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INCREASING COVERAGE:
THE AFFORDABILITY OF URBAN WATER
AND SEWER SERVICE EXTENSION
IN ECUADOR
VOLUME I

AN AID REPORT PREPARED BY THE WASH PROJECT
Field Report No. 316
February 1991

**WATER AND
SANITATION for
HEALTH
PROJECT**

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WASH Field Report No. 316

PN ABH 603

VOLUME I

**INCREASING COVERAGE:
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AND SEWER SERVICE EXTENSION
IN ECUADOR**

**Task 1. Socioeconomic Survey and
Willingness to Pay Analysis**

by Julián Velasco and CEDATOS

**Task 3. Recovery of the Costs of Investment
in Infrastructure Projects**

by Jorge Alfredo Infante

Prepared for RHUDO/SA and USAID Mission to Ecuador
under WASH Task Nos. 120 and 128

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ACRONYMS

BCE	Banco Central del Ecuador (Central Bank of Ecuador)
BEDE	Banco Ecuatoriano de Desarrollo (Ecuadorian Development Bank)
CEDATOS	Centro de Estudios y Datos (Center for Survey Research)
CV	Contingent Valuation
EMA-Q	Empresa Municipal de Alcantarillado de Quito (Municipal Sewer Company of Quito)
EMAP-Q	Empresa Municipal de Agua Potable de Quito (Municipal Potable Water Company of Quito)
ETAPA	Empresa Pública Municipal de Teléfonos, Agua Potable y Alcantarillado de Cuenca (Public Municipal Telephone, Drinking Water and Sewer Company of Cuenca)
FFV	Fondo Financiero de la Vivienda (Financial Fund for Housing)
GOE	Government of Ecuador
IEOS	Instituto Ecuatoriano de Obras Sanitarias (Ecuadorian Sanitary Works Institute)
NSDS	National Shelter Delivery System Program
RHUDO/SA	Regional Housing and Urban Development Office/South America, U.S. Agency for International Development
<i>suces</i>	750 suces = US \$1 (as of mid-February 1990, at time of survey)
USAID	United States Agency for International Development (overseas mission)
WASH Project	Water and Sanitation for Health Project

PREFACE

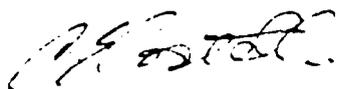
A.I.D. is pleased to share with you accounts of initiatives being taken by local urban communities to plan, finance, and deliver basic urban services. In doing so, these communities are uncovering false, preconceived beliefs that have restrained more widespread action in meeting the challenge of urban growth. Two of those beliefs are that low-income households cannot afford and will not pay for basic infrastructure services such as potable water and sewerage connections, and that they cannot pay for those services at levels which allow service providers—the municipality or the water/sewer authority—to recover their recurrent and investment costs.

The two studies presented in this report illustrate the fallacy of these beliefs. They represent only a few of many examples of poor urban communities that need basic services and are willing to pay for them.

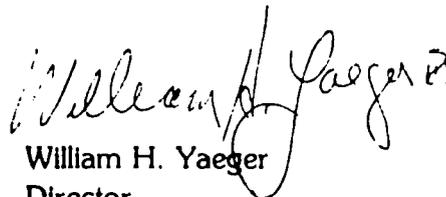
The first study describes the design, application, and analysis of a socio-economic survey to determine willingness and ability to pay for residential water and sewerage connections. The survey was conducted by the municipal water authority of Quito in ten low-income urban neighborhoods in Quito, Ecuador. The analysis clearly establishes residents' willingness and ability to pay for residential infrastructure services. The total cost of financing the connection and monthly consumption charges is less than most residents currently pay to private water vendors for less—and lesser quality—water. A significant added benefit is that these connections to municipal services greatly increase, by as much as one-fourth to one-third, the households' property value, thereby creating wealth among residents of low-income urban neighborhoods.

The second study analyzes cost recovery mechanisms to recoup investment and recurrent costs for water and sewerage services. In this case, too, there is more room for solving infrastructure service deficits than widely believed. In the case of Ecuador, adequate action is already permitted by existing municipal legislation to recover costs and to permit municipal infrastructure agencies to manage their resources as commercial, albeit not-for-profit, enterprises. By initiating innovative financial instruments to help residents finance domestic infrastructure connections, local governments may protect both their own capital and the income of the low-income borrower from the destructive effects of high, persistent inflation. The ability and willingness of low-income households to pay, combined with the availability of a feasible financial instrument, create a viable solution for increasing the coverage of basic infrastructure services in urban areas, even during periods of rapid urbanization.

A.I.D. hopes that this report will aid local governments, technical organizations, and other donor agencies in their analyses and solutions to the challenges of urban growth and the alleviation of poverty.



Charles Costello
Director
USAID Mission to Ecuador



William H. Jaeger
Director
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for South America

EXECUTIVE SUMMARY

This document covers the reports on tasks 1 and 3 of the first phase of a technical assistance plan for the drinking water and sewerage segments being carried out by the U.S. Agency for International Development Mission to Ecuador and the Regional Housing and Urban Development Office/South America as part of the supplemental program to the Housing Guaranty Program in Ecuador. The field work on these tasks was done in Ecuador in late 1989 and early 1990. The objective of task 1 was to develop a methodology for a socioeconomic data survey to determine ability and willingness to pay for drinking water and sewerage systems; the objective of task 3 was to develop a plan for recovering the cost of investment in these systems and in infrastructure projects.

Task 1 involved the use of direct and indirect methods, both observational and hypothetical, to estimate the benefits accruing from public and semipublic works and to determine the willingness to pay for drinking water and sewerage services in Quito.

First, the implicit price of having drinking water and sewerage service was obtained from a regression analysis of the additional value to a housing unit that had these services. This price is an estimate of what people are willing to pay for access to these services.

Second, a contingent valuation differential was calculated for housing units with and without water and sewerage services. This differential is the difference between the value of housing units without these services and the value that people estimated these units would have with connections.

Third, a demand equation based on the amount of drinking water people actually consumed and paid for was used to estimate the responsiveness of quantity consumed to changes in water prices and income.

Fourth, a contingent valuation was used to estimate willingness to pay from what people expressly stated they were willing to pay per month for drinking water and sewerage.

The contingent valuation estimations were based on survey data obtained by the auction method. This method asks a series of questions that simulate the bargaining mechanisms in a market setting to closely approximate what the respondent would be willing to pay. Each question suggests a larger amount, until the respondent expresses an unwillingness to pay.

In general, estimates of the willingness to pay, whether obtained through direct or indirect methods, were far greater than the rates currently charged. These were the specific findings:

- The availability of a connection to the public drinking water and sewerage systems increased the estimated value of a housing unit by \$1,363¹.
- The contingent valuation differential for water service was \$882 and for sewerage service was \$1,489.
- The responsiveness of drinking water demand to changes in the price of water and family income was relatively small. A price increase of 10 percent would reduce consumption by only 1.4 percent. A 10 percent increase in family income would increase consumption by only 3.3 percent.
- Based on contingent valuation, the average willingness to pay for drinking water was about \$0.43 per cubic meter, compared with \$0.06 to \$0.22 per cubic meter charged by the public system. The average willingness to pay for sewerage service was \$0.79 per month.

Task 3 involved the study of the current financial situation of three Quito companies, the legal foundations of their operations, and their accounting methods and procedures. In general, investment funds come from donations and transfers from the government budget or from domestic and foreign credit. Operating under the erroneous conception that donations and transfers have no opportunity costs, the companies tend to invest these resources in a less efficient manner than those generated from credit.

The Municipal Regulations Law, under which these companies operate, does not clearly stipulate that fees can be charged to recover investment costs. However, the law establishes that revenues from fees cannot exceed the operation and maintenance costs of providing drinking water and sewerage services. This has been interpreted to exclude the recovery of investment costs.

The belief is still widespread in Ecuador that water is a social good to be subsidized by the national government, and that the people in communities receiving the services cannot pay for them. The results of task 1 indicated unambiguously that those surveyed in the ten barrios are both able and willing to pay for drinking water and sewerage services.

¹ Throughout this report, the US \$ equivalents were used in place of the local currency.

Sixty percent of the people surveyed paid an average of \$4.31 per month, or \$1.08 per cubic meter, to purchase four cubic meters of water from tankers. The new fees proposed by the Municipal Drinking Water Company of Quito would provide 50 cubic meters per month for \$4.31. Assuming that people connected to the system would consume 20 cubic meters per month, their payments for water used would be only \$1.20 per month, leaving \$3.07 per month to cover the cost of the system.

Municipal companies in other Latin American cities have shown they can cover the costs of operation, maintenance, administration, debt service, and a substantial part of investment requirements with their own revenues, without subsidies or donations from the government. From the records of companies with an acceptable means of measuring consumption, it appears that approximately 20 percent of the users consume about 60 percent of the water. In general, this group consists of high-income households, businesses, and industry, and in many cases contributes up to 80 percent of revenues. Fee structures are based on this fact. In the case of the Municipal Drinking Water Company of Quito, 27 percent of the users consume 54 percent of the water and contribute 64 percent of the revenues. In the case of the Public Municipal Telephone, Drinking Water, and Sewer Company of Cuenca, 16 percent of the users consume 52 percent of the water and contribute 60 percent of the revenue.

These cross-subsidies are made possible by the fact that high-income users have high levels of consumption, while low-income users have low consumption levels. If the marginal cost of future projects, which is always greater than historical accounting costs, is charged to the high consumers, the surplus resources generated can be used to provide a subsidy to low-income, low-consumption households.

Fees for drinking water are extremely low. In Quito, they range from \$0.06 to \$0.22 for residential users and from \$0.11 to \$0.37 for industrial users. In Cuenca, they range from \$0.02 to \$0.14 for residential users and from \$0.09 to \$0.20 for industrial users. With such low fees, companies are forced to meet their commitments with subsidies and with revenues not derived from providing service. For example, they receive 10 percent of the telecommunications accounts, which makes them dependent on another entity and limits their financial autonomy.

The interpretation of the fee policy established in the Municipal Regulations Law has led to financial inefficiency since revenues do not even cover the cost of providing the services, let alone the depreciation of assets at historical cost.

Chapter 1

INTRODUCTION

The U.S. Agency for International Development Mission to Ecuador (USAID/Ecuador) and the Regional Housing and Urban Development Office/South America (RHUDO/SA) are currently implementing the National Shelter Delivery System (NSDS) Program (518-HG-007), as part of the Housing Guaranty Program in Ecuador. The objective of this component is to finance urban improvement, especially drinking water and sewerage systems, in established low-income communities lacking these services.

The institutions participating in the program are the Central Bank of Ecuador (Banco Central del Ecuador-BCE), the Ecuadorian Development Bank (Banco Ecuatoriano de Desarrollo-BEDE), and the municipalities and their water and sewerage companies that must construct and administer the urban improvement projects. BCE manages the technical assistance activities of the program and the Financial Fund for Housing (Fondo Financiero de la Vivienda-FFV), the agency that provides discounts through financial intermediaries to eligible housing and infrastructure projects. BEDE provides technical and financial assistance to municipalities for infrastructure projects and is the financial institution with access to the Ecuadorian Sanitary Works Institute (Instituto Ecuatoriano de Obras Sanitarias-IEOS), which establishes standards and guidelines for water and sewerage systems, analyzes their environmental impact, and constructs and administers them in rural areas and small municipalities.

1.1 Technical Assistance Plan for the Drinking Water and Sewerage Segments of the NSDS Program

USAID/Ecuador developed a two-phase technical assistance plan for the drinking water and sewerage segments of the NSDS Program: the first to include six tasks for the short term, the second to include four tasks for the medium term.

1.1.1 First Phase

Task No. 1 Develop a methodology for a socioeconomic data survey and an analysis of ability and willingness to pay.

Task No. 2 Review and issue technical norms and standards.

Task No. 3 Develop a plan for cost recovery of investment in infrastructure projects and drinking water and sewerage systems.

Task No. 4 Develop a methodology for the technical, economic, and financial evaluation of infrastructure projects.

Task No. 5 Apply evaluation criteria and procedures to infrastructure and drinking water and sewerage projects in low-income communities.

Task No. 6 Develop project monitoring and evaluation systems.

1.1.2 Second Phase

Task No. 7 Develop institutions for the financial administration of drinking water and sewerage systems.

Task No. 8 Hold a workshop on project evaluation methodology.

Task No. 9 Hold a workshop on the financial administration of water and sewerage companies.

Task No. 10 Hold a workshop on organizational development techniques.

This report covers the completion of tasks 1 and 3. A study in late 1989 and early 1990 by Julian Velasco and Associates and the Center for Survey Research (Centro de Estudios y Datos-CEDATOS) focused on task 1. Jorge Alfredo Infante, an economist, completed task 3 in early 1990. Both tasks were carried out under the auspices of the Water and Sanitation for Health (WASH) Project.

1.2 Task 1 Objectives

- Implement and process surveys designed to gather the data required to estimate willingness to pay in the targeted urban centers.
- Estimate the willingness to pay of the target population of each city, using both direct methods (contingent valuation) and indirect methods (calculation of the quantity consumed and the price actually paid).

- Generate demand projections derived from estimated functions and population projections. Define eligible cities and sites. Design the size of the projects based on demand projections.
- Perform economic evaluations of the projects by using cost-benefit analysis and by applying SIMOP and other models considered appropriate for each case. The benefits are those obtained from the estimated willingness to pay.
- Evaluate technical alternatives for drinking water and sewerage systems through cost-benefit analysis.
- Design or redesign fee systems for drinking water and sewerage services, based on the demand and marginal cost functions calculated in another activity of the project. Consider the criteria of efficiency and equity.

1.3 Task 3 Objectives

- Provide municipal companies and municipalities with techniques for the effective implementation of investment and operating cost recovery systems. These techniques will include special improvements taxes, fees, and other methods to increase the financial autonomy of the water and sewerage and infrastructure companies.
- Implement financial systems and legal procedures for the recovery of investment and operating costs taking inflation into account.
- Quantify and evaluate the effect of recovering investment and operating costs through fees. This requires an alternative for the recovery of investment and operating costs at real rates of return.

The two chapters that follow describe the conceptual framework and the results of tasks 1 and 3, respectively. Volume II of the report contains extensive appendices that provide greater detail.

Chapter 2

SOCIOECONOMIC SURVEY AND WILLINGNESS TO PAY ANALYSIS

2.1 Conceptual Framework

A fundamental problem in the cost-benefit analysis of public projects is the quantification of benefits received by the community. When goods or services are traded freely in efficient private markets, their prices reflect true economic benefits to the people that purchase and consume them. But there are situations in which goods are provided by the public sector because they would create a monopoly for the private sector. Drinking water and sewerage systems are examples of goods that would evolve into monopolies if the private sector were allowed to provide them without regulation.

True public goods, by their very definition, cannot have an established free market price, without which it is difficult to determine the true economic benefit to the people who consume them and how much they should be charged. Therefore, it is necessary to resort to methods of economic analysis that use willingness to pay as the means to estimate benefits and design economically efficient fee structures.

2.1.1 Estimating the Benefits of Publicly Provided Goods

Several methods may be used to estimate the benefits of public sector projects, depending on such factors as the kind of project, its location, and available facilities. The methods described in this section are applicable especially to municipal development projects in areas such as drinking water and sewerage, public roads, neighborhood improvement, recreational parks, pollution control, and solid waste treatment.

The two principal methods of measurement are the physical-mechanical method and the behavior method.

The first, without foundation in economic theory but used with some frequency, relates benefits to certain characteristics in a mechanical manner. One example, applicable to drinking water projects, is estimating the demand for water by applying indices to variables such as the number of toilets, showers, or sinks, or the frequency of baths.

The second type links a project and its effects through the analysis of human behavior. This type is most used by economists and other social scientists because it is rooted in economic theory. Following the classification of Mitchell and Carson, behavior methods are divided into:

- Direct/observed methods
- Direct/hypothetical methods
- Indirect/observed methods
- Indirect/hypothetical methods

Direct/observed methods are seldom used. They apply in situations in which, for example, a community decides by vote on the amount of a fee or tax. For the outcome to be a valid measure of benefits, the electors should be able to vote for various levels of the tax or fee, before arriving at the appropriate one. The method is unsuitable for measuring public goods, but is sometimes used in the area of semi-public goods.

Direct/hypothetical methods ask those affected by a project about its positive or negative impact. The use of these methods has grown in recent years because they are rather precise in measuring willingness to pay. Many research studies conducted in the 1980s showed that initial doubts about a possible bias in the responses of those interviewed were not valid.

Indirect/observed methods are based on observation of the market and are highly valid when the benefits can be inferred indirectly. The hedonic price method, frequently used to estimate the willingness to pay for each of the characteristics of a durable good, is an illustration. When applied to dwellings, the value of each additional unit of construction and the availability of drinking water, sewerage, and electrical services, for example, can be estimated by means of a multiple regression model.

Indirect/hypothetical methods are similar, except that they ask what the assigned value would be instead of observing the real behavior of the variables. Using the above example, the benefits of the characteristics of a housing project could be estimated by asking potential beneficiaries how much they would be willing to pay for various kinds of housing, each with different groups of characteristics.

Two of the methods used to estimate willingness to pay (WTP) in the drinking water and sewerage survey conducted in Quito are discussed below. Volume II contains details of the survey (Appendix A), and the criteria and design of the questionnaire, as well as the data processing methods used (Appendices B and C). Appendices D through H provide further information on the analysis.

2.1.2 Indirect/Observed Calculation: Hedonic Prices

This method is used to assign values to the characteristics of durable consumer goods, primarily housing. Housing is not a homogeneous good: when consumers purchase a house they are paying for an assortment of features that differ in each unit of housing. Among these features are some associated with the physical structure, the quality of the materials, the availability of services, and the age of the construction. Other features related to the

characteristics of the lot and the neighborhood may include the square footage of the lot, accessibility to the town center and other important places, and the level of crowding or population density in the neighborhood.

Each family makes its decision with its own preferences and with the restrictions imposed by its income level. These preferences reflect the number of family members, the average age or the age of the head of the household, level of education, and socioeconomic status. For example, large families, in general, prefer houses on large lots, preferring to sacrifice accessibility and move far from the town center.

The market price of a housing unit (P_i) can thus be represented by a function of the kind:

$$P_i = f(X_1, X_2, \dots, X_n; Z_1, Z_2, \dots, Z_m; F_1, F_2, \dots, F_s)$$

where the variables X , Z , and F correspond respectively to the features of the physical structure, the lot and neighborhood, and family characteristics. It can be interpreted as follows: the price of a unit of housing, P_i , depends on its "n" physical features, (X_1, X_2, \dots, X_n), the "m" features of the land (Z_1, Z_2, \dots, Z_m), and the "s" characteristics of the particular family (F_1, F_2, \dots, F_s). The function is a reduced form of the function of demand and supply and does not constitute a demand function.

The price of the housing unit represented here is more than the price of the physical property and its attributes. It is the sum of the services it provides. When neither price controls nor subsidies are a consideration, rents can be used as indicators of renter satisfaction because they are the amounts that the individuals are prepared to pay for the perceived benefits derived from their housing units.

However, since it is not always possible to obtain unbiased values from rents, especially in barrios where tenant-landlord relationships are more complex, it is more useful to use the value of the housing as estimated by the tenants. If the value of the housing unit can be related to the various attributes of housing by econometric techniques, the degree of user satisfaction can be measured in monetary terms. This is called the hedonic, or implicit, price of each characteristic of the housing unit.

If the characteristics that explain the changes in housing prices can be identified, the implicit or hedonic prices of each one of the attributes in question can be obtained. Assuming a linear relationship between the value of the housing (P) and its attributes, the following equation with coefficients that would change for each socioeconomic group would result:

$$P = B_1 X_1 + B_2 X_2 + \dots + B_n X_n + C_1 Z_1 + C_2 Z_2 + \dots + C_m Z_m + u.$$

The coefficients B_i , C_i , corresponding to the implicit prices, indicate the change in value of the housing unit when the independent variable X_i or Z_i changes in a unit; and "u" gathers

the effects that the nonspecified variables have on the rent. For example, assume that the relationship between the value of a housing unit and the size of the lot (X_1) in square meters is $P = 100 X_1$. The coefficient of 100 would be the value for which each home renter would be willing to pay \$100²; so that the renter would pay \$100 for each square meter increase in the size of the lot, or, alternatively, would receive a benefit from the attributes of the housing unit equivalent to \$100 per square meter.

