0.0 0	
49	Consulting services	1.55	0.59	0.33	0.00	0.00	0.00	
49	Land	28.00	0.00	0.00	0.00	0.00	0.00	
49	In -house eng. services	36.47	18.23	13.68	4.56	0.00	0.00	
49	Taxes and duties	0.00	74.67	75.04	18.31	0.00	0.00	
50	Operating and maintenance	0.00	0.00	0.00	0.00	0.00	0.00	
50	Wages	0.00	7.89	28.03	46.92	69.66	95.09	11
50	Chemicals	0.00	1.42	4.94	8.11	11.58	14.89	1
50	Power	0.00	1.81	6.30	10.34	14.75	18.98	2
50	Maintenace	0.00	1.24	4.33	7.11	10.14	13.04	1
50	Income tax	0.00	0.00	0.00	0.00	0.00	0.00	
50	Change in accts. payable	0.00	(1.00)	(2.55)	(2.49)	(1.65)	(1.40)	(
50	Change in cash balance	0.00	0.92	2.39	2.39	1.68	1.54	
50	Loan Repayment	0.00	0.00	0.00	0.00	150.47	133.77	11
50								
51	**TOTAL OUTFLOWS**	66.02	554.48	572.67	198.56	331.32	310.80	30
51								
51	**NET BENEFIT FLOWS**	903.57	(537.90)	(505.13)	(69.26)	(110.77)	(19.12)	2
51	NPV @ 10%	(77.76)						
51	**IRR**	**8**						

Table 12: Economic Benefits of Water for Users

Manila South Water Distribution Project

Economic Benefits to Non-Paying Users

A. Benefits to Non- Paying Users of Water for Drinking

The ratio of drinking water from project used by non-paying consumers is assumed at 25%
If price become 0, the total demand
The ratio of the using water from the project
The ratio of the drinking water from vendors
The average economic price of drinking water to non-paying users

Average price (Pe) Pe =

B. Benefits to Non- Paying Users of Water for Washing

Maximum price for washing water
Minimum price who non-paying users are paying

Average price (Pe) Pe =

c) Economic Benefits for Paying users

Year	1991	1992	1993	1994	1995	1996	1997	2001	2002	2003	2004
Resources Saved from Reduced Vendor Water			5.18	19.50	34.37	45.14	54.96	73.91	77.27	80.75	84.36
Value of increased consumption			1.27	4.79	8.44	11.09	13.50	18.15	18.98	19.83	20.72
Benefits to paying users from washing water			34.54	130.00	229.13	300.96	366.42	492.76	515.13	538.34	562.40
Toal Resources saves from paying users			41.00	154.29	271.94	357.20	434.88	584.82	611.38	638.93	667.47
Accounts Receivables of paying water for economic analysis											
Accounts receivables from drinking water			1.61	6.07	10.70	14.06	17.12	23.02	24.06	25.15	26.27
Change in accounts receivables for drinking water			-1.61	-4.46	-4.63	-3.36	-3.06	-1.00	-1.05	-1.08	-1.12
Accounts receivables from washing water			8.64	32.50	57.28	75.24	91.60	123.19	128.78	134.59	140.60
Change in accounts receivables for washing water			-8.64	-23.86	-24.78	-17.96	-16.36	-5.35	-5.59	-5.80	-6.01
Total change in accounts receivable			-10.25	-28.32	-29.41	-21.31	-19.42	-6.35	-6.64	-6.89	-7.14
Economic Benefits of Non-Paying Users											
Benefits to Non-Paying users of Drinking Water			3.21	10.30	15.44	17.16	18.36	21.58	22.56	23.57	24.63
Benefits to Non-Paying users of Washing Water			11.74	37.65	56.41	62.72	67.08	78.84	82.42	86.13	89.98
Toal Resources saves from non-paying users			14.96	47.96	71.85	79.88	85.44	100.42	104.98	109.71	114.61

Table 13a: Conversion factors of inputs.