The values of the implicit prices can be estimated empirically through econometric methods using multiple regression.

The implicit prices of housing characteristics, by reflecting market prices and what the group analyzed would be willing to pay, allow the quantification of the social benefits of different packages of attributes. Thus, the benefits of alternative housing solutions can be determined.

If some of the attributes of a housing unit do not turn out to be significant, this should not be interpreted to mean that they were considered worthless. Rather, it indicates that other features were the principal determinants of the choice made. If, for example, there are very few housing units that do not have an independent bathroom, other attributes will determine the value of the package of services offered by a particular housing unit.

2.1.3 Direct/Hypothetical Calculation: Contingent Valuation

Direct estimate of willingness to pay by means of contingent valuation (CV) has been widely used in recent years to calculate the benefits of public and semi-public goods because, unlike the indirect method, it allows the quantification of these goods in all cases. It is based on the construction of hypothetical markets that should be valid and easily understood by those interviewed. For this reason, it is necessary to devote sufficient time and resources to the preparation of questionnaires, to training those implementing the surveys, and to the surveys themselves.

In applying the CV method, special attention must be paid to the biases that may arise when responses reflect specific interests and not true preferences. To avoid these biases, two messages must be communicated very clearly to the people being interviewed: that they will be required to pay what they say they are willing to pay, and that the supply of the good or service is contingent on the revealed preference, that is, that the provision of the good or service is not a sure thing.

When the provision of the good is contingent on the revealed preference and interviewees feel that, whatever their response, they will have to pay a set amount, they may name a larger figure than they are really willing to pay, believing that in this way they will have a

² Throughout this report, the US \$ equivalents were used in place of the local currency.

greater chance of receiving the good or service. This would be the case, for example, when people believe that drinking water would be supplied at a fixed fee regardless of their response. They might then suppose that their willingness to pay a greater amount would give them a better chance of obtaining the service.

When interviewees believe that the good or service is guaranteed or very probable, no matter what their response, and that they would be charged what they have offered to pay, another kind of bias is introduced. Respondents may express a willingness to pay less than the true amount, believing that the service will reach their houses anyway.

It is extremely important in developing the questionnaire and conducting the interviews to drive home the message that the obligation to pay is related to the quantity offered and that the provision of the good or service depends on the preference revealed in the survey. Many research studies in recent years have shown that if a survey has been well prepared and implemented, the CV method can reveal the true willingness to pay without biases.

2.1.4 Contingent Valuation: Kinds of Questionnaires

There are several ways to elicit unbiased responses. The principal methods used are described below.

- **Open Questions.** Individuals are asked directly how much they would be willing to pay for the good or service in question. This method is simple and easy to use but can lead to confusion or even rejection by those interviewed, especially if they are not familiar with the good or service to which they are assigning a value.
- **Auction Method.** This has been the most popular and asks a series of questions, each one suggesting a larger amount until the respondent indicates an unwillingness to pay. The interview closes with a question that asks for the respondent's final offer, which should be equal to or greater than the last amount stated affirmatively. The only drawback to this method is that an auction that begins at too low or too high a price could influence responses in the same direction.
- **Auxiliary Card.** This method is an alternative to the auction. Respondents are shown a flash card with numbers from 0 up and are asked to indicate the amount they would be willing to pay. The disadvantage here is that the amount the person has in mind might not appear on the card.

- **The Referendum Method.** Sometimes called the take it or leave it method, this requires a yes or no response to a randomly chosen price from a range of possible prices. The method has more disadvantages than advantages because, on the one hand, it requires a much larger sample since each group of prices is a subsample, and, on the other hand, it does not utilize all the information that could be obtained from the person interviewed. This makes the method very costly in relation to the benefits derived.

2.2 Analysis of Results

2.2.1 Willingness to Pay for Drinking Water: Implicit Prices

The implicit or hedonic price method seeks to determine the value that people assign to public drinking water and sewerage services. It assumes that this value is manifested in the price differentials between housing units that have and do not have these services.

The household survey found that the average estimated value of housing units connected to the public drinking water system (but not to the sewerage system) was \$467 greater than the value of those that were not. The value of units also connected to the sewerage system was \$1,585 greater than the value of those connected to neither the public drinking water nor the sewerage system.

These averages establish the relationship between the value of the housing unit and the willingness to pay for public services, but they do not indicate the implicit prices of these services. These prices are obtained by regressions between the value and the characteristics of the unit, and between these characteristics and the availability of public services. These regressions attempt to explain the variations in value on the basis of the size of the lot; the square footage of the housing unit; the total number of rooms, and the number of bedrooms and bathrooms; the age of the building; the materials of the floor, wall, and roof; and the availability of public electricity, water, sewerage, and telephone services.

Given that the features of a unit of housing are generally closely related, it is very unlikely that every one of these features enters into the determination of the implicit price. The most dominant features are revealed by an iterative regression process. The first regression that was run included all the principal features of housing units which as a group explain 26.4 percent of the total variation in the value of these units. However, only five variables turned out to be significant, given the high degree of correlation among those that were included. The results are summarized in Table 1.

Table 1**Implicit Prices of Housing Characteristics**

VARIABLE	REGRESSION 1 COEFFICIENT	F	REGRESSION 2 COEFFICIENT	F	REGRESSION 3 COEFFICIENT	F
12 UNIT SQUARE FOOTAGE	5.2239	4.56	7.096	9.06	5.5978	10.87
13 # OF ROOMS IN HOUSING UNIT	159.5803	4.54	222.049	10.40	159.0295	10.48
15 # OR BATHROOMS IN HOUSING UNIT	727.1499	9.21				
23 TELEPHONE SERVICE AVAILABLE	1615.7770	7.12	1634.1781	7.22	707.2187	2.64
182 CONNECTED TO WATER & SEWERAGE SYSTEM	695.5545	2.30	1006.985	5.28	1022.283	10.81
REGRESSION CONSTANT	-62.9442	0.01	361.7629	0.20	632.669	4.96
COEFFICIENT OF DETERMINATION	26.4%		22.6%		23.5%	
F RATIO	15.0		16.3117		16.6	
REGRESSIONS IN THE FORM						
Housing Value = a + b Square Footage + C # of rooms ...						

Subsequent regressions performed with smaller groups of variables sought the most significant ones (high F ratios) to explain an acceptable proportion of the variations in value (acceptable coefficient of determination). A superior model that was relatively simple was chosen to explain the value of the housing unit in terms of square footage, number of rooms, and availability of telephone, drinking water, and sewerage services. These variables explain 23.5 percent of the variation and have acceptable levels of importance. With the exception of the variable "has telephone service," the probability of error in considering these variables as explanatory is less than 1 percent.

The estimated coefficients indicate that people implicitly value each characteristic of a housing unit as follows:

- Each additional square meter adds \$7.46 to the value of the unit.
- Each additional room raises it by an estimated \$212.
- The availability of telephone service adds an estimated \$943.

- The availability of a connection to the public drinking water and sewerage systems increases the estimated value by \$1,363. The availability of these services individually did not yield satisfactory results in the regressions, given the high correlation between the two.
- Other features not included in the estimate of implicit prices are expressed in the regression constant, which indicates that the implicit prices begin to have an effect at an initial value of \$844.

The conclusion from these figures is that housing units with a connection to the public drinking water and sewerage systems have, on average, an estimated value of \$2,430 more than units that do not have both these services. If other characteristics of a unit are also taken into account, these two public services contribute to an increase of \$1,363 in value, which is thus the implicit price assigned to these services by this population.

2.2.2 Willingness to Pay for Drinking Water: Contingent Valuation Differential

Just as with the implicit pricing method, it was not possible to isolate willingness to pay for drinking water from willingness to pay for sewerage. The difference between the average value of housing units with and without these services can provide an approximation of the value people assign to them.

The following chart shows the average values of housing units and the average differentials associated with the availability of the two services.

	Average (in US\$)	No. of Cases
Value of housing unit	3,469	241
Value of housing unit with only drinking water service	3,622	179
Differential for drinking water service	882	174
Differential for sewerage and drinking water service	2,430	99

The average value of all housing units in the survey was \$3,469, the value of those with only water service was \$3,622, and the value of those with only sewerage service was \$3,947. The average differential for water service, that is, the added value that people estimated the unit's would have if connected to this service, was \$882. The differential was \$267 for 25 percent of the units, \$667 for 50 percent of the units, and \$1,333 for 75 percent of the units.

2.2.3 Willingness to Pay for Drinking Water Per Unit: Current Payment

The two preceding sections have discussed willingness to pay for access to drinking water. This and the next section discuss willingness to pay for consumption of drinking water.

The first method presented here seeks to determine the relationship between observed demand for homes with drinking water and prices, family income, and availability of sewerage. Although the size of the home influences the demand for water, the effect of size to a great extent is considered in family income because a larger home generally has more wage earners, and therefore a larger income.

People obtain water from various sources, sometimes paying for it, other times traveling to get it, and other times getting it free from a well, a public tap, or rainwater collection. To estimate willingness to pay, only cases in which water is paid for are considered. For the most part, those who bought water from public or private systems did not know the quantity they consumed monthly. The survey responses verified this: the average quantities reported were 5.4 cubic meters from public systems, and 3.9 cubic meters from private systems. These figures are clearly underestimated, representing a daily per capita consumption of only 34.4 liters for a household with an average of 5.24 people.

Faced with this problem, the best way to estimate willingness to pay is to compare the subgroup of homes that obtain their own water with those supplied by tankers. The latter have a monthly family income of \$99, consume an average of 4.45 cubic meters per month, and pay \$1.30 per cubic meter.

The model used to determine the relationship between consumption, price, income, and the connection to a sewer system was a logarithmic regression of the type:

$$\text{Log (consumption)} = a + b \log(\text{price}) + c \log(\text{income}) + d \text{ availability of sewer}$$

where b is the price elasticity of demand, c the income elasticity, d the percentage increase in demand when there is a sewer system available, and a is the regression constant that represents factors that do not depend on the price, income, or availability of sewer service.

The results of this regression were as follows (the F ratios appear in parentheses):

Regression coefficient: 0.1540

F Ratio: 6.31

$a = 0.7535$ (2.03)

$b = -0.1388$ (7.01)

$c = 0.3301$ (10.69)

$d = 0.2650$ (4.82)

The coefficients estimated with this regression indicate that the price elasticity of the demand for water is -0.1388, that is, for each percentage point increase in the price per cubic meter, the demand tends to decline by 0.1388 percentage points. If the price of water were to increase by 10 percent, the demand would decrease by 1.4 percent.

The income elasticity of the demand is 0.3301, indicating that for an increase of one percentage point in family income the demand for water increases by 0.3301 percentage points. An increase of 10 percent in family income would increase demand by 3.3 percent.

The coefficient for connection to the sewer system is 0.2650, showing that if the unit is connected to the sewer system the demand for drinking water will increase 26.5 percent.

The levels of significance for the F ratios are all acceptable because the margin of error in all cases is less than, or equal to, 3 percent.

A difference in price on the order of 2,071.8 percent (\$0.06) between water obtained from the public system and water obtained from tankers means that the difference in consumption should be on the order of 287.6 percent ($2,071.8 \times 0.1388$). In other words, at a lower price of \$0.06 per cubic meter, households that purchase water from tankers are willing to consume 17.25 cubic meters instead of 4.45 cubic meters.

Table 2 presents demand correlated with various prices in accordance with the price elasticity of demand and assuming that family income remains constant.

Besides buying water, some households also carry water home from other sources. Although this water does not have a monetary price, the inconvenience and time in transporting it should be considered opportunity costs. To measure the relationship between the consumption of water that is not paid for and its opportunity cost, the time spent obtaining water was assigned a value proportionate to the average per capita family income of the population surveyed. Thus, the value of each minute spent on trips to and from the water source can be calculated.

The data obtained show a clear relationship between the quantity of water consumed and its opportunity cost. The regression between the two variables indicates that there is a -0.51 elasticity of consumption with respect to the opportunity cost, or that consumption grows at half the percentage rate that the opportunity cost (the time required to carry the water) declines.

Table 2

Demand for Drinking Water in Homes
that Purchase Water from Tankers

PRICE ELASTICITY: -0.1388			
FAMILY SIZE: 5.2378			
Decline in Price	Price (US\$/M ³)	Consumption* (M ³ /month)	Supply* (lt/person/day)
	1.30	4.45	28.3
5.0%	1.24	4.48	28.5
10.0%	1.19	4.51	28.7
15.0%	1.13	4.54	28.9
20.0%	1.09	4.57	29.1
25.0%	1.04	4.60	29.3
30.0%	1.01	4.64	29.5
35.0%	0.97	4.67	29.7
40.0%	0.93	4.70	29.9
45.0%	0.90	4.73	30.1
50.0%	0.87	4.76	30.3
55.0%	0.84	4.79	30.5
60.0%	0.81	4.82	30.7
65.0%	0.79	4.85	30.9
70.0%	0.77	4.88	31.1
75.0%	0.74	4.91	31.3
80.0%	0.72	4.94	31.5
85.0%	0.70	4.98	31.7
90.0%	0.69	5.01	31.9
95.0%	0.67	5.04	32.1
100.0%	0.65	5.07	32.3
200.0%	0.43	5.69	36.2
300.0%	0.33	6.30	40.1
400.0%	0.26	6.92	44.0
500.0%	0.22	7.54	48.0
600.0%	0.19	8.16	51.9
700.0%	0.16	8.77	55.8
800.0%	0.14	9.39	59.8
900.0%	0.13	10.01	63.7
1000.0%	0.12	10.63	67.6
1200.0%	0.10	11.86	75.5
1400.0%	0.09	13.10	83.4
1600.0%	0.08	14.33	91.2
1800.0%	0.07	15.57	99.1
2000.0%	0.06	16.80	106.9
2200.0%	0.06	18.04	114.8

SOURCE: Household Survey, March 1990.
*This column shows the increase in water consumption that results from the corresponding decline in the price of water.

Putting together the households that pay a tanker and those that travel to obtain their water to determine the relationship between consumption and price (or opportunity cost) and income, it was established that the elasticity of consumption with respect to price (or alternatively the opportunity cost) is -0.1290. With respect to income, it is 0.2627. These results strengthen the estimates already discussed on the price elasticity and the income elasticity of the demand for drinking water.

Thus, the willingness to pay for water consumption is clearly related to both quantity and family income, and judging by the real payment made by those who purchase water, the figure is much greater than what the population connected to the public drinking water system currently pays.

2.2.4 Willingness to Pay for Drinking Water Per Unit: Contingent Valuation

Willingness to pay using the contingent valuation method is estimated by what people expressly state they are willing to pay per unit of drinking water, expressed in tanks, cubic meters, or other units. Willingness to pay is assumed to be greater when the current level of consumption is less and the income level is greater. For these reasons, the relationship between willingness to pay and current consumption should be negative, while that between willingness to pay and income should be positive.

For the CV method to be applicable, the people interviewed must know the value they are currently paying per unit and/or the current price. If they do not know this, the figures they give as their willingness to pay may not be very accurate. For this reason, the population supplied by tankers lends itself best to evaluation by the contingent valuation method. Other consumers either do not pay for the water they consume and therefore do not know how much each unit costs, or, if they do pay, they have no idea of unit costs because they have no water meters or meters that are not working.

The average willingness to pay is \$0.43 per cubic meter for all consumers and \$0.50 for those who purchase water from tankers. This willingness to pay is far less than the \$1.30 per cubic meter that households currently pay the tankers, but much higher than the prices charged by the public drinking water system.

The data from the survey did not yield satisfactory results for the relationship between willingness to pay and consumption and family income. The expected relationships could neither be confirmed, nor discounted. This was due very likely to the fact that not enough price options per tank of water were presented to those surveyed. The first of these options (the lesser value) was very low in comparison with the amount that people are currently willing to pay.

2.2.5 Willingness to Pay for Sewerage Service: Implicit Prices

Access to the sewerage system adds an implicit price in the same way as access to the drinking water system. As explained earlier, it was not possible to separate the implicit prices of the two services, but together they add \$1,363 to the estimated value of a unit. Housing units with sewerage service appeared to have an average value \$1,587 greater than those without.

2.2.6 Willingness to Pay for Sewerage Service: Contingent Valuation Differential

Because it was not possible to estimate willingness to pay by the implicit price method or by current payment, an alternative was to estimate the differential between the value of housing units with and without the service using the valuation of respondents that have it.

The following chart shows the average values of housing units and the average differentials ascribed to having public sewer service:

	Average (in US\$)	No. of cases
Value of the housing unit	3,468	241
Value of the housing unit with only sewer service	3,947	112
Differential for sewer service	1,505	103
Differential for drinking water and sewer service	2,430	99

According to the survey, the average differential in the value ascribed to sewerage service was \$1,505. In other words, a connection to the system for housing units that do not have one would increase their value by an average of \$1,489, according to the estimates of respondents who have the service. This differential was \$533 for 25 percent of the units, \$1,067 for 50 percent of the units, and \$1,333 for 75 percent of the units.

2.2.7 Willingness to Pay for Sewerage Service Monthly: Current Payment

The willingness to pay monthly for sewerage service can be gauged from the amount households currently pay for wastewater removal. Households with a septic tank or latrine must pay for cleaning the tank or replacing the latrine as well as for repairs. The cost per month for this is equivalent to the minimum they would be willing to pay for sewerage

service. The public system not only removes wastewater conveniently, but also improves hygienic conditions which people value.

Data from the survey were not very reliable because of confusion in interpreting responses. The true monthly amount households pay for removal of wastewater could not be determined. Later surveys should provide sufficient data to establish, by means of regressions, the relationship between this true amount and family income or at least the average monthly payment for removal of wastewater.

2.2.8 Willingness to Pay for Sewerage Service Monthly: Contingent Valuation

Willingness to pay monthly for sewerage service is usually determined by what people explicitly state. The average willingness to pay stated by households was \$0.79 monthly, 25 percent would pay up to \$0.27, 50 percent up to \$0.67, and 75 percent up to \$1.33 monthly.

A regression between the monthly willingness to pay and family income determined, with 94 percent reliability, that the income elasticity of willingness to pay was 0.25, that is, for each percentage point increase in family income, willingness to pay for sewerage service would increase by 0.25 percentage points. The results were as follows:

Independent variable:	Log. of family income	
Dependent variable:	Log. of monthly willingness to pay	
Coefficient of determination:	0.0277	
Intercept: 4.9830	t = 9.12	Significance = 0.00
Slope: 0.2499	t = 1.91	Significance = 0.06

Willingness to pay monthly for sewerage service tends to increase with family income but at a smaller rate, as indicated by the fact that the elasticity is greater than 0.0 but less than 1.0.

2.3 Conclusions and Recommendations

Willingness to pay estimates, whether obtained through direct or indirect methods, were far higher than current rates. The specific findings were:

- The availability of connections to the public drinking water and sewerage systems would increase the estimated value of a housing unit by \$1,363.

- The contingent valuation differential was \$882 for water and \$1,489 for sewerage.
- The responsiveness of drinking water consumption to changes in the price of water and family income is relatively small. If the price of water were to increase by 10 percent, consumption would decrease by only 1.4 percent. If family income were to rise by 10 percent, consumption would increase by only 3.3 percent.
- Based on contingent valuation, the average willingness to pay was \$0.43 per cubic meter for drinking water, which is much higher than the public rate (\$0.06 to \$0.22 per cubic meter). Average willingness to pay for sewerage service was \$0.79 per month.

Chapter 3

RECOVERY OF THE COSTS OF INVESTMENT IN INFRASTRUCTURE PROJECTS

3.1 Analysis of the Legal Foundation of the Operations of Public Companies

The legal status of municipally-owned utilities must underlie any system for recovering their investment and operational costs. In Ecuador, the legislation that provides the foundation for the operations of municipal utility companies is the Municipal Regulations Law. This chapter analyzes the implications of this law in the Ecuadorian context and may help in suggesting similar research in other settings.