	A	B	C	D
711	**1. Economic cost of foreign exchange***		0.246	
713	**2. Economic cost of capital***		10.30%	
715	**3. Investment Cost Items**			
717	*3a. Civil works*		Conversion Factor =	
718	Civil works constitutes labor, material and equipment. To find the conomic cost of civil			
719	works, one needs to find the economic cost of each component and then find a weighted			
720	average. The weighting is based on the respective cost shares.			
722	*3b. Material and equipment*		Conversion Factor =	
723	Since tariffs and taxes have been treated separately, the only distortion affecting the economic price			
724	of this item is due to the foreign exchange premium.			
725				
726	*3c. Office buildings**		Conversion Factor =	
727	The economic cost of this item is a weighted average of the economic costs of all its components.			
728				
729	*3d. Consulting services*		Conversion Factor =	
730	As there is no reason to pay these consultants more than their market value, their economic cost is			
731	considered equal to their financial cost.			
732				
733	*3e. Land*		Conversion Factor =	
734	As there are no distortions in the land market, the economic price is considered equal to the financial price.			
735				
736	*3f. In-House engineering services*		Conversion Factor =	
737	It is assumed that 70% of the services are incremental, and would not have been performed without the project.			
738	It is also assumed that the providers of these services are paid their market value. Therefore, the conversion			
739	factor is 0.7*1.0.			
741	*3g. Taxes and duties*		Conversion Factor =	
742	These are transfers, and do not reflect any economic costs.			
743				
753	**4. Operating Cost Items**			
755	*4a. Wages*		Conversion Factor =	
756	Workers are paid their market value.			
758	*4b. Chemicals**		Conversion Factor =	
759	The financial price has been adjusted for duties, taxes and the foreign exchange premium.			
760				
761	4c. Power*		Conversion Factor =	
762	The conversion factor of 1.07 reflects the subidized electricity prices, taxes on inputs, and			
763	the foreign exchange premium.			
765	*4d. Maintenance*		Conversion Factor =	
766	The economic cost of maintenance is the weighted average of the economic costs of the			
767	maintenance of the specific components. These are civil works, buildings, pipes and pumps. Their			
768	respective cost shares determine their weights and the economic cost and conversion factor for			
769	maintenance are determined accordingly.			
771	*4e. Changes in accounts payable*		Conversion Factor =	
772	The conversion factor for accounts payable is the weighted average of all the operating cost items			
773	(excluding labor). Ideally one should estimate a conversion factor for each year since the cost shares			
774	of the operating cost items are likely to change over time. However, as the item 'changes in accounts			
775	payable' is a small cost item and the cost shares of the components of operating costs (excluding labor)			
776	do not change much over the life of the project, an average was used. In this case, the average was 1.00.			
778	*4f. Changes in cash balance*		Conversion Factor =	
779	The economic cost of the cash held is equal to its financial cost.			
781	*4g. Changes in accounts receivable*		Conversion Factor =	
782	The conversion factor for accounts receivable is the weighted average of the conversion factor			
783	for all revenue items.			

Table 13b: Summary of Conversion factors:

	A	B	C	D	
794		**SUMMARY OF CONVERSION FACTORS**			
795					
796	**OUTPUT**				
797	Revenue water	2.10			
798	Ch. in acc. receivable	2.10			
799	Non-Revenue water*	Undefined	Economic value	7.68	(19
800					
801					
802	**INPUTS**				
803	Investment Items				
804	Civil works	0.98			
805	Equipment and materials	1.25			
806	Office buildings	1.02			
807	Consulting services	1.00			
808	Land	1.00			
809	In-house eng. services	0.70			
810	Taxes and duties	0.00			
811					
812	Operating and Maintenance items				
813	Wages	1.00			
814	Chemicals	0.96			
815	Power	1.07			
816	Maintenance	0.96			
817	Ch. in acc. payable	1.00			
818	Ch. in cash balance	1.00			
819					
820					
821	*. Since the financial price for non-revenue water is zero, the conversion factor is undefined.				
822					

Table 14: Real Projected Economic Net Benefit Statement:

	CF	1991	1992	1993	1994	1995	2000	2001	2002	20
Economic Benefits										
Resources Saved from reduced Vendors supply		0.00	0.00	5.18	19.50	34.37	70.71	73.91	77.27	80.7
Value of increased consumption		0.00	0.00	1.27	4.79	8.44	17.37	18.15	18.98	19.8
Benefits to paying users from washing water		0.00	0.00	34.54	130.00	229.13	471.37	492.76	515.13	538.3
Toal Resources saves from paying users		**0.00**	**0.00**	**41.00**	**154.29**	**271.94**	**559.44**	**584.82**	**611.38**	**638.**
Change in account receivable from drinking water		**0.00**	**0.00**	(1.61)	(4.46)	(4.63)	(1.43)	(1.00)	(1.05)	(1.0
Change in accounts receivable from washing water		**0.00**	**0.00**	(8.64)	(23.86)	(24.78)	(7.64)	(5.35)	(5.59)	(5.8
Change in accounts receivable		**0.00**	**0.00**	(10.25)	(28.32)	(29.41)	(9.07)	(6.35)	(6.64)	(6.8
Benefits to Non-Paying users of Drinking Water		0.00	0.00	3.21	10.30	15.44	23.62	21.58	22.56	23.5
Benefits to Non-Paying users of Washing Water		0	0	11.74	37.65	56.41	86.30	78.84	82.42	86.1
Resources saves from non-paying users		0	0	14.96	47.96	71.85	109.91	100.42	104.98	109.7
GROSS ECONOMIC BENEFITS		**0**	**0**	**45.71**	**173.92**	**314.38**	**660.28**	**678.90**	**709.72**	**741.**
ECONOMIC COSTS										
Investments										
Civil works	0.98	0.00	92.21	198.96	193.41	43.18	15.36	10.75	11.25	11.6
Equipment and materials	1.25	0.00	145.19	301.01	302.56	73.82	23.94	16.75	17.53	18.1
Office buildings	1.02	0.00	4.19	4.19	0.00	0.00	0.00	0.00	0.00	0.0
Consulting services	1.00	1.55	1.22	0.59	0.33	0.00	0.00	0.00	0.00	0.0
Land	1.00	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
In-house eng. services	0.70	25.53	12.76	12.76	9.57	3.19	0.00	0.00	0.00	0.0
Taxes and duties	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Operating and maintenance		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Wages	1.00	0.00	0.00	7.89	28.03	46.92	95.09	96.92	103.35	110.1
Chemicals	0.96	0.00	0.00	1.36	4.75	7.79	14.30	14.29	14.93	15.6
Power	1.07	0.00	0.00	1.93	6.74	11.06	20.31	20.29	21.21	22.1
Supplies & other exp.	0.96	0.00	0.00	1.19	4.16	6.82	12.52	12.51	13.08	13.6
Income tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Change in accts. payable	1.00	0.00	0.00	(1.00)	(2.55)	(2.49)	(1.40)	(0.77)	(1.25)	(1.3
Change in cash balance	1.00	0.00	0.00	0.92	2.39	2.39	1.54	0.92	1.43	1.5
GROSS ECONOMIC COSTS		**55.08**	**255.58**	**529.81**	**549.39**	**192.69**	**181.65**	**171.66**	**181.53**	**191.**
NET ECONOMIC BENEFITS		**(55.08)**	**(255.58)**	**(484.11)**	**(375.46)**	**121.70**	**478.63**	**507.23**	**528.18**	**550.**
NPV economics		**2,117.87**								
EIRR		24%								