3.1.1 Title III: Municipal Administration

Chapter I. Functions of Municipal Administration. The following sections and articles are relevant:

Section 2a. Functions
Paragraph 3. Public Services

Article 163. "Concerning matters of public service, the municipal administration is authorized to:

- c) Provide drinking water and sewerage services to residents in its jurisdiction;
- e) Charge property owners for the installation of electricity and drinking water connections and the necessary repairs to the streets and sidewalks..."

Chapter II. Administrative Structure. The following sections and articles are relevant:

Section 2a. Municipal Companies
Paragraph 1. Formation of Companies

Article 194. "A municipality may establish public companies for the provision of public services..."

Article 195. "The public companies will be established pursuant to the provisions of this law and their capital will consist of contributions from the respective municipality, either in assets or budgetary allocations..."

Paragraph 2. Definition of Governing Bodies

Article 197. "The public municipal company is an entity incorporated by ordinance, with autonomy over administration and assets, to operate on a commercial basis and provide a public service for which a rate or price is charged and taxes are levied."

Paragraph 3. General Provisions

Article 206. "In the case of the constitution of public municipal companies , the council will approve all fees to be charged for services provided, and no charges may be imposed without its authorization...."

Article 210. "Each public municipal company will maintain its own accounting system according to commercial criteria and in such a way as to make clear its costs of operation in providing public services and its financial position."

Discussion

Article 163 assigns a municipal administration the responsibility for providing drinking water and sewerage services to people in its jurisdiction. Paragraph 2 states that the cost of installing a drinking water connection will be borne by property owners. Article 194 authorizes municipalities to establish public companies to provide public services. This article provides the legal foundation for the creation of the companies studied—EMAP-Q and EMA-Q in Quito, and ETAPA in Cuenca. Article 195 states that capital for each company will be contributed by the respective municipality. Article 197 decrees that the municipal company must be created by ordinance, with autonomy over administration and capital. However, the most important part of this article is the reference to operating on a commercial basis and charging a rate or price, and levying the corresponding taxes for the public service provided. This should be interpreted to mean that the rate or price and the taxes should include all costs incurred in providing the services, including investment. Thus, the recovery of costs should apply to this total.

Article 206 establishes that fees may be set only with the approval of the municipal council. Article 210 establishes that the accounting system must be maintained "according to commercial criteria" so that it is possible "to determine clearly and concretely the costs of operation in providing public services, and the financial position of the company." To comply with this article, companies must have a cost accounting system.

3.1.2 Title VII: Municipal Rates

Chapter I. General Provisions. The following articles are relevant:

Article 397. "Municipalities may apply the tax rates for public services established in this law. They may also apply such rates for other public municipal services provided that the sum total generated by these rates maintains a relationship with the cost of producing these services. In this regard, it is understood that the cost of production is that cost which results from the application of generally accepted accounting principles..."

Article 398. "Rates may be charged for the following services: d) drinking water; k) sewerage system and piping..."

Chapter V. Rates and Fees for Drinking Water. The following articles are relevant:

Article 407. "Municipalities will set such rates for drinking water as shall not exceed the cost of maintaining and providing the service..."

Article 409. "...Municipalities shall charge fees for connection and reconnection, that do not exceed the cost of materials and labor for such service."

Chapter VI. Rates for Sewer Service and Piping. The following article is relevant:

Article 411. "Municipalities shall set, by means of ordinances, such rates for sewerage service and piping, as shall not exceed the cost of maintaining and operating the service, and the charge shall be applied in proportion to the volume of drinking water consumed by each user."

Discussion

Article 397 establishes rates for the provision of public services that bear a relationship to the cost of production, and specifies that this cost should be determined by the application of generally accepted accounting principles. Cost accounting is absolutely necessary to implement this provision.

Article 398 authorizes charges for drinking water and sewerage services. Article 407 stipulates that rates for drinking water shall not exceed the cost of maintaining and operating the service, that is, no profit margin or percentage of return may be included. However, depreciation of the revalued fixed assets should be included to prevent decapitalization of the companies and to generate reserve funds for the replacement of such assets. At the same time, Article 407 should be supplemented so that municipalities can impose special

assessments, through ordinances, to recover the investment and operating costs of specific projects, such as the installation of secondary systems for the distribution of drinking water in specific sectors or barrios. Article 409 authorizes the charging of fees commensurate with the actual cost of connection and reconnection of these services.

With respect to sewerage service, Article 411 states, in the same way as for drinking water, that the rates may not exceed the cost of maintaining and operating the service. The comment made about Article 407 also applies to Article 411. Another policy established by this article is that the charges for sewerage service will be based on the volume of drinking water consumed by each user, a mechanism that is very acceptable.

3.1.3 Title VIII: Special Improvements Taxes

The following articles are relevant to the analysis of cost recovery:

Article 415. "The purpose of the special improvements tax is the real or presumptive benefit distributed proportionately to urban real property by the construction of any public work."

Article 416. "A benefit to which the previous article refers exists, when a property is adjacent to a public project or is located within the zone of benefit or influence declared by ordinance of the respective council."

Article 420. The following are established as appropriate for special improvements taxes: (d) Sewer system projects; ... (i) Other projects that the municipalities specify by means of ordinances, subject to the pertinent legal decree."

Article 421. "The base of this tax shall be the cost of the project prorated among the beneficiary properties in the manner and proportion established in this law."

Article 427. "The total cost of the sewerage systems constructed in a municipality shall be paid entirely by the beneficiary property owners in the following manner: In the new developments the developers will pay the entire cost or will construct the needed systems on their own, and they will also pay the cost of, or will construct on their own, the subsewers that may be necessary for connection to the existing sewers.

"In order to pay the total cost of existing sewers or of those that may be constructed in the future, the urban development ordinances will authorize a tax per square meter of useful land.

"When constructing new sewerage systems in urbanized areas or expanding existing sewers, the total value of the project will be prorated in accordance with the recorded assessed value of the beneficiary properties."

Article 430. "For other projects decided upon by the municipalities, pursuant to Article 420, paragraph I), the total cost shall be prorated by ordinance."

Article 439. "Each municipality shall establish a fund with the proceeds of the improvements taxes collected to be used exclusively for constructing new reimbursable projects, with the exception of the sums set aside to pay for the financial services to which the following article refers...."

Article 440. "The municipalities may issue public municipal debt bonds or take on other forms of debt.... for the purpose of establishing the fund referred to in the previous article, setting aside the proceeds of the improvements taxes for the financial servicing of this debt."

Discussion

Article 415 clearly defines the special improvements tax. Article 416 establishes that the benefit to which Article 415 refers applies not only to properties that are adjacent to a public project but also to properties within a declared area of benefit or influence. Article 420 specifies the public works for which the special improvements taxes are authorized and stipulates sewerage projects among these in paragraph (d). However, paragraph (i) leaves open the possibility of including other projects that the municipalities may designate by means of ordinance, among which may be drinking water projects. Notwithstanding this, it would be preferable if a paragraph were added to Article 420 clearly specifying that special improvements taxes were permissible for the construction and expansion of infrastructure projects and drinking water systems.

Article 421 states that the basis of the tax is the cost of the project prorated among the beneficiary properties but in the form determined by the law. Article 427 provides this form, but only for sewerage projects. This article should be amended to include drinking water projects as well. If the paragraph suggested above is not added to Article 420, the special tax for drinking water projects would be included in paragraph (i) of the same article. Article 430 establishes that their total cost will be prorated by means of an ordinance.

Article 439 provides for a fund to be established with the proceeds of the special taxes to be devoted exclusively to the construction of new reimbursable projects. This fund is of the utmost importance for the continuation of public works programs. Article 440 authorizes municipalities to issue bonds or contract debt for the formation of the fund.

3.1.4 Title IX: Non-Tax Revenues

Chapter II. Non-Tax Revenues from Capital. The following sections and articles are relevant:

Section 1a. Public Loans

Article 455. "Municipalities have the authority to obligate themselves and to contract loans"

Article 457. The following limits are also established for the public municipal debt:

- a) The loans for installation of public reimbursable services will be limited by the amount that can be recovered in prices or rates towards the amortization of the contracted debt within the loan period or the duration of the service
- b) The loans for the construction of public reimbursable projects with special improvements taxes will be limited by the financial possibility of retiring these loans within the contracted period with the proceeds of these taxes..."

Discussion

Article 455 authorizes municipalities to borrow money for the construction of public works when their own resources are not sufficient. The limits of public municipal debt are established in Article 457, which specifies that an amortization fee should be included in the prices or rates for installation of services, and that the loans for the construction of public reimbursable projects with the special taxes will be limited by the financial possibility of amortizing the entire loan during the loan period with the revenues from the taxes. This provision thus guarantees the total recovery of the investment.

3.2 Analysis of Accounting Methods and Procedures

The analysis of municipal budget accounting, cost accounting, and general accounting procedures that follows was performed to recommend modifications that would benefit the companies, and to help them establish the most appropriate systems and mechanisms for the recovery of their investment and operating costs.

The accounting and budgeting offices report to the Finance Administration, which controls activities covered by the Comprehensive Financial Administration and Control Act (Ley Organica de Administracion Financiera y Control). There is no manual covering internal functions, procedures, and methods that govern or regulate these activities.

Accounting is the area most in need of strengthening. For example, because its functions are not coordinated with the needs of the Finance Administration, it does not produce

complete and timely data. There are no procedural manuals for accounting and budgeting, nor clear directives governing the flow of data and data reporting intervals.

3.2.1 Budget Accounting

An accountant is responsible for budget accounting. The method for recording accounts complies with the requirements of the Budget Act (Ley de Presupuesto) and uses the public sector expense classification codes. Revenue projections are based on collections for prior years from sources that may include the business activity itself, transfers (subsidies) from other entities, tax revenues, property income, and internal or foreign credits.

Expenses are budgeted according to the program activities of each company. The principal expense areas are:

- General Administration
- Administrative Management
- Financial Administration
- Technical Administration
- Public Debt

Budgetary records are maintained according to the traditional system, and the budget is presented every quarter. Greater prior control over expenses and budgetary review would ensure the appropriateness and accuracy of authorized payments.

3.2.2 Cost Accounting

The theory of costs is central to quantifying the cost of producing goods and/or services. Although the nature of municipal service companies requires them to operate as nonprofit companies, their investment and operating costs are meant to be self-financed through revenues.

No cost accounting records have been maintained in the three municipal companies analyzed, but there are proposals to have a system up and running at the end of this year.³

The municipal companies have isolated documentation in each of the departments and in the budgeting and accounting areas. The various forms used for reporting to accounting, if properly used and completed, could be entered into computer systems and processed. The data would then serve as a base for the cost accounting program.

³ Such cost accounting systems were implemented in EMAP-Q and ETAPA during 1990.

No data are available that reflect costs by service provision and could serve in the preparation of studies and for decision-making. Costs are not assigned to cost centers but rather are summarized as total costs or are assigned by program, so that the accounting function is not a useful tool for planning and decision-making.

The cost accounting system should include investment costs, which make up the total effort and resources applied to the production of the service. Services provided by the municipal companies require a series of investments in which fixed and fluctuating prices are governed by the market. For example, the construction of a drinking water system would incur the costs of its collection system, transportation system, storage and treatment facilities, and distribution system. When the finished product, water, is produced, it is necessary to determine the costs of this production, including operating, maintaining, and administering the system.

The assignment of costs against revenues collected during the same accounting period is a complex problem. It requires an accounting technique that will provide for collecting, classifying, and prorating the components of costs according to the activities to which they relate. Costs are assigned to revenues collected during the same period and are part of the profit and loss statement for that period. The cost of investing in fixed assets will appear in the general balance sheet and will continually change as depreciation causes a revaluation of assets.

3.2.3 General Accounting

The accounting system, as of the time of this study, is a cash system that experiences considerable delays and records transactions in the conventional governmental accounting manner. The financial statements are inadequate and of little value in evaluating the administration of finances and planning and establishing policies.

The statements do not contain ready data on expenses by line item or on the cost of collecting, transporting, treating, and distributing drinking water, and removing wastewater. This information can be obtained only by extensive arithmetic calculations and reference to numerous lists attached to the balance sheets and other documents.

The location and division of the accounts do not allow proper identification of their nature nor of their importance for public, nonprofit, service delivery companies such as EMAP-Q, ETAPA, and EMA-Q. Asset accounts are grouped according to liquidity. The most important asset accounts, by their nature, representation, and value, are the fixed assets because these are the foundation of the operations of these municipal companies.

3.3 Financial Analysis

3.3.1 Municipal Drinking Water Company of Quito (EMAP-Q)

EMAP-Q was established by municipal ordinance no. 2270 in July 1983, which replaced ordinance no. 1188. The governing body consists of the mayor of Quito, president; two city council members; the director of planning; the minister of finance or a representative; a representative of the national development council; the executive director of the IEOS or a representative; and the director of EMAP-Q (non-voting member).

Among the functions of the company are to develop fee studies, which must be approved by the Municipal Council, and to obtain financing for the projects.

Sources and Composition of Revenues

Fees

The fee structure is based on ranges of consumption from 15 cubic meters to more than 1,000 cubic meters per month, with a minimum of \$0.41 for up to 15 cubic meters, so that the average price rises from \$0.03 to \$0.09 per cubic meter for consumption of 1,000 cubic meters. In this way, the larger consumers subsidize the smaller consumers, who in general are from low-income families.

The following figures for residential service were obtained from billing data and fees in effect in November 1989. Users who consume up to 29 cubic meters monthly represent 24 percent of the users but only 7.4 percent of total consumption and 5 percent of total billing. On the other hand, users who consume more than 100 cubic meters per month represent 8.7 percent of the total users, but 27.7 percent of total consumption and 36.8 percent of total billing, which supports the assumption that the cross-subsidy plan is working, at least theoretically, given that only about 40 percent of residential users have water meters and consumption is estimated for the rest.

Another form of cross subsidy is established by the classification of users by type: residential (94.6 percent), commercial (3.7 percent), industrial (0.5 percent), and governmental and municipal (1.2 percent). Connections as of November 1989 totaled 102,582. The subsidy thus benefits residential users, who pay a lower rate than other users.

Pursuant to ordinance 2285 of December 2, 1983, EMAP-Q is authorized to adjust fees, as approved by the board of directors. This ordinance establishes an equation for calculating the "new cost" per cubic meter produced. It is based on independent variables indexed to the current cost and the cost in effect for the latest calculation performed, and for all the expenses incurred in the production of water.

The equation is:

$$Pr - Po (P1 \frac{B1}{Bo} + P2 \frac{C1}{Co} + P3 \frac{D1}{Do} + P4 \frac{E1}{Eo} + P5 \frac{F1}{Fo} + Px \frac{X1}{Xo})$$

where Pr and Po are the average cost per cubic meter to be calculated and the cost in effect for the past calculation respectively, and P1 to P5 are the coefficients of costs weighted in relation to their contribution to the total cost of production. These costs are payroll, electricity, fuel, chemical products, depreciation, and repairs. B1/Bo is the ratio between the present minimum wage and the minimum wage at the time of the previous calculation; C1/Co, D1/Do, and E1/Eo are the ratios between the current and prior prices of electricity, fuel, and chemical products respectively; F1/Fo is the ratio between the current value of the company's fixed assets and the value as of the last revaluation; and X1/Xo is the ratio between the current and prior consumer price indexes.

When the equation was applied, EMAP-Q determined that the average cost per cubic meter was \$0.28 for the lowest rate of consumption. This figure was used to calculate the fee distribution based on consumption, a figure that does not reflect the impact of the real cost increments during the life of the fee. The reasons for this is are that the fee update considers the variations in costs from the year immediately before the revision, and that the depreciation of fixed assets is based on their historical not their current value, so that neither the operating nor the investment costs are recovered satisfactorily. This hinders the financial soundness of the company.

For example, during 1989, according to the financial reports, the costs of operation and maintenance, including depreciation at cost, totaled \$6.17 million. For a total billing of 83.1 million cubic meters, the cost works out to \$0.07 per cubic meter. This is 22.9 percent greater than the average price of \$0.06 that results from dividing the total amount billed according to the then-current rates by the same number of cubic meters.

EMAP-Q has high subsidies in its fee structure that continue to rise because of delays in updating the levels that operate in the adjustment equation. In

addition, there is an important discrepancy from water that is not accounted for and from deficient collections. The fee adjustment study should have been implemented from February 1990 to eliminate the high subsidies at least in part. The study using the equation determined that, based on the residential fees in effect, the rate for consumption of 15 cubic meters per month would rise from \$0.03 to \$0.06 per cubic meter, and for 1,000 cubic meters per month, from \$0.09 to \$0.19 per cubic meter. Based on the above, the average fee per cubic meter billed would rise from the current \$0.06 to \$0.13. This represents an average adjustment of 110 percent, so that EMAP-Q's monthly billing of \$418,667 would rise to \$880,000.

Billing for service is done in two ways. Those who have a working water meter are billed for actual consumption; those who do not have a water meter are assigned a monthly consumption and billed in accordance with the fee table. The monthly bills are not sent to users, but rather users must go to the EMAP-Q offices to pay them. A few pay through their banks, using their checking accounts. The penalties for late payment are an interest charge and a cutoff of service after three months. There is no detailed list of users showing months owed and total amounts; only the total amount of accounts receivable is computed.

In spite of this inefficient billing and collection system, total collections are about 70 percent of billings. This is not an acceptable percentage but is an improvement on the previous administration, which collected only 52 percent of receivables.

Taxes

The largest contribution from taxes comes from the 10 percent surcharge on accounts with the telecommunications company. Other sources are the 1 percent add-on to the sales tax and \$0.01 per thousand to the appraised value of vehicles.

Transfers and Capital

Transfers come from the central government and/or the municipal government and are intended generally for the construction of specific projects in barrios or the payment of service on the company's debt. Capital contributions are distinguished from transfers in that they do not have a specified purpose except to capitalize the company.

Other Non-Tax Revenues

These revenues come from improvements taxes charged primarily to new users.

3.3.2 Public Municipal Telephone, Drinking Water and Sewer Company of Cuenca (ETAPA)

ETAPA was established by municipal council ordinance on March 29, 1984, and modified the ordinance of October 13, 1988, which replaced the ordinance of January 2, 1968.

The board of directors is made up of the mayor of Cuenca, president; three members designated by the municipal council; one citizen appointed by the council; one representative each from the Chambers of Industry, Commerce, Agriculture, and Small Industry, and from the Azuay Federation of Workers; one representative from the Azuay College of Civil Engineers; one municipal official appointed in accordance with article 198 of the Municipal Regulations Law; and the Director of ETAPA (non-voting member).

Proposals affecting both revenues and expenditures are made by the company but the final decision is the responsibility of the municipality.

ETAPA's functions and responsibilities include the proposal and implementation of new projects and the operation and maintenance of current services. New projects are financed by capital transfers and domestic and foreign loans.

Source and Composition of Revenues

Fees

The fee structure for residential users is based on consumption ranges from under 20 to 200 or more cubic meters per month, and for commercial and industrial users from under 50 to 1,000 or more cubic meters per month.

A study of fees in March 1990 yielded an estimate of the cost of service, including asset depreciation and indirect costs, that led to an increase in April. This represents an increase of 56.9 percent through December 1990, for which a gradual monthly increase of 3.78 percent is being implemented.

According to data for the month of January based on the new fees, 24.7 percent of residential users consume between 1 and 20 cubic meters per month but represent only 7 percent of the total consumed and contribute only 3.7 percent of total revenues. On the other hand, 8.5 percent of residential users consume more than 100 cubic meters per month and represent 28.9 percent of the total consumed and

57.1 percent of total revenues. This confirms that there is a functioning cross subsidy from high consumption to low consumption users. Eighty-five percent of users have water meters.

Another cross subsidy is based on the classification of users as can be seen in the following summary extracted from the fee study.

User Class	Total No. of Users	% of Total Users	Average Fee (US\$ per M ³)	Estimated Billing/Month (in US\$)
Residential	27,049	95.3	0.04	41,237
Commercial and Industrial	1,268	4.5	0.14	35,093
Special	73	0.2	0.05	1,077
Total	28,390	100.0	0.06	77,408

The average fee for commercial and industrial users is 3.6 times higher than that for residential users.

One point that should be emphasized is that, beginning in May 1988, a charge for sewerage equivalent to 50 percent of the amount billed for drinking water was imposed on users who have sewerage service.

The resources from drinking water fees will be necessary to cover the costs of administration, operations, maintenance, depreciation of assets at historical cost, and expansion and improvements of facilities. The total resources needed vary and should allow self-financing of costs within a reasonable period that will depend on the size of the variation in cost components. The resources needed should be determined by the same equation applied by EMAP-Q as stated in Article 32 of the fee ordinance currently in force. A determination must be made of: the average cost per cubic meter of water billed at current fees; the percentage coefficients of the components included in the costs of production; and the relationship between wages and prices for these components on the date on which the new fee adjustment is made and on the date of the last fee adjustment. The new average cost per cubic meter of drinking water can be obtained by applying these factors to the equation, and can be considered valid as of the date on which the costs were updated.

In contrast with the system used by EMAP-Q, ETAPA considers projected costs for the period that the new fee structure will be in effect. As a result, ETAPA obtains much better financial results.

Bills for the 85 percent of users who have water meters are based on consumption. When a reading cannot be taken, an average is calculated. The 15 percent who do not have water meters are assigned a consumption volume and charged the corresponding fee. Their share remains the same as long as there is no adjustment in fees.

Monthly bills are not sent to users, but rather users must pay at the company's office. There is no schedule of due dates and no detailed list of accounts receivable by dates and amount, only a grand total.

In spite of this inefficient system, the collection rate went from 80 percent in 1987 to 85 percent in 1988, where it has remained.

Taxes

Revenues from taxes are established by law, which sets a rate of 10 percent on the value of the accounts of the telecommunications company.

Transfers and Capital

Transfers come from the central or municipal government for the construction of specific projects, primarily in the barrios.

Fees

These originate in telephone subscription charges.

Other Non-Tax Revenues

These revenues are derived principally from improvements taxes. A study submitted in January 1989 proposed an increase in these taxes from the current rate of \$0.03 per square meter, which has been in effect since 1977, to between \$0.12 and \$0.20 per square meter, depending on the sector of the city. This proposal had not been approved as of this writing.

3.3.3 Municipal Sewer Company of Quito (EMA-Q)

EMA-Q was created by the municipal council of Quito by means of ordinance no. 979 of May 17, 1966.

The board of directors consists of the mayor of Quito, president; two council members; one citizen representative appointed by the council; one representative from the College of Engineers; and one representative from the business committee of the workers.

Although the ordinance did not explicitly authorize the company to contract debt, paragraph (m) on the objectives of the company confers this power implicitly when it states that the company must make payment on the debts it contracts.

The company is authorized to charge fees, which the municipal council must approve, for the services it provides and may share in municipal taxes, special taxes, and assessments.

Source and Composition of Revenues

The revenues of the company are derived from three main sources:

- The five per thousand surcharge on the property taxes collected by the municipality
- The taxes for sewers calculated on the basis of eight per thousand of 1, 2, and 3 minimum wages, depending on the sector of the city
- Central and municipal government transfers allocated for specific purposes, such as the construction of projects in designated areas or to pay obligations on foreign debt

In 1989 these sources yielded 32 percent, 8 percent, and 38 percent of total revenues, respectively.

The fee is represented in the surcharge on property taxes. The taxes for sewers are used for the recovery of investment costs. An increase on the order of 100 percent in the five per thousand surcharge will be requested for 1991, raising collections from \$1 million to \$2 million, since instead of the five per thousand surcharge, there would be a one percent surcharge on the property tax. This charge is considered unjust by taxpayers who own their homes and do not benefit from the service but who still have to pay the five per thousand surcharge.

Revenues from the five per thousand surcharge are collected by the municipal treasury of Quito and transferred to EMA-Q. The other revenues are collected directly by the company.

3.4 Evaluation of the Current Situation with Respect to Financial Implications and Proposal for the Recovery of Investment and Operating Costs

3.4.1 The Current Situation

In general, the funds for investment come from donations and transfers from the government or from domestic and foreign credit. Operating under the erroneous conception that donations and transfers are really costless, the companies tend to invest these resources less efficiently than those from credit.

The Municipal Regulations Law does not clearly stipulate the establishment of fee levels to recover investment costs by including a factor for the depreciation of revalued assets and/or debt service. However, the law establishes that revenues from fees cannot exceed the cost of providing and maintaining drinking water and sewerage services. This has been interpreted to exclude the recovery of investment costs.

Water is regarded as a social good that should be subsidized by the national government because it is believed the beneficiaries cannot pay for adequate services. However, the results of the study carried out under task 1 show that the people of the ten barrios surveyed have both the ability and the willingness to pay. The following table provides figures (in US\$):

	Monthly Family Income	Present Monthly Payment for Water	Willingness to Pay per M ³ of Water
San Jose de Monj.	101.43	5.02	0.25
Argella	93.62	0.38	0.36
Obrero Indep.	137.00	7.87	0.36
Nueva Aurora	93.73	0.93	0.32
S. Anita Norte	92.80	0.40	0.11
Ecuatoriana	99.48	0.51	0.47
Lucha Pobres	78.26	2.25	0.50
Coop. Carcelen	98.34	6.06	0.58
Coop. S.Francisco	99.63	0.83	0.34
S. Enrique de V.	94.49	4.41	0.62
Average	98.88	2.87	0.39

Sixty percent of the people surveyed buy 4 cubic meters of water a month from tankers for \$4.31, or \$1.08 per cubic meter. At the rate proposed by EMAP-Q, \$4.31 would buy them

50 cubic meters per month. Assuming that people connected to the system consumed 20 cubic meters per month, they would pay \$1.20, leaving \$3.11 for the cost of the system.

It is clear that users are willing and able to pay for satisfactory drinking water and sewerage services that do not have to be provided below cost. Experience in other cities of Latin America shows that municipal companies can cover the costs of operation, maintenance, administration, and debt service and meet a substantial part of their investment requirements with their own revenues and without subsidies or donations from the government.

Where consumption can be measured, it is generally true that approximately 20 percent of the users (high-income households, business, and industry) consume 60 percent of the water and can contribute up to 80 percent of the revenues. In the case of EMAP-Q, 27 percent of the users consume 54 percent of the water and contribute 64 percent of the revenues; in the case of ETAPA, 16 percent of the users consume 52 percent of the water and contribute 60 percent of the revenues.

The cross subsidy is made possible by the fact that high-income users consume more water than low-income users. If the marginal cost of projects, which is always above the historical accounting costs, is charged to the high-income consumers, the excess resources generated can be used to subsidize service to low-income households.

The current fees for drinking water are extremely low. In Quito, they range from \$0.06 to \$0.22 per cubic meter for residential users and from \$0.11 to \$0.37 per cubic meter for industrial users. In Cuenca, they range from \$0.02 to \$0.14 per cubic meter for residential users and from \$0.09 to \$0.20 for industrial users. The companies have been forced to meet their costs by obtaining subsidies and revenues not derived from service. For example, they receive 10 percent of the telecommunications accounts, making them dependent on another entity and limiting their financial autonomy. The fee policy established in the Municipal Regulations Law is financially inefficient because it does not permit recovery of the cost of service, including the depreciation of assets at historical cost.

3.4.2 Proposal for Establishing a Financial Plan for Cost Recovery

The companies and their customers are governed by policies of a general nature established by the Municipal Regulations Law, as well as by policies of local application established by municipal ordinances. (For a description of the current municipal reforms for EMA-Q, EMAP-Q, and ETAPA see Volume II, Appendix I.) The objective of financial self-sufficiency that the companies seek could be achieved by meeting the expenses of administration, operation, maintenance, expansions, and improvements from fees and other operating revenues, and by building depreciation reserves from the special improvements tax, the tax levied on telephone calls (while in effect), and fees. The surplus after deducting the costs of

operation, administration, maintenance, and debt service, and the money from loans and the transfers from the government would be applied to construction programs.

A self-financing operation must have reliable statistical, financial, and planning data from records providing macro- and micro-measurements at strategic installations of the drinking water system. The data from the macro meters would be analyzed in the operations office, which would send a summary of the results to the planning office. The data from the micro meters would be used for billing, after analysis by the marketing office. Copies of billing summaries and historical consumption graphs would be sent to the planning office.

An equitable fee policy must first distribute the charges necessary to recover the cost of providing drinking water and sewerage services among those who have direct connections. But it must also tax those whose properties benefit from the existence of the systems. The fees for the use of the services constitute one part of the revenues. The other part will come from the rates charged to beneficiary properties, including those in any future urban development, the cost recovery of project construction provided by law.

The expenses to be covered for self-financing to be achieved are operating expenses, maintenance expenses, administrative expenses, and expansion and improvement expenses. Operating expenses include the depreciated value of fixed assets which in turn will be used to cover the expenses related to expansions or improvements. If there are none, these revenues may be used to increase the funds set aside for investment in new projects or for debt service. Capital investments will be covered in budgets for construction, which will be undertaken in stages. The investments at each stage will be the sum of the budgetary values for each project, in successive years. Investment costs will be met in part from the company's own funds and in part from loans from domestic and international banking institutions.

The annual resources needed must cover planned construction expenses plus payments on any loans. This revenue will come from positive operating balances, depreciation reserves, special improvements taxes, minimum indispensable transfers, and credit extended by domestic and international banking institutions. The step-by-step methodology for calculating the resources that must be generated by fees and the total resources necessary for investment and debt service is explained in Volume II, Appendix J.

Fees should be based on the resources needed to provide the service and on the volume of water actually consumed by users of the system. These two factors must reflect actual costs as well as actual recorded consumption.

Fees will be of a differential nature, as stated in the various ordinances, with values of at least 50 percent of the average cost assigned to lower-volume residential consumption and not greater than 300 percent of the average cost to higher-volume consumption. In addition,

fees will consist of a basic charge assigned to a basic volume of consumption, and a surcharge assigned to consumption above that.

Drinking water service will be classified according to the purposes for which it is used, following the categories defined in the ordinances. One category, mentioned in the Municipal Regulations Law, should be added for social service and public educational institutions, for which a payment of 50 percent of the standard fee is established.

The fees for sewerage service, pursuant to the provisions of Article 411, will be based on water consumption and, as with water, should cover all costs. The required resources both for providing service and for investment in new projects will be determined separately from the resources required for the water system. When consumption of drinking water is metered, the simplest way to establish a just and equitable fee for sewerage service is to relate it to this consumption.

Special improvements taxes are levied on properties within the area of a public project that benefit from it. The total cost of drinking water and sewerage systems can be recovered from these taxes, according to provisions in the Municipal Regulations Law. However, an ordinance by the municipal council concerned must state the project costs to be met by these taxes, as well as the rate and the manner of applying them. The revenues generated must be used exclusively for financing capital investments.

The current rates for large and small sewer collectors and for principal and secondary drinking water systems will continue to be applied but should be updated periodically as part of the process of revaluing assets. Neighborhood developments, apart from meeting the total cost of their own public works and connections to city systems, will pay a prorated charge for new projects or for reconstructing existing systems according to the volume of use.

Mechanisms for adjusting the fees and special improvements tax rates in response to inflation are necessary in order to recover investment and operating costs in actual values,

- Adjusting Fees

Fees will be adjusted by the timely application of the formula stated in the ordinances. The data for calculation will be provided by the accounting department from statements developed by the cost centers. The timing will be determined by each company's planning office based on the deviation of the average cost calculated according to the formula from the average cost calculated according to the sum total invoiced. To this end, these costs will be monitored monthly for indications of their trends. When the deviation of the real cost is 10 percent above the fee, it will be time to update the

fee structure. The new average cost will be used to determine the new total resources required.

- Adjusting Rates

The mechanism for adjusting the special improvements tax rate has two components: the total cost of the projects and the total area of the property benefitted. The mechanism will operate as part of the corresponding increase in the fixed assets resulting from changes, expansions, or reconstruction of the systems, and depreciation, inflation, and devaluation. The same will apply to modification of the areas of benefit.

The registration of users, the reading of meters, and billing and collection, which are critical to self-financing, must be managed efficiently. The customer listing should have accurate details of each connection for drinking water and sewerage. Within 30 days, water meter readings must be taken and verified and invoices must be prepared and delivered to the collection windows. This period corresponds to the billing cycle, although in reality there are only 20 working days in the cycle.

As the systems are extended and their capacities are increased, attempts will be made to incorporate all the people residing within the city limits as users and to make payments for installing connections easier. In addition, the benefits of the special improvements taxes will be distributed to potential users previously unable to make these payments, thereby discouraging surreptitious use of the systems.

3.4.3 Proposal and Operational Plan for Recovering the Costs of Investing in Drinking Water and/or Sewerage Systems in Barrios without a General Developer (Spontaneous Settlements)

So far the discussion of mechanisms for recovering investment and operating costs and procedures for maintaining up-to-date fees and tax rates has concerned areas in which general developers have constructed or paid the entire cost of projects including the special improvements taxes, as required by law. However, a special plan must be designed to recover investments in barrios that do not have general developers and are described as spontaneous settlements or marginal barrios. The barrios financed under the USAID supplemental program, above all others, should be included in this plan, a recommended outline of which follows.

A revolving fund for the construction of drinking water and/or sewerage systems in barrios lacking a general developer should be established in those municipalities or municipal

companies that undertake projects under the supplemental program. This fund has its foundation in the provisions of Article 439 of the law (see Section 3.1.3) and would be managed by an administrative unit within each municipality or municipal company.

The administrative unit would control investments in public works and conduct socioeconomic surveys to determine the capacity and willingness of potential users in each of the barrios to pay for services. It would amortize the loans obtained and calculate the minimum subsidies required to maintain the true value of the fund so that the continuity of the plan is guaranteed.

The unit would report directly to the general manager in the municipal companies and to the mayor in the municipalities. It would have the following functions:

1. Design procedures to administer and control the fund in coordination with the electronic data processing, marketing, technical management, and accounting units.
2. Design the annual project construction programs and present them for the approval of management in coordination with the technical management unit.
3. Design the forms and paper flow procedures for the proper operation of the fund.
4. Implement socioeconomic field surveys to identify the ability and willingness to pay within the barrio communities.
5. Promote the drinking water and sewerage system services in those communities or barrios that do not have them.
6. Design the programs and reports necessary for the proper management and control of the fund in coordination with the data processing, marketing, and accounting units.
7. Prepare the documents, studies, and analyses necessary to obtain the approval of management for the construction of new projects, and undertake prior verification of the legal ownership of the land with the appropriate authorities.
8. Monitor the value of each project by detailing the number of properties benefiting from it and the fees to be recovered from each one.

9. Analyze the listings for recovering the investments in each project, report on inconsistencies, and collaborate in clarifying or correcting them.
10. Maintain a system to identify the balance due from each user and for each project, and ensure that collections are made and late payments avoided.
11. Make adjustments in the costs of investment to include charges for properties or lots that were unoccupied when the projects were being constructed or that for some reason had not been connected to the system.
12. Design and keep current the cash flow projected for the revolving fund.
13. Calculate the annual capital requirements to maintain normal project construction programs, based on the project construction programs for each year and the investments that have been recovered.
14. On the basis of annual cash flow, determine the credit resources that may be necessary to implement projects and the debt service on loans in the process of amortization.
15. Prepare a financial investment plan for each project that states the subsidies that may be required and their origin.
16. Obtain the appropriate official indices of variations in expenses incurred for construction to serve as a basis for updating costs for those who have not been connected to the service.
17. Generate reports on the status of the fund and other reports that may be required by management.
18. Prepare the documentation required to seek loans that may be needed to finance projects of the fund and to implement the discounts for the respective institutions.
19. Carry out all the functions that are required for the proper administration and operation of the revolving fund.

The capital for the fund will come from the following sources:

- The company itself will set aside resources in its own budget in accordance with the public works programs that may be undertaken and the availability of funds.
- Contributions from the community will come from advances paid by users, determined on the basis of socioeconomic survey results, and from monthly fees.
- Credit resources from domestic and foreign institutions once the administrative unit has determined the amounts and dates when they are required.
- Resources derived from transfers and/or donations from the government in the form of transparent subsidies when they are justified.
- Other resources may be needed when surveys determine that the users' ability to pay is not sufficient to meet project costs. The total amount of transparent subsidies will be estimated for each year in such a way that it is obtained through fees and included in the monetary fund through an adjustment over and above normal adjustments for prices per cubic meter based on a consumption of 40 cubic meters per month. Other revenues to capitalize the fund may be derived from the sale of assets, the profits from investing excess cash, and the profits and economies of operation.

The cost of each project is based on the budget developed by technical management and should be updated when a long time has passed between the date of the budget and the date of implementation. This adjustment should be included in the final liquidation of the project.

To determine the period required to recover the cost of investment, the population density and development of the barrio or project target area as well as the term of the investment should be considered. However, to avoid a lack of liquidity in the fund as a consequence of unoccupied or undeveloped lots or properties, charges should be structured on the basis of the property tax and be made part of the fund. Another method would be to charge from the time service is requested. But, the updated cost must be used to recover the true value. The administrative unit must determine the adjustment factor for charging users who later request the service.

This unit, together with the electronic data processing, marketing, and accounting offices, will design the reporting procedures and formats to maintain control over investments. The reports on each investment should be prepared monthly and must contain the following data: identification of the project; identification of each property; total current cost of the project; total recovered value; and number of accounts to be billed and the current balance.

The accounting office will maintain detailed records, in a special account called the "system revolving fund," of project costs, expenditures, and revenues from installment payments, fees, loans, or other sources. A monthly reconciliation should be made of the capital of the fund, the investments, the amount recovered, the balances to be collected, and the payments on debt service.

3.4.4 Alternative Mechanism for Recovering and Calculating the Costs of Investment at Real Rates of Return⁴

The traditional mechanism for recovering costs is to establish a rate of interest, currently 36 percent, set a period of time, perhaps 60 months, and calculate the fixed monthly fees to be paid.

The disadvantages of this mechanism are:

- It does not recover costs at real rates of return because the interest rate is less than the rate of inflation.
- The nominal monthly fee as a percentage of the minimum wage is in general very high at the beginning (see Volume II, Appendix K, Scenarios 1,2,3, and 4). These examples have assumed an average project cost of \$333.33 per property, resulting in payment-to-income ratios of 29.85 percent for 5 years, and 24.57 percent for 10 years.
- If the rate of inflation declines, the ratio of the fee to the minimum wage will remain high, but if not it will be low.
- If the interest rate is adjusted annually according to the rate of inflation, the ratio of the minimum wage to the monthly fee would vary.

⁴Editor's note: Those readers interested in a more developed treatment of this cost recovery mechanism are directed to a RHUDO/SA document entitled *Creating a Viable Market-Based Housing Finance System in an Inflationary Economy* (July, 1990).

An analysis of the relationship between the annual increase in the minimum wage and the annual rate of inflation for the period 1975 to 1989 for various Latin American countries has found that this ratio varied between 75 percent and 95 percent. For Ecuador, it was 85.9 percent (see Volume II, Appendix L). The years without increases in the minimum wage were compensated for in subsequent years with increases greater than the rate of inflation.

In line with this finding, the fee structure should establish a charge equivalent to one day of the minimum wage for a residential consumption of 20 cubic meters per month. (Proposed fees would be \$1.20 for Quito and \$0.74 for Cuenca, which is equal to 3.3 percent of the minimum wage for drinking water service each month.)

The alternative mechanism would be related to capacity and willingness to pay as a percentage of the minimum wage, obtained from the surveys. In the examples (see Volume II, Appendix K, Scenarios 5 and 6), a 14 percent payment-to-income ratio was used (\$5.97 monthly during the first year). This payment is later raised to a yearly fee and adjusted to the current net value by the estimated annual inflation rate. A term of 10 years is estimated for the repayment of the project cost by each property. It was anticipated that the ratio between the increase in the minimum wage and the annual inflation rate, conservatively speaking, would be only 75 percent for the scenarios studied, and it is recommended that this percentage be adopted.