Table 15: Real Projected Flow of Externalities

	A	B	C	F	H	K	N	V
712			**1991**	**1994**	**1996**	**1999**	**2002**	**2010**
713								
714	**BENEFITS EXTERNALITIES**							
715	Ext. for paying users from drinking water		0	20.13	46.60	68.25	79.76	87.08
716	Ext. for paying users from washing		0	50.93	117.90	172.68	201.80	220.32
717	Loss to the vendor		0	5.82	13.46	19.72	23.05	25.16
718	**Total Exter. To paying users from DW**		**0.00**	**25.94**	**60.06**	**87.97**	**102.80**	**112.23**
719	Change in accts.rec. DW		0.00	(3.67)	(2.64)	(0.88)	(0.57)	0.33
720	Change in accts.rec. WW		0.00	(8.96)	(4.45)	1.80	3.36	6.33
721	**Change in accts. rec. (DW+WW)**		**0.00**	**(12.63)**	**(7.10)**	**0.93**	**2.79**	**6.67**
722	Accts. Rec. from from Vendor (for the externalities)		0.00	1.45	3.37	4.93	5.76	6.29
723	Change in accts. rec.		0.00	(1.07)	(0.80)	(0.32)	(0.25)	0.00
724	Benefits to non-paying users		0.00	47.96	79.88	102.79	104.98	114.61
725	**TOTAL BENEFITS EXTERNALITIES**		**0.00**	**106.38**	**237.28**	**344.64**	**389.32**	**428.67**
726								
727								
728	**COSTS EXTERNALITIES**							
729	Investments							
730	Civil works		0.00	(3.95)	(0.74)	(0.30)	(0.23)	0.00
731	Equipment and materials		0.00	59.73	11.10	4.48	3.46	0.00
732	Office buildings		0.00	0.00	0.00	0.00	0.00	0.00
733	Consulting services		0.00	0.00	0.00	0.00	0.00	0.00
734	Land		0.00	0.00	0.00	0.00	0.00	0.00
735	In-house eng. services		(10.94)	(4.10)	0.00	0.00	0.00	0.00
736	Taxes and duties		0.00	(75.04)	0.00	0.00	0.00	0.00
737	Operating and maintenance		0.00	0.00	0.00	0.00	0.00	0.00
738	Wages		0.00	0.00	0.00	0.00	0.00	0.00
739	Chemicals		0.00	(0.20)	(0.40)	(0.56)	(0.62)	(0.68)
740	Power		0.00	0.44	0.89	1.24	1.39	1.52
741	Supplies & other exp.		0.00	(0.17)	(0.35)	(0.49)	(0.55)	(0.60)
742	Income tax		0.00	0.00	0.00	0.00	0.00	0.00
743	Change in accts. payable		0.00	0.00	0.00	0.00	0.00	0.00
744	Change in cash balance		0.00	0.00	0.00	0.00	0.00	0.00
745	**TOTAL COSTS EXTERNALITIES**		**(10.94)**	**(23.28)**	**10.51**	**4.38**	**3.45**	**0.24**
746								
747	**NET ECONOMIC EXTERNALITIES**		**10.94**	**129.66**	**226.78**	**340.27**	**385.87**	**428.43**
748								
749	**NPV (MODEL RESULT) @**	**10.30%**	**2,560.76**					