The advantages of this method in comparison with the traditional method are:

- The real costs of investment are recovered, and the user who does not have the capacity to pay is provided a transparent subsidy, via fees, and the percentage with respect to the minimum wage is less (see Volume II, Appendix K, scenario 7).
- The interest rate is not defined in advance. Instead, the inflation rate is used to obtain the current net value of the fees.
- Users are guaranteed that monthly payments during the amortization period will always be the same percentage of the minimum wage.
- If the percentage increase in the minimum wage is greater than estimated (75 percent of the inflation rate), the user will have a net gain to compensate for the net loss when the increase of the minimum wage is less than estimated. This is unlikely during the period, so the tendency will be to pay in a shorter time (see Volume II, Appendix K, scenario 8).

- Where users pay in advance, they can reduce the percentage of the payment in relation to the minimum wage (see Volume II, Appendix K, scenario 7) or, if it is not reduced, can pay in less time.
- If the percentage increases in the wages are greater, yielding net gains in the payment of real fees, the real cost of the projects will be covered for the property of a given user, before the term of the obligation is canceled.

Table 3 provides a summary of the proposed cost recovery plan.

Table 3

Summary of Proposed Financial Plan for the Recovery of Investment and Operating Costs for the Provision of Drinking Water and Sewer Services

TYPES OF COSTS OR EXPENSES	SOURCE OF RESOURCES FOR PAYMENT OR RECOVERY	MECHANISM TO RECOVER COSTS AND EXPENSES	LEGAL BASIS FOR THEIR COLLECTION
I Investments in Drinking Water Infrastructure Projects 1.1 Collection 1.2 Transport 1.3 Treatment II Investments in Drinking Water Distribution Projects 2.1 System matrices, primary 2.2 Storage tanks	<ul style="list-style-type: none"> • Positive operating balances and depreciation reserve when not set aside for payment of debt service • Special Improvements Taxes • Domestic or Foreign credit resources • Minimum required transfers 	<ul style="list-style-type: none"> • Special Improvements taxes • Adjustment of fees of high consumers (more than 40m³/month) to cover required subsidies transparently 	<ul style="list-style-type: none"> • Municipal Regulations Law, Article 420, par. 1, and ordinance of respective council • Ordinance of respective council
2.3 Secondary systems in barrios	<ul style="list-style-type: none"> • Developers pay for or construct them • Special Improvements task when no general developer (revolving fund) • credit resources 	<ul style="list-style-type: none"> • Special Improvements tax 	<ul style="list-style-type: none"> • Municipal Regulations Law, Article 420, par. 1, and ordinance of respective council and Article 439
III Investments in Drinking Water Residential Connections 3.1 Connections 3.2 Water meters	<ul style="list-style-type: none"> • paid directly by the users at real cost 	<ul style="list-style-type: none"> • Fees 	<ul style="list-style-type: none"> • Municipal Regulations Law, Article 409

<p>IV. Investments In Sewer Projects</p> <p>4.1 Large Collectors</p> <p>4.2 Wastewater treatment</p> <p>4.3 Systems in barrios</p>	<ul style="list-style-type: none"> • The same source as for Investments for drinking water for costs I and II, but in this case for sewer systems • Same source as for Investments for drinking water, #2.3 but for sewer system 	<ul style="list-style-type: none"> • Special Improvements tax • Special Improvements tax 	<ul style="list-style-type: none"> • Municipal Regulations Law and Article 420, paragraph d. • Municipal Regulations Law, Article 427
<p>V Investments In Expansions and Improvements</p> <p>5.1 Buildings and land</p> <p>5.2 Vehicles and accessories</p> <p>5.3 Office equipment and furniture</p> <p>5.4 General service equipment</p> <p>5.5 Radiocommunication equipment</p>	<ul style="list-style-type: none"> • Fees for service provision 	<ul style="list-style-type: none"> • Fees for service provision 	<ul style="list-style-type: none"> • Municipal Regulations Law, Articles 197, 210 and 407 and ordinance of respective council, for drinking water, and Articles 197, 210, and 411 and ordinance of the respective council
<p>VI Operating, Maintenance, and Administrative Expenses</p> <p>6.1 Wages, salaries, and social services</p> <p>6.2 Maintenance and repair of buildings, office, fire transport equipment</p> <p>6.3 Tools and materials</p> <p>6.4 Electricity</p> <p>6.5 Chemical products</p> <p>6.6 Fuel and lubricants</p> <p>6.7 Paper and desk articles</p> <p>6.8 General expenses</p> <p>6.9 Other expenses</p>	<ul style="list-style-type: none"> • Fees for service provision • Other operating revenues 	<ul style="list-style-type: none"> • Fees for service provision 	<ul style="list-style-type: none"> • Municipal Regulations Law, Article 407 for drinking water and 411 for sewerage, and the ordinance of the respective council
<p>VII. Service on the Debt</p>	<ul style="list-style-type: none"> • Positive operating balances and depreciation reserve • Special Improvements tax 	<ul style="list-style-type: none"> • Fees for service provision • Special Improvements tax 	<ul style="list-style-type: none"> • Municipal Regulations Law, same articles as for number V, plus article 457 and council ordinance
<p>VIII. Depreciation of Revaluated Fixed Assets</p>	<ul style="list-style-type: none"> • Fees 	<ul style="list-style-type: none"> • Fees 	<ul style="list-style-type: none"> • Municipal Regulations Law, same articles as for number V and council ordinance

3.5 Recommendations

Recommendations based on the analysis performed are presented below.

Short Term

- Because the Municipal Regulations Law lends itself to different interpretations with respect to the inclusion of depreciation on revalued fixed assets in setting prices and rates, the following clarifications or additions are recommended:
 - Regarding the establishment of rates and fees, the words "including the depreciation of all revalued fixed assets" should be added to articles 407 and 411.
 - Article 407 should be expanded to permit municipalities to levy special assessments by ordinance to recover investment and operating costs of specific projects, such as the installation of secondary systems for the distribution of drinking water.
 - Although Article 420, paragraph (i), allows for the possibility of special taxes for other public works projects, a paragraph should be added clearly authorizing the imposition of such taxes for the construction and expansion of infrastructure projects and drinking water systems.
- The municipal companies should immediately introduce financial accounting and cost accounting systems and undertake studies to revalue fixed assets.
- The relevant ordinances should be modified to include the depreciation of fixed assets in the formulas for adjusting fee levels.
- The companies should begin discussions with the competent authorities for the national government to assume the risk of changes in the exchange rate for new loans and to absolve the companies of current foreign currency debts.
- The alternative mechanism for recovering investment costs at real rates should be implemented.
- For the recommended cost recovery plan to succeed, an inter-institutional group representing the following should be formed to develop a course of action: Ecuadorian Development Bank (BEDE); the Comptroller General of the State (Contraloría General del Estado); public municipal companies; the Association of Municipalities of Ecuador; the Ecuadorian Sanitary Works Institute (IEOS); the

Finance Ministry; and FONAPRE. This course of action should set forth specific time frames, propose any necessary changes, suggest the most appropriate policies to achieve the objectives, and provide for follow-up on the issues.

Medium Term

- The proposed general plan for recovering investment and operating costs should be adopted.
- Each company should create an administrative unit to manage the revolving fund.
- The proposed mechanism for updating rates and fees should be introduced.
- The methodology (see Volume II, Appendix J) for the calculation of the resources to be generated through fees and the total resources necessary to cover investments and/or the debt service should be implemented.
- The proposed operational plan should be adopted, with special attention to strict control over the resources of the fund, including recovery, updating, accounting, collection, and allocation, if the fund is not to fail.
- Higher fee levels for recovery of the entire cost of investment and operations must be instituted gradually to replace the transfers and subsidies, as well as the tax on telephone service.
- The quality of water and sewerage services should be steadily improved so that a more favorable image of the municipal companies will make rate adjustments more acceptable.

INCREASING COVERAGE:
THE AFFORDABILITY OF URBAN WATER
AND SEWER SERVICE EXTENSION
IN ECUADOR
VOLUME II

AN AID REPORT PREPARED BY THE WASH PROJECT
Field Report No. 316
February 1991

**WATER AND
SANITATION for
HEALTH
PROJECT**

Sponsored by the U.S. Agency for International Development
Operated by CDM and Associates

WASH Field Report No. 316

VOLUME II

**INCREASING COVERAGE:
THE AFFORDABILITY OF URBAN WATER
AND SEWER SERVICE EXTENSION
IN ECUADOR**

**Task 1. Socioeconomic Survey and
Willingness to Pay Analysis**

by Julián Velasco and CEDATOS

**Task 3. Recovery of the Costs of Investment
in Infrastructure Projects**

by Jorge Alfredo Infante

Prepared for RHUDO/SA, USAID Mission to Ecuador
under WASH Task Nos. 120 and 128

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Task 1

SOCIOECONOMIC SURVEY AND WILLINGNESS TO PAY ANALYSIS

Prepared by Julián Velasco and CEDATOS

B. Dwelling Data

9. Area of the lot (in m²)
10. Constructed area (in m²)
11. Number of rooms in the dwelling
12. Number of bedrooms in the dwelling
13. Number of bathrooms in the dwelling
14. Age of the dwelling (years)
15. Are the floors made of a different material than the ground?
YES 1 NO 0
16. Are the walls made of a durable material?
YES 1 NO 0
17. Is the roof made of a durable material?
YES 1 NO 0
18. The public thoroughfare in front of the house is constructed of:
- Dirt 1
Loose crushed stone 2
Paved stone 3
Asphalt-cement 4
19. Distance to the town center in blocks?
20. Does the dwelling have electricity service?
YES 1 NO 0
21. Does the dwelling have telephone service?
YES 1 NO 0
22. How much do you think a dwelling such as this one is worth?

Sucres
(Thousands)

23. State whether the household is connected to:

- The public drinking water and sewer systems 1
Only to the public drinking water system² 3
Only to the public sewer system 3
None of the public systems 4

24. If the response to 23 is 2, how much do you think this dwelling would be worth if it were connected to the public sewer system?

Sucres
(thousands)

25. If the response to 23 is 3, how much do you think this dwelling would be worth if it were connected to the public drinking water system?

Sucres
(thousands)

26. If the response to 23 is 4, how much do you think this dwelling would be worth if it were connected to both the public drinking water and sewer systems?

Sucres
(thousands)

27. How many sucres per square meter is land in this area worth?

Sucres

28. Ownership of the dwelling

- Property with title 1
Property without title 2
Renter 3
Lease (anticresis) 4
Other (state) 5

29. How many years has the head of household lived here?

30. If you pay rent, how much do you pay per month in sucres for this dwelling?

Sucres

31. If the dwelling was constructed with a loan, how many sucres per month do you pay on the loan?

Sucres

C. Data on Water Origin and Consumption

32. What is the principal source of water supply that this dwelling uses?

- Public System Connection 1
- Private System Connection 2
- Tanker 3
- Water Carrier 4
- Neighbor 5
- Well 6
- Public Tap 7
- Rainwater 8
- Spring 9

33. How much water per month do you consume from this source?

34. What unit of volume do you use?

35. Equivalent in liters of the unit used (interviewer)*

36. Do you pay anything for the water from this source?

Suces

- Yes, I pay per unit at the time of purchase 1
- Yes, I pay per unit monthly 2
- Yes, I pay a fixed fee monthly 3
- No, I do not pay anything for water 4

37. If the response to question 36 is 1 or 2, how much do you pay per unit?

Suces

38. If the response to question 36 is 3, how much do you pay monthly?

Suces

39. If this source is from outside the home, how many trips per week must you make?

40. What quantity do you carry on each trip, in the unit stated above?

41. How far is this source from your home? (in blocks)

42. How do you carry the water from this source?

- On foot 1
- On the back of an animal 2
- Bicycle or human power 3
- Automotive vehicle 4
- Other 5

43. How much time do you spend on each round trip? (in minutes)

44. Does the person who makes the trip work? Yes 1 No 0

45. The quality of the water from this source is:

- Very good (can be drunk) 1
- Good (cooking and washing dishes) 2
- Average 3
- Poor 4

46. What is the second most important source of water supply used in this dwelling?

- Public system connection 1
- Private system connection 2
- Tanker 3
- Water Carrier 4
- Neighbor 5
- Well 6
- Public Tap 7
- Rainwater 8
- Spring 9
- None 0

47. How much water per month do you consume from this source?

48. What unit of volume do you use?

49. Equivalent in liters of the unit used (interviewer)*

50. Do you pay anything for the water from this source?

- Yes, I Pay Per unit at the time of purchase 1
- Yes, I pay per unit monthly 2
- Yes, I pay a fixed fee monthly 3
- No, I do not pay anything for water 4

51. If the response to question 50 is 1 or 2, how much do you pay per unit?

Suces

52. If the response to question 50 is 3, how much do you pay monthly?

Suces

53. If this source is from outside the home, how many trips per week must you make?
54. What quantity do you carry on each trip, in the unit stated above?
55. How far is this source from your home? (in blocks)
56. How do you carry the water from this source?
- On foot 1
 On the back of an animal 2
 Bicycle or human power 3
 Automotive vehicle 4
 Other 5
57. How much time do you spend on each round trip? (in minutes)
58. Does the person who makes the trip work? YES 1 NO 0
59. The quality of the water from this source is:
- Very good (can be drunk) 1
 Average 3
 Good (cooking and washing dishes) ... 2
 Poor 4

USE THE APPROPRIATE CODE TO INDICATE THE WATER SOURCE YOU USE FOR EACH OF THE FOLLOWING:

60. Drinking
 61. Cooking
 62. Bathing
 63. Washing clothes
 64. Washing dishes
 65. Washing animals

CODING OF SOURCES

- Connection 1
 Bottled water 2
 Tanker 3
 Water carrier 4
 Neighbor 5
 Well 6
 Tap 7
 Rainwater 8
 Spring 9

66. Is the quantity of water you currently consume sufficient? YES 1 NO 0

IF CONNECTED TO THE PUBLIC DRINKING WATER SYSTEM:

67. Does the dwelling have a functioning water meter? YES 1 NO 0
68. How many hours per day do you receive water on the average?
69. How many water faucets do you have?
70. How many toilets do you have?
71. How many showers do you have?

(*) EQUIVALENCIES AND CODES FOR EACH UNIT

- | | | | |
|---|---|---|-----------------------|
| 1 | 1 cubic meter = 4.8 55-gallon tanks | 5 | 1 gallon = 3.8 liters |
| | 1 cubic meter = 1000 liters = 264 gallons | 6 | |
| 2 | 1 55-gallon tank = 203 liters | 7 | |
| 3 | 1 10-liter bucket = 10 liters | 8 | |
| 4 | 1 5-gallon can = 19 liters | | |

D. Willingness to Pay for Drinking Water

(Please complete only if there is no residential connection)

The Municipality of Quito is interested in extending the drinking water system to as many families as possible. It is believed that all families would like to have their own residential connection in order to have drinking water at any time. The following questions refer to what your family would be willing to pay for the water it consumes, independent of the cost of connection to the system.

72. Would you be willing to pay 20 sucres for each 55-gallon tank of water? YES 1 NO 0

If the response is "YES," go to the following question.

If the response is "NO," or you are not sure, go to question no. 75.

73. Would you be willing to pay 50 sucres for each 55-gallon tank of water? YES 1 NO 0

If the response is "YES," go to the following question.

If the response is "NO," or you are not sure, go to question no. 76.

74. Would you be willing to pay 100 sucres for each 55-gallon tank of water? YES 1 NO 0

If the response is "YES," go to the following question.

If the response is "NO," or you are not sure, go to question no. 76.

75. Would you be willing to pay 200 sucres for each 55-gallon tank of water? YES 1 NO 0

If the response is "YES," go to the following question.

If the response is "NO," or you are not sure, go to question no. 76.

76. How many sucres is the maximum you would be willing to pay for each 55-gallon tank of water? Sucres

77. How many sucres is the maximum you would be willing to pay for the connection to the drinking water system? Sucres

78. Of the amount stated in the previous question regarding payment for the connection to the drinking water system, how much would you be willing to pay monthly? Sucres

79. For how many months would you pay for the connection to the drinking water system?

80. If your dwelling were connected to the drinking water system, how much water do you think you would consume in comparison to your current consumption?

The same 1
 A little more 2
 More than twice as much 3

E. Data on the Removal of Waste Water and the Willingness to Pay for Sewer Service

81. How do you remove waste water?

- Public sewer system 1
- Private sewer system 2
- Septic well 3
- Latrine 4
- Stream or river 5
- In the open 6

82. If the response to question 81 is 1 or 2, how much does it cost you (or do you have to pay) each month?

 Sucres

83. If the response to question 81 is 3, 4 or 5, how much was the expense you incurred last year for repairs, cleaning, replacement parts, etc., in order to be able to use the well, latrine or stream?

 Sucres

The Municipality (or the Sanitation Company) is interested in connecting all dwellings to the sewer system. As you may understand, this would require ongoing maintenance entailing a cost, which would have to be paid through monthly charges to those who would have the privilege of using the sewer system. (Proceed with this section only where there is no connection to the public sewer system.)

84. Would you be interested in being connected to the public sewer system?
 YES 1 NO 0

If the response is "yes," proceed to question 86; if the response is "no," proceed to the following question.

85. Why are you not interested in being connected to the sewer system?

- Financial reasons 1
- Distrust the company or the municipality 2
- Going to change residence 3
- Not interested and prefer to continue as is 4
- Other (please state) 5

86. Would you be willing to pay 200 sucres monthly for public sewer system service?
 YES 1 NO 0

If the response to the question is "YES," proceed to the following question. If the response to the question is "NO," or you are not sure, proceed to question no. 90.

87. Would you be willing to pay 500 sucres monthly for public sewer system service?
 YES 1 NO 0

If the response to the question is "YES," proceed to the following question. If the response to the question is "NO," or you are not sure, proceed to question no. 90.

88. Would you be willing to pay 1000 sucres monthly for public sewer system service?
 YES 1 NO 0

If the response to the question is "YES," proceed to the following question. If the response to the question is "NO," or you are not sure, proceed to question no. 90.

89. Would you be willing to pay 2000 sucres monthly for public sewer system service?
 YES 1 NO 0

If the response to the question is "YES," proceed to the following question. If the response to the question is "NO," or you are not sure, proceed to question no. 90.

90. How many sucres per month would be the maximum you would be willing to pay for public sewer system service?

 Sucres

91. How many sucres would be the maximum you would be willing to pay for a connection to the public sewer system?

 Sucres

92. Of the amount stated in the previous question as payment for connection to the sewer system, how much would you be willing to pay on a monthly basis?