Table 16: Allocation of Externalities

	A	B	C	D	E	F	G
775		**Table 16**					
776		**DISTRIBUTION OF EXTERNALITIES**					
777		**(millions of 1991 pesos)**					
778							
779		(A)	(B)	(B-A)			**DISTRIBUTION**
780		PV Financial	PV Economic				
781		at Economic	at Economic	PV of			
782		Discount Rate	Discount Rate	Externalities		Government	Non-Paying Users
783		of 10.30%	of 10.30%				
784							
785	**BENEFITS**						
786	Revenue Gener. Water	2,091.45	3,876.90	1,785.46	Drinking		
787					Washing		
788	Change in accts. rec.	(83.94)	(90.51)	(6.57)	Drinking		
789					Washing		
790	Benefits from non-revenue water (drinking)	0.00	159.07	159.07	Drinking		159.07
791	Benefits from non-revenue water (washing)	0.00	581.21	581.21	Washing		581.21
792	**TOTAL BENEFITS**	**2,007.51**	**4,526.68**	**2,519.17**			
793							
794	**COSTS**						
795	Investments						
796	Civil works	**510.32**	500.11	(10.21)		10.21	
797	Equipment and materials	**624.87**	778.59	153.72		(153.72)	
798	Office buildings	**7.11**	7.25	0.14		(0.14)	
799	Consulting services	**3.39**	3.39	0.00			
800	Land	**28.00**	28.00	0.00			
801	In-house eng. services	**81.26**	56.88	(24.38)			
802	Taxes and duties	**162.32**	0.00	(162.32)		162.32	
803	Operating and maintenance	**0.00**	0.00	0.00			
804	Wages	**710.43**	710.43	0.00			
805	Chemicals	**102.19**	98.10	(4.09)		4.09	
806	Power	**130.22**	139.34	9.12		(9.12)	
807	Maintenance	**89.50**	85.92	(3.58)		3.58	
808	Income tax	**0.00**	0.00	0.00			
809	Change in accts. payable	**(11.54)**	(11.54)	0.00			
810	Change in cash balance	**12.33**	12.33	0.00			
811	**TOTAL COSTS**	**2,450.40**	**2,408.80**	(41.60)			
812							
813	**NET BENEFITS**	**(442.89)**	**2,117.87**	**2,560.76**		**17**	**74**
814							
815						* As these are the net benefits of the externalities	
816						of the consumer surplus on drinking and wash wa	
817						producer surplus, due to the fact that the well ow	

Table 17: Reconciliation between Economic/Financial and Distribu

	A	B	C	D	E	F
804					**TABLE 17**	
805						
806					**Distributive Analysis of Net Benefits**	
807						
808	**Reconciliation between Economic/Financial and Distributive Analysis:**					
809	DISCOUNT RATES					
810	Financial	10.30%				
811	Economic	10.30%				
812						
813	Econ.NPV @ 10.3%=			Fin.NPV@10.30%	+	NPV Ext. @10.30%
814		2,117.87	=	-442.89	+	2,560.76
815						
816			=	2,117.87		
817						
818	**Distribution of Total Net Benefits**					
819						
820		**Government**		**Non-Paying**		**Paying**
821				**Users**		**Users**
822	**NPV Exter. @ 10.3%**	17.22		740.28		1,921.61
823						

Table 18: Sensitivity Analysis of Financial Outcome

Financial Water Tariff	NPV equity
	(77.76)
4	(345.71)
4.5	(191.92)
5	**(77.76)**
5.5	(3.24)
5.5301	(0.02)
5.7	15.47
6	31.64
6.83	2.03
7	(17.51)
7.5	(101.55)
9	(591.48)
10	(1116.29)

Accounts receivables	NPV equity
	(77.76)
1	(20.59)
2	(49.17)
3	**(77.76)**
4	(106.35)
5	(134.93)
6	(163.52)
7	(192.11)
8	(220.69)
9	(249.28)
10	(277.87)
11	(306.45)
12	(335.04)

Real

Cost -Over runs	NPV equity
	(77.76)
-7%	17.59
-6%	3.97
-5%	(9.65)
-4%	(23.27)
-3%	(36.90)
-2%	(50.52)
-1%	(64.14)
0%	**(77.76)**
5%	(145.87)
10%	(213.97)

Installation Efficiency	NPV equity
	(77.76)
0.6	-331.52
0.7	-225.79
0.8	-120.05
0.84	**-77.76**
0.9	-14.32
1	91.42