 Sucres

93. For how many months would you be willing to pay?

**F. Data on the Household and Family Members Who are Working,
Looking for Work, or have Income of Any Kind**

94. Total number of persons in the home:
95. Number of women:
96. Persons in the household who work full time:
97. Children from 0 to 11 years of age:

98. Youth from 12 to 17 years of age:
99. Persons from 18 to 40 years of age:
100. Persons from 41 to 65 years of age:
101. Persons greater than 65 years of age:

	Monthly Income	Age in Years Completed	School Years Completed	Sex Male = 1 Female = 0	Born in the City? Y = 1 N = 0	Employment Status *	Employment Activity *	Occupational Category *
Head of Household	102. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	103. <input type="checkbox"/> <input type="checkbox"/>	104. <input type="checkbox"/> <input type="checkbox"/>	105. <input type="checkbox"/>	106. <input type="checkbox"/>	107. <input type="checkbox"/>	108. <input type="checkbox"/>	109. <input type="checkbox"/>
Person 2	110. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	111. <input type="checkbox"/> <input type="checkbox"/>	112. <input type="checkbox"/> <input type="checkbox"/>	113. <input type="checkbox"/>	114. <input type="checkbox"/>	115. <input type="checkbox"/>	116. <input type="checkbox"/>	117. <input type="checkbox"/>
Person 3	118. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	119. <input type="checkbox"/> <input type="checkbox"/>	120. <input type="checkbox"/> <input type="checkbox"/>	121. <input type="checkbox"/>	122. <input type="checkbox"/>	123. <input type="checkbox"/>	124. <input type="checkbox"/>	125. <input type="checkbox"/>
Person 4	126. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	127. <input type="checkbox"/> <input type="checkbox"/>	128. <input type="checkbox"/> <input type="checkbox"/>	129. <input type="checkbox"/>	130. <input type="checkbox"/>	131. <input type="checkbox"/>	132. <input type="checkbox"/>	133. <input type="checkbox"/>
Person 5	134. <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	135. <input type="checkbox"/> <input type="checkbox"/>	136. <input type="checkbox"/> <input type="checkbox"/>	137. <input type="checkbox"/>	138. <input type="checkbox"/>	139. <input type="checkbox"/>	140. <input type="checkbox"/>	141. <input type="checkbox"/>

(*) CODING OF THE LAST THREE VARIABLES

LABOR STATUS

- WORK FULL TIME 1
 WORK PART TIME 2
 LOOKING FOR WORK 3
 RETIRED 4
 OTHER 5

EMPLOYMENT ACTIVITY

- AGRICULTURE AND LIVESTOCK 1
 MINING 2
 INDUSTRY 3
 WATER AND ELECTRICITY 4
 CONSTRUCTION 5
 TRADE 6
 TRANSPORTATION OR COMMUNICATION 7
 FINANCIAL SERVICES 8
 PERSONAL SERVICES 9
 PUBLIC ADMINISTRATION 0

OCCUPATIONAL CATEGORY

- LABORER 1
 EMPLOYEE 2
 OWNER - EMPLOYER 3
 SELF-EMPLOYED 4
 OTHER 5

How much does the family pay monthly for:

142. FOOD
143. HOUSING

144. DRINKING WATER
145. ELECTRICITY

146. CLOTHING
147. OTHER EXPENSES (TRANSPORTATION, EDUCATION)

NOTE: If you have any comments, please write them on the back of this page.

Appendix B

QUESTIONNAIRE: CRITERIA, STRUCTURE AND FORM

Criteria Applied

The design of the drinking water and sewer system survey had to comply with the following requirements:

- The survey should yield an estimate of the willingness to pay for drinking water and sewerage services, both with respect to installation (connection) and monthly rates, by cubic meter for drinking water and for overall sewerage service.
- The survey should gather data on the quantity of water consumed and the amount paid per unit, permitting an estimate of the demand functions by means of the price and income elasticities of demand.
- The survey should produce a definition of the variables, besides price and income, that affect the quantity of water consumed (for example, the number of family members, the availability of sewerage service).
- The survey should provide a guide to the design of an efficient and equitable fee system. Therefore, it must yield an estimate of both willingness to pay for each unit (cubic meter) of drinking water and a monthly fee for sewerage service, as well as the willingness to pay for the installation of the service itself (connection).
- By applying various methods to estimate willingness to pay, the results of each methodology should be suited for comparison and evaluation of advantages and disadvantages. The survey should yield an estimate of willingness to pay using direct methods (contingent valuation) and indirect methods.
- The survey should yield quantified economic benefits of drinking water and sewerage projects and, therefore, support cost-benefit analyses.
- The survey should support the financial projections required to analyze the profitability of drinking water and/or sewerage system projects.

- The survey, and, in general, the methodology used in Quito should be replicable in other cities in Ecuador, with modifications that account for local differences. The form should be simple enough so that officials of small municipalities with little training can use it and even process it, directly or under the guidance of the BEDE. For this reason the survey form is almost entirely pre-coded.
- The survey should not include questions that do not have a direct bearing on its immediate purpose. Therefore, questions should only be included that yield data that is indispensable to producing estimates of the demand for the services indicated.

Designing the Questionnaire

The following steps were followed in designing the form for the socioeconomic surveys:

1. Preliminary designs based on research performed in November 1989 and on the objectives of the survey. This first draft of the form, as well as of the corresponding survey implementation manual, were included in the November 1989 preliminary report submitted to WASH.
2. Application of the first version of the form by CEDATOS between December 7 and December 10, 1989, and evaluation of the results.
3. Preparation of the second version of the survey form based on experience gained during the evaluation test.
4. Implementation of the survey using the second version of the form, in February 1990. The delay between the preparation of the second version of the form on December 21, 1989 and the implementation of the survey was due to the fact that BEDE wished to use the form designed for the IDB/IBRD project, broadening its use.
5. Evaluation of the form used in the surveys, considering the criteria outlined in the above point.
6. Design of the final version of the form, included in Volume 2 of this report, which included the experience of both the data collection stage and the data processing stage. At the same time, the final survey implementation manual was designed.

Evaluation of the Questionnaire Used

The main problem with the survey implemented in February 1990 was that the officials performing the survey had difficulty understanding the conversion of units of drinking water. Although changes have been introduced in the new form that improve this situation, improved selection and training of those implementing the survey will be required for future surveys. The importance of properly completing the questions on the quantity consumed and the price paid should be emphasized.

The housing units connected to the public system did not correctly report on the water they consumed. Because they did not have water meters, they were charged a fixed monthly fee and do not keep track of consumption.

People who purchase water from tankers and carry it from public taps exercise greater control over the quantity consumed. In the first case, there is greater control because they pay by the unit, whether at the point of purchasing the water or monthly. In the second case, because of the effort required to carry water from sources outside the housing unit, water consumption can be accounted for with greater precision.

In the case of public taps and wells, the questions on the number of trips made and the quantity of water carried for each trip allowed the detection of erroneous responses with respect to the quantity of water consumed, because people tend to underestimate their consumption. Another factor that affected the results in a negative manner was that those performing the survey, officials of EMAP-Q, worked standard office hours, that is, until 6:00 p.m. Many heads of households would return home after this time, and it was impossible to survey them.

Proposed Changes to the Questionnaire

The following changes were made to the questionnaire based on the experiences gained from the survey:

- Include coding to track who performed each survey and their supervisors, in order to make later corrections and establish a correlation between the questionnaires and the quality of those performing the survey, which in many cases was not satisfactory.
- Integrate the questions relating to housing complexes and homes, because the sample should be taken only for housing with a single housing unit. In Latin America and in Ecuador in particular, the provision of drinking water is carried out at the level of housing complexes and not of individual homes. Moreover, willingness to pay

is a function of economic behavior of a family unit. The analysis of implicit prices refers to the characteristics of the housing, and it is very difficult to separate this data for analysis when the housing contains several housing units.

For the above reasons, home surveys on demand for drinking water and sewer service should be performed only for single unit housing. As a consequence, the questions aimed at establishing the kind of housing (single family, two family, etc.) and the interior structure of the homes (number of rooms and bedrooms in the home, etc.) were eliminated.

- The definition of geographical unit was limited to city and barrio because it was thought that other geographical area definitions were not necessary for this kind of survey.
- The questions relating to the exclusivity of the use of the bathroom and kitchen were eliminated because in almost all housing units there is exclusive use of these services.
- New questions aimed at estimating the accessibility of the housing unit, both with respect to its distance from the center of the city (Q19) and the kind of public roads available (Q18), were included.
- The questions relating to the availability of drinking water and sewer services were changed in order to provide for the options of having both services, one of them, or none. The resulting change was also made in the questions relating to the value that homes would have with one or both of these additional services (Q23 - Q26).
- The fee for water by unit, calculated monthly, was included, because in the course of the survey it was found that in many cases people would purchase water by the tank or cubic meter but would pay for it monthly. This phenomenon lead to confusion.
- One question was added on the way in which water was carried from sources outside of the home (Q42, Q56) in order to remove subjectivity from this area. The quality of the water was identified with respect to its ability to be used for drinking (very good), for cooking, and for washing utensils (good) (Q45, Q59).
- In order to compare responses on the quantity of water consumed, questions (Q67 - Q71) were included that would allow the validity of the responses on the quantity of water consumed to be established, information which those surveyed with access to the drinking water

system did not provide because they had no working water meters, in the case of Quito. These questions replace question 63 on the form used in the survey.

- The range on the questions relating to the willingness to pay was increased from {10, 20, 50, 100} to {20, 50, 100, 200}. Almost all of the people interviewed were willing to pay 10 sucres. Moreover, inflation requires a periodic increase in the values over which willingness to pay is evaluated.
- In view of the small number of those surveyed with septic wells and latrines, and the low cost of maintaining them, questions 79 to 82 on the original form have been replaced by questions 82 and 83 on the recommended form.
- In view of the fact that 10% of those surveyed did not believe that sewer service was indispensable, a follow-up question on this subject is included on the recommended form (Q85).
- The range for the price that people would be willing to pay for sewer service was increased slightly, for the same reasons for which the range for the willingness to pay for drinking water was raised. Thus the range of {100, 200, 500, 1,000} was increased to {200, 500, 1,000, 2,000}.
- Questions were included on willingness to pay for the connection to the public sewer system (Q91 to Q93), and also on the period over which the individual would be willing to pay for this connection and for the drinking water connection.
- Questions 89 and 90, relating to damages resulting from flooding and rain, were eliminated.
- The maximum number of people in the household was reduced to five, as had been initially proposed, because only one home of the 391 surveyed had more than five persons in the category established in block F.
- The monetary units were revised by standardizing them into sucres in all of the questions, with the exception of questions relating to the value of the housing, which were left in thousands of sucres.

Structure and Form of the Proposed Questionnaire

The structure of the form was divided into six general sections corresponding to six specific areas. Sections A and B present general information on the housing unit, sections C and D cover the provision of and payment for drinking water, section E includes information about sewer service, and section F addresses the income level of the family group. The following paragraphs establish the relationship between the objectives and the information required in each section.

- A. **BASIC DATA:** In this section, basic general data is obtained on the geographical location of the housing, in addition to data on the person interviewed, the person performing the survey, and the supervisor. In this section, the character of the housing is defined.
- B. **HOUSING DATA:** the purpose of this section is to establish the physical category within which the housing unit falls, and so define the influence its external features have on the value this unit of housing may attain. This section includes data on the physical characteristics of the housing unit, such as construction materials, size and condition of the unit, and availability of public services. In addition, the relationship between the inhabitants and the unit (ownership and value), and the relationship between the unit and its surroundings (distance to the town center and the cost per square meter, etc.) are determined.
- C. **DATA ON WATER SOURCE AND CONSUMPTION:** this section of the form attempts to define, at the moment of the survey, the relationship between the unit of housing and the drinking water factor, with a view to establishing whether current consumption and manner of obtaining drinking water are satisfactory to the user, or if the state should intervene to improve these conditions, or, in the extreme case, should provide these services to this area. This section explores the sources of drinking water that enter the home, the manner of obtaining this water, the quality of the source, and the integral cost of this supply.
- D. **WILLINGNESS TO PAY FOR DRINKING WATER:** by means of the direct method of discrete selection, an attempt is made to measure willingness to pay for drinking water service and its installation in the areas that do not enjoy this service. This section questions the individual surveyed about the quantity of sucres he would pay for a specific volume of water and for connection to the service. In this way, the value the users would assign to this service may be defined.
- E. **DATA ON THE ELIMINATION OF WASTEWATER AND THE WILLINGNESS TO PAY FOR SEWER SERVICE:** Just as section D attempts to establish the value that users ascribe to drinking water service, this section attempts the same for sewer service. This value is reflected in willingness to pay for the price of installation. At

the beginning, the method for disposing of wastewater is defined, in order to later be able to establish willingness to pay for this service by those who do not have public sanitation sewer service. Willingness to pay is established using the direct method of discrete selection.

- F. **DATA ON THE HOME AND ON FAMILY MEMBERS WHO ARE WORKING, LOOKING FOR WORK, OR WHO HAVE INCOME OF ANY KIND:** The purpose of this section is to establish the level of family income in order to define the correlation between this income and ability or willingness to pay for drinking water and sewer services and their installation. Data is requested on the family group, with respect to income, ages and occupations. Finally, the questions attempt to establish the monthly expenses of the entire family group.

The questionnaire contains 147 questions in six sections. It consists of five pages, in which an attempt is made to gather complete subject areas onto discrete pages in order to better coordinate the survey.

The questions are almost all closed, that is, they are almost all pre-coded (discrete variables) or have a number of defined fields (continuous variables). This attempt to pre-code the questionnaire responds to the initial requirements that the form be easy to read and implement, as well as to tabulate. The pre-coded questions are presented in two forms: binary (Yes or No) and multiple (1, 2, 3, 4, 5, etc.).

The visual flow of the questions is generally vertical and in two columns, sometimes interrupted by a full horizontal strip in which one may insert notes or instructions that concern the entire section (equivalencies, variable coding, etc.). An attempt has also been made to locate the reference elements (such as variable codes) on the same pages for which they are required by the questions.

It should also be noted that in section C (data on water source and consumption), questions are included on the principal source right next to the questions on the secondary source, in order to rapidly establish this correlation while the survey is being performed, and so control or improve the responses given during the survey itself.

The above formal organizational elements have been studied in a detailed manner and it is recommended that, if the questionnaire is changed or broadened in the future, they be considered and followed as much as possible.

Conclusions Pertaining to the Questionnaire

- The basic criteria that applied to the development of the questionnaire were the capability of estimating willingness to pay for

drinking water and sewer services and installation, and a design that would be simple enough to be applied by officials with little training.

- It is recommended that the sample only be taken in single unit housing because, although the provision of these services takes place at the level of the housing complex, the willingness to pay for services is measured at the level of the individual home.
- The main problem presented in the tests of the questionnaire was the difficulty encountered by the individuals implementing the survey in understanding the conversions of units of volume of drinking water.
- Although the form is simple and easily implemented, those implementing the survey should be sufficiently trained in order to guarantee the validity of the sample.
- During the implementation of the survey itself, an attempt should be made to control as much as possible the quality of the responses, because after the tests were performed it was necessary to change certain questions, since they were poorly interpreted by those implementing the survey itself.
- The data collection period for this survey should include non-office hours or weekends, so that the best person to respond to the survey, the head of the household, may have the opportunity to do so.

Appendix C

DATA PROCESSING

The processing of the data obtained from the home survey was performed by means of a computer package called "StatPac Gold", which provides the tools to produce descriptive statistics, distributions, variable crossings and the regressions necessary to analyze willingness to pay and other socioeconomic characteristics. This package is relatively simple to handle and easy to learn, without sacrificing versatility. It also has the capability to produce information that can be processed with other packages of varying usefulness, such as electronic spreadsheets, word processors, and data bases.

Because it is relatively easy to learn and implement, this package does not require the user to be knowledgeable in the area of information systems to develop programs. Thus the economist or any other professional can manipulate and process the data without much training.

Error Correction and Data Cleanup

The information from the survey, after data entry and tabulation, was reviewed for errors, in data entry or collection, and for inconsistencies. The errors detected were compared with the source information for correction.

The most frequent errors that appeared were the following:

- The figures on consumption, expense or income were very often implausible because of confusion in the units (sucres and thousands of sucres, for example). This error should be corrected as much as possible by doing a thorough critique of the information before data entry.
- Invalid codes: the step of reviewing the information and producing a preliminary listing of the frequency distributions will facilitate the correction of this kind of error.
- Responses with a value of zero (0) for the number of persons in the home, area of the lot, square footage, and age of the individuals. The lists of preliminary descriptive statistics facilitate the detection and correction of these errors.

- Inconsistencies of various kinds, the most important being:
 - Questions that should not have been answered, such as willingness to pay for drinking water when the housing unit is already connected to the public system.
 - Inconsistent values, such as a lower value for the housing unit when it is connected to the sewer system than when it is not connected.

These kinds of inconsistencies can be detected and corrected by data checking programs.

It is very important to retain copies of the survey forms in files before making any corrections, because programming errors are not infrequent.

Frequency Distributions and Basic Statistics

The descriptive statistics are listed in two steps, with the first taken in order to cross-check and detect coding errors, values that are too high or too low, etc., and the second step to produce the final data for analysis.

It is of the utmost importance to guarantee that all errors have been corrected before printing the final descriptive statistics and generating new variables. If this step is not taken, an enormous amount of time can be lost if one should discover uncorrected errors at a later stage.

The descriptive statistics generally consist of the frequency distributions of the discrete variables (that yield only a finite number of values), and the basic descriptive statistics on the continuous variables (that may yield an infinite number of variables) such as the mean, the median, the mode, the standard deviation, the maximum, the minimum, and the distributions by quartiles and deciles.

Generation of New Variables

Once the data has been cleaned up one can proceed to generate new variables derived from the original variables in the survey. The programs utilized for this purpose are included in this appendix.

The main purpose of generating new variables is to provide data for the analysis of willingness and ability of the households surveyed to pay. Variables are generated relating to family income, family expenses, the consumption of drinking water expressed in common

units (cubic meters per month), the payment for drinking water and the removal of waste water, the prices of water, the logarithms of some of the above variables needed to correct regressions, and other variables of interest.

New Basic Statistics, Crossed Tabulations, and Disaggregated Averages

From the new variables generated, basic statistics are also listed not only for the analysis of willingness to pay, but also in order to provide a final check for possible errors.

Beyond the basic statistics, crossed tabulations are also generated, especially with variables such as the barrio, type of housing, ownership, and principal water source. The disaggregated averages are used to determine income, consumption, expenses and average prices of various subgroups of the population surveyed, especially by barrio, principal water source, housing ownership, method of removing waste water, and the availability of public services. The disaggregation is used to perform a comparative analysis of certain variables.

Data Processing: Evaluation and Recommendations

The crucial step in data processing is the cleanup of the data, that is, the detection and correction of the errors and inconsistencies. The errors that are not detected have later repercussions in loss of time, because their correction requires the return to previous steps, and repetition of work that has already been performed.

The cleanup of the data consists of the following three phases:

- Critique of the completed survey forms by direct inspection of the forms in order to verify that those implementing the survey completed the forms correctly.
- Detection of errors and inconsistencies through the use of computer programs that can be performed with the same statistical package, including automated correction of the errors.
- Preliminary analysis of the basic statistics by which coding errors, implausible values and other errors can be detected.

Before beginning to generate new variables, these three phases should be performed very thoroughly. If they are not completed, entire days of work and computation can be lost.

It is especially important to retain copies of the survey forms at various stages in the files, especially before important changes and corrections are made.

Appendix D

INSTRUCTION MANUAL FOR CARRYING OUT THE SURVEY

A. DATOS BASICOS

DILIGENCIE ANTES DE ENTRAR A LA VIVIENDA:

1. NUMERO DE LA ENCUESTA: Deje el espacio en blanco, lo diligenciará el supervisor.
2. CIUDA: Llenar con la información pertinente, para luego codificar.
3. DIA. Anotar el día de la encuesta, ejemplo : si esta se realiza el 12 de enero, registrar "12", si el 8 de enero, registrar "08"
4. BARRIO O COOPERATIVA : Escriba el nombre del Barrio, o la unidad geográfica menor en que esta ubicada la vivienda. Se entiende por barrio la Unidad geográfica con características homogéneas, generalmente, aunque no siempre, creados por el Concejo Municipal y corresponden a la unidad básica de la ciudad.
5. MANZANA #. Anote el número de la manzana en que se ubica la vivienda, según la nomenclatura adoptada en la encuesta.
- 6-7. ENCUESTADOR-SUPERVISOR. Escriba los nombres que correspondan, para luego codificar.

A CONTINUACION, INGRESE EN LA VIVIENDA, IDENTIFIQUESE Y COMIENCE LA ENCUESTA PREGUNTANDO POR EL NUMERO DE HOGARES QUE HABITAN EN LA VIVIENDA, SEGUN LAS DEFINICIONES SIGUIENTES:

- Vivienda: Espacio separado por paredes, piso y techo, de otras unidades, con acceso independiente directo a la vía pública, destinado a ser usado como alojamiento permanente de las personas que la habitan.
- Hogar: Persona o grupo de personas que ocupan la totalidad o parte de una vivienda y que comparten la comida y la dormida. No

necesariamente tienen vínculos familiares entre sí. Las empleadas domésticas forman parte del hogar si son internas, lo mismo que huéspedes temporales o permanentes.