Dom

Percentage of Non-Revenue W Leakage	NPV equity	NPV economics
	(77.76)	2,117.87
15%	46.37	2237.84
20%	28.12	2220.20
25%	9.86	2202.55
30%	(8.39)	2184.91
35%	(26.65)	2167.27
40%	(44.90)	2149.63
45%	(63.16)	2131.99
49%	**(77.76)**	**2117.87**
50%	(81.41)	2114.35
55%	(99.67)	2096.71
60%	(117.92)	2079.06
65%	(136.18)	2061.42
70%	(154.43)	2043.78
75%	(172.69)	2026.14
80%	(190.94)	2008.50

Percentage of Non-Revenue Water Non-Leakage	NPV equity	NPV economics
	(77.76)	2117.87
15%	53.68	1722.34
20%	35.42	1777.28
25%	17.17	1832.21
30%	(1.09)	1887.15
35%	(19.34)	1942.08
40%	(37.60)	1997.02
45%	(55.85)	2051.95
51%	**(77.76)**	**2117.87**
50%	(74.11)	2106.89
55%	(92.36)	2161.82
60%	(110.62)	2216.76
65%	(128.87)	2271.69
70%	(147.13)	2326.63
75%	(165.38)	2381.56
80%	(183.64)	2436.50

Table 19: Sensitivity Analysis of Economic Outcome

Manila South Water Distribution Project

	A	B	C	E	
895	**SENSITIVITY OF ECONOMIC RETRUN TO KEY VARIABLES**				
896	**(millions of 1991 pesos)**				
897					
898					
899					
900	**Variation in Financial Tariff**			**Variation in Average Eor**	
901	**of Water**			**of Washing Water to No**	
902		NPV Econ			NP
903			**2,118**		
904	2.50		2,511	3.00	
905	3.00		2,475	3.50	
906	3.50		2,417	4.00	
907	4.00		2,339	4.50	
908	4.50		2,239	**5.00**	
909	**5.00**		**2,118**	5.50	
910	5.412		2,002	6.00	
911	5.50		1,975	6.50	
912	6.00		1,812		
913	6.50		1,626		
914	7.00		1,420		
915					
916	**Variation in Average Eonomic Benefit of**			**Minimum supply of wate**	
917	**of Drinking Water to Non-Paying Users**			**E**	
918		NPV Econ			
919			**2,118**		
920	9.0		2,014	5.0	
921	12.0		2,032	10.0	
922	15.0		2,051	15.0	
923	18.0		2,069	**20.0**	
924	19.0		2,075	25.0	
925	22.0		2,093	30.0	
926	**26.0**		**2,118**	35.0	
927	27.0		2,124	40.0	
928	28.0		2,130		

Table 20: Risk Variables, Probability Distributions, and Range valu

Risk variable	Base value	Probability distribution	Minimum value	Maximum value
Ability of MWSS to meet Non-Revenue water targets	100%	normal	-25%	+25%
Investment cost overrun factor	0	normal	-20%	+20%

			Range value	Probability
Installation efficiency factor for connections	.84	step	.60 - .80 .80 - 1.00	0.30 0.70
Average accounts receivable period, months	3	step	1 - 2 2 - 3 3 - 4 4 - 5	0.10 0.45 0.30 0.15

Table 21: Risk Analysis Results

Manila South Water Distribution Project

Heading	NPV Equity	NPV Economic	Government Benefit	Non Paying Users Benefit	Paying Users Benefit
Expected Value	(78.70)	2121.68	17	745	1921
Standard Deviation	160.54	348.51	2	82	178
Minimum	(597.01)	1057.83	13	490	1443
Maximum	383.80	2940.02	21	1003	2241
Coefficient of variation	-2.04	0.16	0.10	0.11	0.09
Probability of negative outcome	67.51%	0.0%	0.0%	0.0%	0.0%