Si LA RESPUESTA ES 2 O MAS HOGARES, AGRADEZCA LA ATENCION DEN ENTREVISTADO, DE POR TERMINADA LA ENCUESTA Y CONTINUE CON LA SIGUIENTE ENCUESTA.

SI LA RESPUESTA ES 1, CONTINUE , PREGUNTANDO LA DIRECCION, TELEFONO Y NOMBRE DEN ENTREVISTADO Y CONSIGNE LA INFORMACION EN LA CASILLA CORRESPONDIENTE.

8. EN ENTREVISTADO ES JEFE DEN HOGAR: Preguntele al entrevistado. Se define como Jefe de Hogar, la persona que por su edad, por motivos economicos o por otras razones, es conocido y aceptado como tal; puede ser hombre o mujer.

B.- DATOS DE LA VIVIENDA

9. AREA DEN LOTE: Pregunte el area (aproximada- del lote que ocupa la vivienda, en m². Si el informante no conociere este dato, averigüe cuantos metros tiene el lote de frente y de fondo, y multipliquelos para obtener el area aproximada en mts².
10. AREA CONSTRUIDA: Corresponde al area cubierta de la vivienda; por ejemplo, si tiene dos pisos con 50 mts². en el primero y 35 mts². en el segundo, el area construida es de 85 m². Los patios interiores no se cuentan como area construida.
11. NUMERO DE CUARTOS EN LA VIVIENDA: Anotar el número de cuartos en la vivienda. Se considera como cuarto, todo espacio separado por paredes del resto de la vivienda y destinado a uso como dormitorio, estudio, sala o comedor y todos los demas, con excepcion de baño, cocina, garaje, taller o negocio.
- 12-13. NUMERO DE DORMITORIOS Y DE BAÑOS EN LA VIVIENDA: Registre la informacion correspondiente.
14. AÑOS DE CONSTRUIDA: Indicar los años que tiene de construida la vivienda, en forma aproximada.
- 15-17. ESTAN LOS PISOS, PAREDES Y TECHOS FABRICADOS CON MATERIALES DURABLES: Por materiales durables de los pisos se entienden todos los diferentes a la tierra. En el caso de las paredes son durables el ladrillo ceramico,

bloque de cemento, concreto, tapial, madera tratada, etc. Para los techos se entiende como material durable: lamina de zinc, teja de barro, teja de eternit, placa de concreto, etc.

18. LA VIA PUBLICA, AN FRENTE DE LA VIVIENDA ES DE: marcar con x la respuesta correspondiente, segun las definiciones siguientes:

- Tierra: el suelo esta al natural y no ha sido tratado. (1)
- Grava-piedra suelta: el piso ha sido tratado con piedra menuda y apisonada. (2)
- Adoquinado-empedrado: el suelo ha sido recubierto por una capa de adoquines de cualquier material, o de piedras grandes uniformes. (3)
- Asfaltado-encementado: el suelo ha sido pavimentado o asfaltado en forma uniforme. (4)

19. DISTANCIA AN CENTRO EN CUADRAS. Pregunte al informante la distancia aproximada al centro de la ciudad, en cuadras, o unidades equivalentes de 100 mts. aproximadamente.

20-21. TIENEN SERVICIO DE ENERGIA ELECTRICA O DE TELEFONO: Consignar si la vivienda tiene estos servicios y en funcionamiento.

22. CUANTO CREE QUE VALE UNA VIVIENDA COMO ESTA: Se trata de establecer en cuanto valora la casa quien la habita, mediante el metodo directo de valoracion. La respuesta debe anotarse en el formulario en miles de sucres.

23. INDIQUE SI LA VIVIENDA ESTA CONECTADA A: marque con x, asi:

- Las redes Publicas de agua potable y alcantarillado: Cuando la vivienda esta conectada a las acometidas correspondientes, y el servicio se presta en forma aceptable. (1)
- Solo la red Publica de agua potable: Cuando la vivienda esta conectada a la acometida de la red publica de agua potable y el agua fluye por las salidas. Pero no esta conectada a la red publica de alcantarillado. (2)
- Solo la red publica de alcantarillado: La vivienda esta conectada a la acometida y el servicio de alcantarillado se presta en forma aceptable. Pero no existe conexion a la red publica de agua potable. (3)

- Ninguna de las redes Publicas: Cuando la vivienda no esta conectada ni a la red publica de agua potable ni tampoco a la red publica de alcantarillado. (4)
24. CUANTO CREE QUE VALDRIA ESTA VIVIENDA SI TUVIERA EN SERVICIO DE ALCANTARILLADO: Indica la valoracion contingente o hipotetica de la vivienda si esta tuviera el servicio de alcantarillado, ademas del agua potable. Solo se aplica si la respuesta 23 es 2. La respuesta debe darse en miles de sucres.
25. CUANTO CREE QUE VALDRIA ESTA VIVENDA SI ESTUVIERA CONECTADA A LA RED DE AGUA POTABLE: Corresponde a la valoracion contingente de la vivienda si esta tuviera el servicio de agua potable, ademas del de alcantarillado que ya tiene; solo se aplica cuando la respuesta 23 es 3. Establece la valoracion de la casa por quien la habita. La respuesta debe darse en miles de sucres.
26. CUANTO CREE QUE VALDRIA ESTA VIVIENDA SI SE CONECTA A LAS REDES PUBLICAS DE AGUA POTABLE Y ALCANTARILLADO: Se aplica cuando la respuesta 23 es 4. Indica la valoracion contingente de la casa si esta tuviera los servicios de agua potable y alcantarillado publico, de los que no dispone actualmente. La respuesta debe darse en miles de sucres.
27. CUANTOS SUCRES VALE EN METRO CUADRO DE TIERRA EN ESTE LUGAR. Registrar la apreciacion del entrevistado al respecto, entendiendo por "lugar" la zona geografica mas cercana a la vivienda y que puede ser la manzana, la cooperativa o el barrio.
28. TENENCIA DE LA VIVIENDA. Es el caracter mediante el cual un hogar ocupa una vivienda; sea como propietario, arrendatario, anticresis u otro.
- Propietario, cuando la familia que habita el hogar es dueña de la vivienda, no importando si tiene aun deudas por su compra. Puede ser con titulo o sin titulo, siendo este el caso de los invasores. (1 o 2)
 - Arrendatario, cuando la familia que la habita paga una renta periodica, generalmente mensual, por el usufructo de la vivienda. (3)
 - Anticresis cuando usufructua la vivienda por haber entregado el manejo y usufructo de un capital al propietario de esta. (4)
 - Otro, puede ser en prestamo, o alguna otra situacion. Indique cual es esta situacion. (5)
29. AÑOS DE VIVIR AQUI EN JEFE DEN HOGAR: Indique hace cuantos años habita en la vivienda el jefe del hogar encuestado. Si no los recuerda con precision, anotelos en forma aproximada.

30. SI PAGA ARRIENDO, CUANTOS SUCRES PAGA AN MES POR LA VIVIENDA: Indicar el monto mensual del arriendo de la vivienda, Solamente se aplicara cuando la familia sea arrendataria; en los otros casos, dejar en blanco.
31. SI LA VIVIENDA ES CONSTRUIDA CON PRESTAMO, CUANTOS SUCRES PAGA AN MES POR EN CREDITO. Registrar el monto de los pagos mensuales por concepto de amortizacion del credito. Si no paga amortizacion mensual, dejar en blanco.

C. DATOS SOBRE ORIGEN Y CONSUMO DE AGUA

EN ESTA PARTE DE LA ENCUESTA SE BUSCA DEFINIR LA CANTIDAD DE AGUA CONSUMIDA POR LA VIVIENDA, SEGUN DISTINTAS FUENTES, Y SU COSTO, QUE PUEDE SER DIFERENTE PARA CADA FUENTE. UNA VEZ SE HAYA ESTIMADO EN CONSUMO TOTAN Y EN VALOR PAGADO, SERA POSIBLE ESTIMAR LA "DISPOSICION A PAGARó POR EN METODO INDIRECTO.

INICIALMENTE, DE 32 A 38, SE INCLUYEN PREGUNTAS SOBRE LA UNIDAD DE VOLUMEN UTILIZADA, LA UNIDAD DE TIEMPO, LA CANTIDAD POR UNIDAD DE TIEMPO Y EN COSTO, POR UNIDAD DE VOLUMEN. EN PROPOSITO ES OBTENER LA INFORMACION REQUERIDA PARA CALCULAR LA CANTIDAD CONSUMIDA MENSUALMENTE Y EN VALOR PAGADO EN ESE MISMO LAPSO POR EN AGUA.

SI LA FUENTE ESTA FUERA DE LA VIVIENDA, SU COSTO RADICA EN LOS VIAJES QUE DEBEN HACERSE PARA LLEVAR EN AGUA A LA VIVIENDA. EN CONSECUENCIA, SE PREGUNTAN: EN NUMERO DE VIAJES DE LA VIVIENDA A LA FUENTE POR SEMANA, LA CANTIDAD DE AGUA RECOGIDA POR VIAJE, LA DISTANCIA EN CUADRAS Y EN TIEMPO QUE TOMA CADA VIAJE REALIZADO PARA TRAdR AGUA. ESTE ES EN CARACTER DE LAS PREGUNTAS 39 A 44.

LUEGO SE REPITEN LAS PREGUNTAS PARA LA SEGUNDA FUENTE DE SUMINISTRO DE AGUA, SI ESTA EXISTE. (46 A 59)

- 32,46. CUALES SON LA PRINCIPAN Y LA SEGUNDA FUENTE DE SUMINISTRO DE AGUA QUE LA VIVIENDA UTILIZA: Indicar la principal fuente utilizada, entre las opciones existentes (32). Asimismo indicar i la segunda fuente en importancia

(46). Se entiende como principal fuente, la que mayor cantidad de agua provea al hogar y por la cual se desembolsa la mayor cantidad de dinero.

- Conexion Red Publica: la vivienda esta conectada a la red publica de agua potable, y se recibe el servicio actualmente. (1)
- Conexion Red Privada: la vivienda esta conectada a la red de agua potable de alguna entidad privada como cooperativa, minga, asociacion, etc; y el servicio se recibe actualmente. (2)
- Tanquero: el agua es suministrada por un carro tanquero que lleva el agua a las viviendas. (3)
- Aguatero: el agua es suministrada por individuo que lleva el agua hasta la vivienda. (4)
- Vecino: el agua es suministrada por un vecino y generalmente se debe pagar por ella. (5)
- Pozo: El agua proviene de un pozo profundo y debe ser llevada a la vivienda por un medio diferente a red. (6)
- Grifo publico: El agua se obtiene de un grifo publico y debe ser llevada a la vivienda por un medio diferente a red. (7)
- Lluvia: El agua es recogida directamente de la lluvia. (8)
- Vertiente: El agua es tomada de alguna quebrada o rio, y debe ser llevada a la vivienda por un medio diferente a red. (9)

33,47. CANTIDAD DE AGUA CONSUMIDA AN MES: Indique que volumen de agua consume al mes de esta fuente, anotando la unidad en que obtiene el agua; o sea, si la unidad en que le suministran el agua es "baldes de 10 litros", y al mes obtiene 8 baldes, la respuesta sera "008 baldes de 10 litros".

34,48. UNIDAD DE VOLUMEN UTILIZADA PARA MEDIR EN CONSUMO DE AGUA: En cada caso, indicar la unidad de capacidad que se usa. Por ejemplo, si la vivienda esta conectada a la red, la medida seria el metro cubico (M3), en otros casos seria el tanque de 55 galones, el balde de 10 litros, etc. Cada tipo de medida tendra codigo distinto, el que sera definido despues de realizada la encuesta.

35,49. EQUIVALENCIA EN LITROS DE LA UNIDAD UTILIZADA. Para ser llenada por el encuestador, haciendo la conversión del número de unidades consumidas (preguntas 33,47) según la unidad utilizada, (preguntas 34,48) a litros. Apoyese en la tabla de equivalencias ubicada al final de la página 2 de la encuesta.

36,50. PAGA ALGO POR EN AGUA DE ESTA FUENTE. Si se paga algo por el agua de la fuente, indicar la modalidad según las opciones:

- Si, pago por unidad y en el momento de comprarla. Se paga cada vez que se recibe el agua. (1)
- Si, pago por unidad y mensualmente. El pago de las unidades suministrada se realiza una sola vez al mes, aunque el suministro se reparte en varias partes al mes. (semanal, diario, etc.). (2)
- Si, pago globalmente al mes. Se paga una vez al mes, no importa cuánto consuma. (3)
- No pago nada por el agua. El agua es suministrada en forma gratuita. (4)

37,51. SI LA RESPUESTA 36,50 es 1 o 2, CUANTO PAGA POR CADA UNIDAD. Indicar el costo por cada unidad pagada, aunque el pago se haga una vez al mes.

38,52. SI LA RESPUESTA 36,50 es 3, CUANTO PAGA MENSUALMENTE. Indicar el costo mensual pagado.

CUANDO EN AGUA SE ADQUIERE DE UN VECINO, DE POZOS, PILA PÚBLICA, AGUA LLUVIA, RÍO O QUEBRADA, PROBABLEMENTE SEA NECESARIO REALIZAR VIAJES DE LA VIVIENDA A LA FUENTE, QUE TENDRIAN UN COSTO EN TÉRMINOS DE TIEMPO. LOS SEIS CONJUNTOS DE PREGUNTAS SIGUIENTES CORRESPONDEN A VIAJES POR SEMANA, CANTIDAD DE AGUA RECOGIDA POR VIAJE, DISTANCIA EN CUADRAS Y TIEMPO DE DURACIÓN DE CADA UNO DE ESTOS.

39,53. SI ESTA FUENTE ESTA FUERA DE LA VIVIENDA, CUANTOS VIAJES POR SEMANA DEBE HACER: Las veces que van a recoger el agua a las fuentes alejadas, en el transcurso de una semana. Si por ejemplo se realizan tres viajes diarios a la fuente durante los días de semana pero el domingo solo se hacen dos, la respuesta es 20 viajes.

40,54. QUE CANTIDAD TRAE EN CADA VIAJE, EN LA UNIDAD INDICADA. Indicar la cantidad de unidades que se recogen en cada viaje. Por ejemplo si la unidad es

"balde de 10 litros", y en cada viaje se llevan dos baldes, la cantidad por viaje sería de 20 litros.

- 41,55. **A. QUE DISTANCIA (EN CUADRAS) QUEDA LA FUENTE:** La distancia que separa la vivienda del lugar de la fuente; la cuadra equivale aproximadamente a 100 metros y es la distancia entre las intersecciones en la manzana española tradicional.
- 42,56. **EN QUE TRAE EN AGUA DE ESTA FUENTE.** Indique cual es el medio utilizado para llevar el agua hasta la vivienda:
- A pie. (1)
 - A lomo de animal. (2)
 - Bicicleta o tracción humana (carretilla o carreta empujada o tirada por un hombre). (3)
 - Vehículo automotor. Carro, jeep, camión, etc. (4)
 - Otro, si el medio de transporte es diferente a los anotados arriba. (5)
- 43,57. **CUANTO TIEMPO GASTA EN EN VIAJE DE IDA Y VUELTA (EN MINUTOS).** Lo que se demora en promedio la persona que va a traer el agua a las fuentes que quedan alejadas de la vivienda. Se debe anotar el tiempo total, o sea, lo que demora a la ida a la fuente, al regreso a la vivienda y también el tiempo que dura la recolección del agua en la fuente.
- 44,58. **LA PERSONA QUE REALIZA EN VIAJE TRABAJA ?.** Si trabaja en un empleo remunerado, indicarlo. En caso contrario, registrar "no".
- 45,59. **CALIDAD DEL AGUA.** Indicar si la calidad del agua consumida es buena, regular o mala, según los criterios indicados en el cuestionario, así:
- Muy buena. Se puede beber de esta agua. (1)
 - Buena. Sirve para cocinar y lavar utensilios. (2)
 - Regular. (3)
 - Mala. (4)
- 60-65. **INDIQUE DE QUE FUENTE OBTIENE EN AGUA PARA CADA UNO DE LOS SIGUIENTES USOS.** Registre, frente a cada uno de los usos (beber, cocinar, etc), la fuente de la que predominantemente obtiene el agua para ese uso, utilizando los códigos que aparecen indicados abajo de la pregunta. Por ejemplo, si para beber y cocinar compran agua de un aguatero, para bañarse y lavar, van por el agua al grifo público y no tienen animales, se llenaría así:

Numeral 60=4; numeral 61=4; numeral 62=7; numeral 63=7; numeral 64=7; numeral 65 dejar en blanco.

66. LA CANTIDAD DE AGUA QUE CONSUME ACTUALMENTE ES SUFICIENTE: Indicar si considera que el agua que puede consumir actualmente es suficiente para cubrir sus necesidades.

SI ESTA CONECTADO A LA RED PUBLICA DE AGUA POTABLE, O SEA SI LA RESPUESTA 32 O LA 46 ES 1, FORMULE LAS PREGUNTAS 67 A 71.

EN CASO CONTRARIO, PASE A LA PREGUNTA 72.

67. TIENE LA VIVIENDA UN MEDIDOR EN FUNCIONAMIENTO. Indicar si existe un medidor de agua potable y se encuentra en aceptable forma.

68. CUANTAS HORAS AN DIA, EN PROMEDIO, RECIBE EN AGUA. Si no recibe agua las 24 horas del dia, escriba el numero de horas promedio en que el agua llega a la vivienda, aproximadamente.

69. CUANTAS LLAVES DE AGUA TIENE. Entendiendo por llave los puntos de salida del agua diferentes a sanitarios o duchas.

70-71. CUANTOS SANITARIOS Y DUCHAS TIENE. Consigne la informacion en las casillas correspondientes.

D.- DISPONIBILIDAD A PAGAR POR AGUA POTABLE

AN INICIAR LA ENCUESTA O LA PARTE CORRESPONDIENTE A LA DISPONIBILIDAD A PAGAR, SE DEBE LEER LA INTRODUCCION QUE APARECE AN PRINCIPIO. ESTA PARTE DE LA ENCUESTA SE DEBE DILIGENCIAR SOLO EN AQUELLAS VIVIENDAS QUE NO TIENEN CONEXION DOMICILIARIA, O SEA, CUANDO LA RESPUESTA A LA PREGUNTA 23 HAYA SIDO 3 O 4.

PREGUNTAS 72 a 76.

Esta seccion tiene por objeto investigar la disposicion a pagar mediante el metodo directo de preguntarles a los encuestados si estarian dispuesto a pagar una suma mensual determinada por una unidad de volumen consumida. Se ha tomado como medida el tanque de 55 galones, pues es la medida mas utilizada por los encuestados, y es mas facil equipararla con medidas a que estan acostumbrados los encuestados, ejemplo: Baldes de 10 litros, latas de 5 galones y metros cubicos.

El método directo aplicado es el de selección discreta, que simula un proceso de regateo, en el que se le va preguntando al Entrevistado si está dispuesto a pagar una suma cada vez mayor, hasta que responden que no, en cuyo caso se le pregunta cuánto entonces estaría dispuesto a pagar. Los estudios empíricos han demostrado que el método de selección discreta produce resultados más confiables que preguntando directamente el valor que estaría dispuesto a pagar el Encuestado.