Figure 1: Manila Water Distribution Project

Cumulative Distributions: Financial (Equity) and Economic NPVs

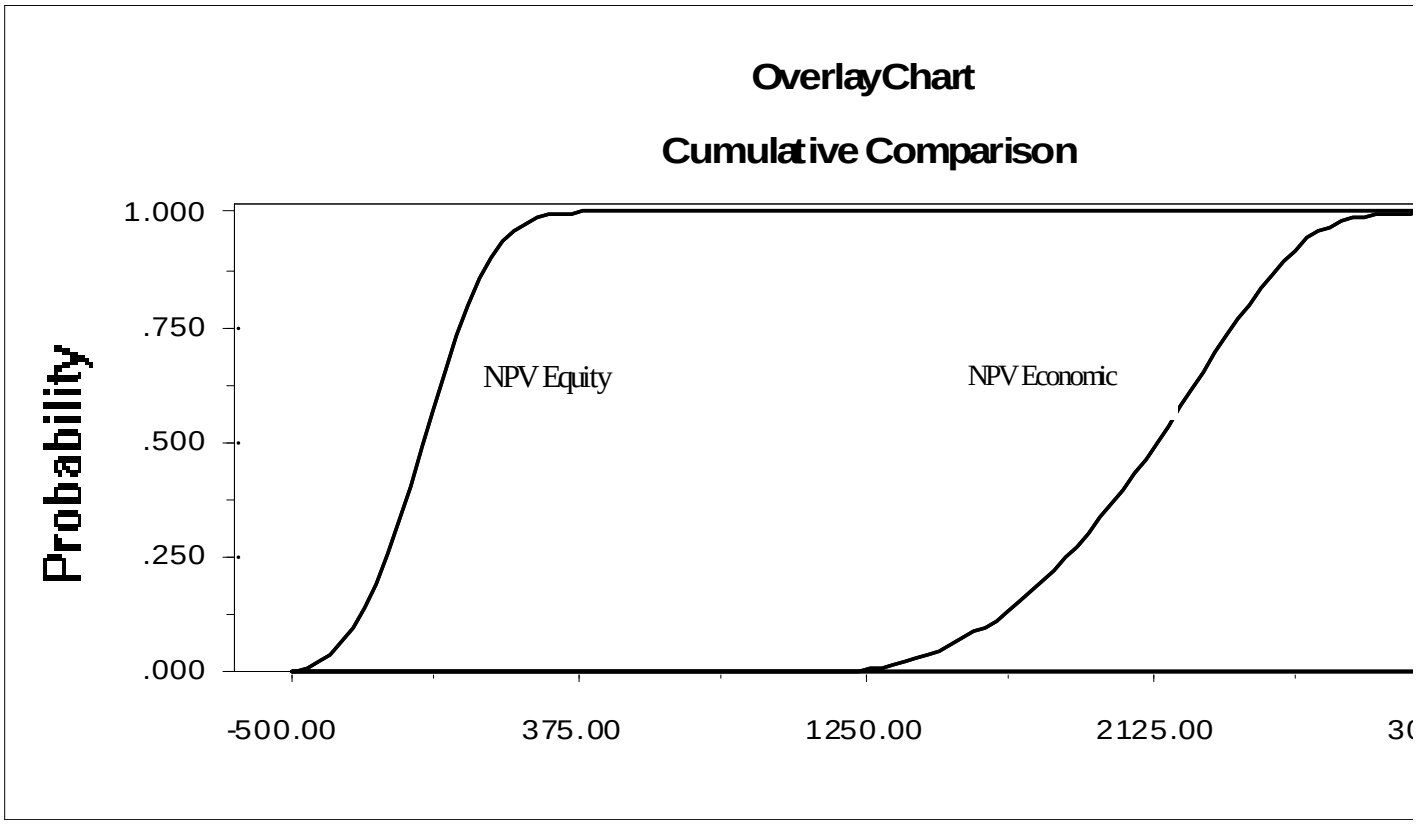

Figure 2: Water Distribution Project

Probabilities of Realization of Net Benefits