77. CUANTOS SUCRES SERIA LO MAXIMO QUE ESTARIA DISPUESTO A PAGAR POR LA ACOMETIDA DE AGUA POTABLE. Se refiere al pago por la conexión inicial, que tiene un costo diferente al costo del agua que se consume mensualmente.
78. DE LA SUMA ANTERIOR, CUANTO ESTARIA DISPUESTO A PAGAR MENSUALMENTE. Las Empresas de Agua Potable del Ecuador tienen la posibilidad de diferir, de acuerdo con los beneficiarios de las conexiones o acometidas, la forma de pago, por mensualidades. En esta pregunta se busca averiguar cuál sería el pago mensual preferido por los encuestados.
79. DURANTE CUANTOS MESES PAGARIA LA ACOMETIDA DE AGUA POTABLE. Pregunte por la cantidad de tiempo en meses, que estaría dispuesto a pagar el costo de obtener la acometida de agua potable. Este costo es diferente al del consumo normal al mes. El producto de esta pregunta y la anterior debe dar una suma igual a la respuesta 77.
80. SI LA VIVIENDA ESTUVIERA CONECTADA A LA RED DE AGUA POTABLE, CONSUMIRIA LO MISMO, UN POCO MAS O MAS DEN DOBLE. Indicar aquí si cree que la familia consumiría más agua, de tener la posibilidad de hacerlo, o su consumo no cambiaría fundamentalmente.

E. DATOS SOBRE ELIMINACION DE AGUAS SERVIDAS Y LA DISPOSICION A PAGAR POR ALCANTARILLADO

81. COMO EVACUA LAS AGUAS SERVIDAS. Marcar con una "x" la respuesta adecuada.
- Red de alcantarillado Público. El sanitario está conectado a la red pública de la ciudad. (1)
 - Red de alcantarillado Privado. El sanitario está conectado a una red no pública sino privada, o de una organización cooperativa o comunal. (2)
 - Pozo séptico, indica que el sanitario está conectado a un sistema de eliminación con pozo profundo. (3)

- Letrina, indica que existe un hueco que al saturarse generalmente se tapa y se cambia de lugar abriendo otro. (4)
- Acequia o rio, cuando se utilizan cauces naturales para eliminar las aguas servidas. (5)
- Cielo abierto, se registra cuando la vivienda no cuenta con ningun sistema de eliminacion de aguas servidas y se tiene que salir al campo abierto. (6)

82. SI LA RESPUESTA A LA PREGUNTA 81 ES 1 O 2, CUANTO LE CUESTA (O TIENE QUE PAGAR) AN MES. En el caso de que este conectado a alguna red de alcantarillado, indique el costo mensual pagado por este servicio. Aqui debe indicar no solo lo que se paga directamente como tarifa, sino la suma que se debe pagar bajo cualquier otra denominacion (impuesto, contribucion por mejora), por el derecho a tener el servicio de alcantarillado.

83. SI LA RESPUESTA A LA PREGUNTA 81 ES 3, 4 O 5, EN CUANTO CALCULA EN GASTO QUE TUVO QUE HACER EN ULTIMO AÑO PARA REPARACIONES, LIMPIEZA, REPUESTOS, ETC, PARA PODER USAR EN POZO, LETRINA O ACEQUIA. Si evacua las aguas servidas por pozo septico, letrina o en acequia-rio; señale el costo global del ultimo año, por limpieza equipo, reparaciones, mantenimiento, repuestos y otros gastos ocasionados por dicho uso.

ANTES DE COMENZAR LAS PREGUNTAS SIGUIENTES, RELACIONADAS CON LA DISPOSICION A PAGAR POR LA ACOMETIDA DEN SERVICIO DE ALCANTARILLADO, SE LEERA LA FRASE QUE APARECE ANTES DE LA PREGUNTA 84. ESTAS PREGUNTAS SOLO SE DILIGENCIARAN DONDE NO HAYA CONEXION A LA RED PUBLICA DE ALCANTARILLADO SANITARIO.

84. ESTARIA UD. INTERESADO EN ESTAR CONECTADO A LA RED PUBLICA DE ALCANTARILLADO SANITARIO. Registrar la respuesta adecuada; la pregunta debe poder establecer si el encuestado considera conveniente tener acceso a la red de alcantarillado o si puede pasar sin este servicio.

SI LA RESPUESTA A LA PREGUNTA 84 ES NO, CONTINUE CON LA PREGUNTA 85, EN CASO CONTRARIO, PASE A LA PREGUNTA 86.

85. POR QUE NO LE INTERESA ESTAR CONECTADO A LA RED DE ALCANTARILLADO. Seleccione la respuesta entre las opciones presentadas. Diligenciese solo si la respuesta anterior fue no.

PREGUNTAS 86 A 90

Estas preguntas estan orientadas a determinar la disposicion a pagar de las familias, mediante el metodo directo de "Seleccion discreta", que se aplico tambien al caso del servicio de agua potable. pues es muy importante que el encuestado entienda claramente cual es el servicio sobre el que se le pregunta su valoracion.

91. CUANTOS SUCRES SERIA LO MAXIMO QUE ESTARIA DISPUESTO A PAGAR POR LA ACOMETIDA DE ALCANTARILLADO SANITARIO. Se refiere al pago por la conexcion inicial, que tiene un costo diferente al costo mensual del servicio.
92. DE LA SUMA INDICADA EN EN PUNTO ANTERIOR, CUANTO ESTARIA DISPUESTO A PAGAR MENSUALMENTE. Se busca averiguar el valor de las cuotas mensuales en que se diferira el pago de la acometida de alcantarillado.
93. DURANTE CUANTOS MESES PAGARIA LA ACOMETIDA DE ALCANTARILLADO SANITARIO. Pregunte por la cantidad de tiempo en meses, durante el cual estaria dispuesto a pagar el costo de obtener la acometida de alcantarillado. Este costo es diferente al del pago normal del mes. El producto de esta pregunta (numero de meses) por la anterior (cuota mensual) debe dar una suma igual a la respuesta 91.

F.- DATOS SOBRE EN HOGAR Y LAS PERSONAS QUE TRABAJAN, BUSCAN TRABAJO O TIENEN INGRESOS POR CUALQUIER CONCEPTO

PREGUNTAS 94 A 101.

NUMERO DE MUJERES, NUMERO DE PERSONAS EN EN HOGAR, NUMERO DE PERSONAS DEN HOGAR QUE TRABAJAN Y DISTRIBUCION SEGUN GRUPOS ETARIOS. Registre al frente de cada pregunta el numero que corresponda, prestando atencion a que la informacion sea consistente. Las edades se entienden en años cumplidos. La suma de las respuestas 97 a 101 debe dar igual a la respuesta 94.

PREGUNTAS 102 A 141.

DATOS DE LAS PERSONAS QUE TRABAJAN, BUSCAN TRABAJAN O RECIBEN INGRESOS. Llenar la informacion solicitada para los miembros del hogar que cumplan una o varias de las siguientes condiciones:

- Que sea el jefe del hogar.
- Que trabaje y reciba remuneración por ello.
- Que estando sin trabajar, este buscando trabajo activamente
- Que reciba ingresos de cualquier tipo, tales como pensiones, rentas, arriendos, donaciones periódicas, intereses, etc.

102,110,118,126,134.

INGRESOS MENSUALES. Registre aquí los ingresos recibidos por cada persona en un mes típico, como noviembre de 1989, en miles de sucres. Se trata de obtener información sobre los ingresos mensuales, por cualquier fuente regular (salarios, pensiones de jubilación, renta de alquiler, venta de comida, utilidad por ventas ambulantes, etc.). No se debe tener en cuenta primas ni bonificaciones esporádicas o semestrales, pero sí primas y subsidios permanentes.

103,111,119,127,135.

EDAD. Anotar los años cumplidos; si se presentara el caso de una persona con 100 años o más, registrar 99.

104,112,120,128,136.

ESCOLARIDAD. Indique el número total de grados aprobados de educación primaria, secundaria y superior. Por ejemplo, si el entrevistado es analfabeta marque "00"; si terminó el segundo año de bachillerato, "08"; si es arquitecto graduado, "17"; si ha hecho dos años de postgrado, "19".

105,113,121,129,137.

SEXO. Registre el sexo de la persona, "1" si es hombre y "06" si es mujer.

106,114,122,130,138.

NACIO EN ESTA CIUDAD. Con esta pregunta se busca conocer si la persona es inmigrante o no; en algunos casos la demanda de agua puede variar si la persona es nacida en otros sitios.

107,115,123,131,139.

SITUACION LABORAL. Marcar una "x" según sea el caso y de acuerdo con las siguientes definiciones.

- **Trabaja a tiempo completo:** significa que en el momento se encuentra laborando a tiempo completo en cualquier actividad remunerada, diferente al servicio doméstico interno. (1)

- Trabaja tiempo parcial: cuando la persona trabaja la mitad o menos de la jornada laboral ordinaria en el Ecuador; tal sería, por ejemplo, el caso de una ama de casa que trabajara como secretaria medio tiempo. (2)
- Busca trabajo: significa que no está trabajando actualmente pero que busca trabajo activamente. (3)
- Jubilado : significa que la persona disfruta de una pensión por jubilación o invalidez. (4)
- Otro: corresponde a cualquier situación diferente a las anteriores, como sería el caso del jefe de hogar que no trabaja ni está desempleado ni es pensionado. También sería el caso del rentista o la persona que recibe periódicamente remesas del exterior. (5)

108,116,124,132,140.

ACTIVIDAD ECONOMICA. Registre la actividad económica desarrollada en el sitio de trabajo de la persona. Solo se aplica a quienes están trabajando o buscan trabajo en la actualidad. En este último caso, indicar la actividad económica de su último sitio de trabajo. Marque con una "x" la rama de actividad correspondiente, según las definiciones siguientes:

- Agricultura-ganadería: significa que la persona trabaja en una empresa cuya actividad económica principal es la producción agropecuaria, los servicios agrícolas, el cuidado de animales, el cuidado de bosques, la extracción de madera, la pesca, etc. También se aplica a la persona que trabaja por cuenta propia en cualquiera de estas actividades. (1)
- Minas y canteras: se aplica cuando la persona trabaja en labores extractivas tales como en areneras, canteras o minas de socavón o cielo abierto. (2)
- Industria: significa que la persona trabaja en una empresa de producción y/o fabricación de alimentos procesados, bebidas, textiles, muebles y accesorios, papel, imprentas, sustancias químicas, productos de caucho y plástico, productos metalmeccánicos, eléctricos, etc. (3)
- Electricidad, gas y agua: cuando la persona trabaja en la producción y distribución de estos servicios, sea en el sector público o en el sector privado. En Quito, a los empleados de EMA-Q, EMAP-Q y la Empresa de Energía, preguntarles si están directamente vinculados a la producción y distribución del servicio respectivo. En caso contrario, registrar en la categoría de Administración Pública. (4)
- Construcción: significa que la persona trabaja en una entidad cuya principal actividad económica es la construcción. (5)

- Comercio: Cuando la persona trabaja, por cuenta propia o como empleado, en el comercio al por mayor, al detal, o en restaurantes, cafes, hoteles y lugares de alojamiento y, en general, en establecimientos que expendan comidas o bebidas. (6)
- Servicios financieros: cuando la persona presta servicios en bancos, corporaciones de ahorro y credito, compañías de seguros, oficinas de propiedad raiz, compañías fiduciarias, compañías de "leasing", etc. (7)
- Transportes: cuando la persona trabaja por cuenta propia o como empleado de una entidad, en la prestacion del servicio de transporte terrestre, aereo, maritimo y fluvial, o en servicio conexos como terminales, aeropuertos, estaciones ferroviarias, muelles, etc. (8)
- Administracion Publica: cuando la persona trabaja en entidades del gobierno, en administracion publica, justicia, defensa y policia. Se exceptuan los trabajadores de los sectores de salud, educacion y asistencia social, asi como quienes laboran en establecimientos comerciales e Industriales del Estado. (9)
- Servicios personales, sociales y comunales: cuando la persona trabaja en instituciones educativas y de investigacion, en bibliotecas, museos, presta servicios medicos, odontologicos, veterinarios, en institutos de asistencia a la niñez, a los ancianos, a los invalidos y desvalidos, presta servicios profesionales, trabaja en jardines botanicos, zoologicos, servicios de diversion y esparcimiento, presta servicios de reparacion, domestico (externo), de limpieza, lavanderias, peluquerias, etc. (10)

109,117,125,133,141.

CATEGORIA OCUPACIONAL. Se aplica esta pregunta solamente a quienes estan trabajando o buscando activamente trabajo el dia de la encuesta. Marcar con una "x" la categoria adecuada, segun las definiciones siguientes.

- Obrero: cuando se trabaja mediante vinculacion laboral, sea esta verbal o escrita, en labores donde predomina la actividad fisica sobre la intelectual. (1)
- Empleado: significa que la persona tiene un contrato de trabajo (verbal o escrito) con sus empleadores o patronos, su actividad es predominantemente intelectual y se desarrolla principalmente en oficinas o locales comerciales. (2)
- Patrono o empleador: cuando la persona no es empleado ni obrero sino el jefe de su propia empresa; se refiere principalmente a los propietarios de empresas, profesionales independientes y a los empresarios, en general que laboran en el sector formal de la economia. (3)

- Trabaja por cuenta propia: cuando la persona trabaja por cuenta propia, sin estar empleada ni tener empleados, remunerados o no. Esta categoría corresponde principalmente a los trabajadores del sector informal, como vendedores ambulantes, lustrabotas, etc. (4)
- Otros. Registre esta categoría cuando la persona no pertenezca a ninguna de las anteriores. Especifique cual. (5)

142-147. CUANTO PAGA MENSUALMENTE LA FAMILIA POR CONCEPTO DE :
Indique el promedio mensual, en sucres, gastado por la Familia, por cada uno de los conceptos establecidos.

- Alimentos
- Vivienda
- Agua potable
- Energía eléctrica
- Vestidos
- Otros gastos: Educación, Transporte, Recreación, Salud, etc.

FINALICE LA ENCUESTA, AGRADEZCA LA COLABORACION
PRESTADA Y CONTINUE CON LA SIGUIENTE ENCUESTA.

SI UD. O EN SUPERVISOR TIENE ALGUNA OBSERVACION, POR
FAVOR ANOTE LA AN REVERSO DE LA ENCUESTA Y
COMENTE LA CON EN SUPERVISOR.

Appendix E

**CODES USED FOR THE BARRIOS OF QUITO
AND FOR UNITS OF VOLUME USED**

ANEXO 5: CODIGOS

CODIGOS DE BARRIOS DE QUITO

SAN JOSE DE MONJAS	01
ARGELIA	02
OBRERO INDEPENDIENTE	03
NUEVA AURORA	04
SANTA ANITA NORTE	05
ECUATORIANA	06
LUCHA DE LOS POBRES	07
COOP. CARCELEN	08
COOP. SAN FRANCISCO	09
SAN ENRIQUE DE VELASCO	10
LA TOLA	11
EN PANECILLO	12

UNIDAD DE VOLUMEN QUE UTILIZA

TANQUE DE 55 GLNS. = 220 LTS	1
GALON DE 3.8 LTS.	2
TINA DE 10 LTS.	3
BALDE DE 10 LTS.	4
LATA O CANECA DE 5 GLNS. = 19 LTS.	5
BALDE DE 20 LTS.	6
SISTERNA DE 1 METRO CUBICO = 1000 LTS	7

Appendix F

COMPUTER PROGRAMS USED FOR GENERATING VARIABLES (Expressed in Cubic Meters and Months)

```
codebook AGUA
data AGUA
AVERAGE AUX1 = V97, V105, V113, V121, V129
COUNT AUX2 = V97, V105, V113, V121, V129
COMPUTE V162 = AUX1*AUX2
WRITE AGUA

..
AVERAGE AUX1 = V153 - V158
COUNT AUX2 = V153 - V158
COMPUTE V163 = AUX1*AUX2
write AGUA

..
COMPUTE V164 = V162/V9
COMPUTE V165 = V154/V162
COMPUTE V166 = V9/V31
COMPUTE V167 = V9/V32
COMPUTE V168 = V11*V29
COMPUTE V169 = V26 - V168
IF V35>0 THEN COMPUTE V170 = V35*V162
IF V36>0 THEN COMPUTE V170 = V36*V162
WRITE AGUA

..
COMPUTE V171 = V38*V40/1000
COMPUTE V172 = V51*V53/1000
IF V41=1 THEN COMPUTE V173 = V38*V42
IF V41=2 THEN COMPUTE V173 = V43
IF V54=1 THEN COMPUTE V174 = V51*V55
IF V54=2 THEN COMPUTE V174 = V56
COMPUTE V175 = V173/V171
COMPUTE V176 = V174/V172
WRITE AGUA

..
IF V173>0 THEN COMPUTE V177 = V173
IF V174>0 THEN COMPUTE V177 = V174
IF V173>0 AND V174>0 THEN COMPUTE V177 = V173 + V174
COMPUTE V178 = V162/V177
COMPUTE V179 = V155/V177
COMPUTE V180 = V156/V177
WRITE AGUA

..
COMPUTE V181 = V75*4.545454
IF V24=0 OR V25=0 THEN COMPUTE V182=0
IF V24=1 AND V25=1 THEN COMPUTE V182=1
IF V24=1 OR V25=0 THEN COMPUTE V183=0
IF V24=0 AND V25=1 THEN COMPUTE V183=1
IF V24=0 OR V25=1 THEN COMPUTE V184=0
IF V24=1 AND V25=0 THEN COMPUTE V184=1
IF V182=0 AND V183=0 AND V184=0 THEN COMPUTE V185=(V27-V26) + (V28-V26)
IF V182=0 AND V183=1 AND V184=1 THEN COMPUTE V186=(V27-V26)
IF V182=0 AND V183=1 AND V184=0 THEN COMPUTE V187=(V28-V26)
COMPUTE V188 = V82/V81
COMPUTE V189 = V79*V80/12
WRITE AGUA
```

```

CODEBOOK AGUA
DATA AGUA
IF V44>0 THEN COMPUTE V191 = V44*V47*4.333*16.3268/43200
IF V57>0 THEN COMPUTE V191 = V57*V60*4.333*16.3268/43200
IF V44>0 AND V57>0 THEN COMPUTE V191 = (V44*V47 + V57*V60)*4.333*16.3268/43200
IF V41=3 THEN COMPUTE V192 = V171
IF V54=3 THEN COMPUTE V192 = V172
IF V41=3 AND V54=3 THEN COMPUTE V192 = V171 + V172
COMPUTE V193 = V191/V192
WRITE AGUA
**
AVERAGE AUX1 = V191, V173, V174
COUNT AUX2 = V191, V173, V174
COMPUTE V194 = AUX1*AUX2
IF V171>0 THEN COMPUTE V195=V171
IF V172>0 THEN COMPUTE V195=V172
IF V171>0 AND V172>0 THEN COMPUTE V195=V171+V172
COMPUTE V196 = V194/V195
IF V41="1/2" THEN COMPUTE V198 = V171
IF V54="1/2" THEN COMPUTE V199 = V172
WRITE AGUA
**
IF V182=1 THEN COMPUTE V197 = 1
IF V183=1 THEN COMPUTE V197 = 2
IF V184=1 THEN COMPUTE V197 = 3
IF V182=0 AND V183=0 AND V184=0 THEN COMPUTE V197 = 4
WRITE AGUA
**
AVERAGE AUX1 = V191, V173, V174
COUNT AUX2 = V191, V173, V174
COMPUTE V194 = AUX1*AUX2
COMPUTE V196 = V194/V195
IF V41<=2 THEN COMPUTE V198 = V171
IF V54<=2 THEN COMPUTE V199 = V172
WRITE AGUA
**
IF V18=1 AND V19=1 AND V20=1 THEN COMPUTE V206 = 1
IF V18=0 OR V19=0 OR V20=0 THEN COMPUTE V206 = 0
WRITE AGUA
**
IF V37=3 THEN COMPUTE V208=V175
IF V37=7 THEN COMPUTE V208=V193
IF V37=9 THEN COMPUTE V208=V193
WRITE AGUA
**
COMPUTE V209 = LOG(V208)
WRITE AGUA
**
IF V25=0 THEN COMPUTE V205=(V27-V26)
IF V24=0 THEN COMPUTE V206=(V28-V26)
WRITE AGUA

```

Appendix G

CODEBOOK

ENCUESTA DE AGUA POTABLE Y SANEAMIENTO RELACION DE VARIABLES (CODEBOOK)

V1-# ENCUESTA	V23-TIENE SERVICIO TELEFONO
V2-PROVINCIA	1=SI
V3-CIUDAD	0=NO
V4-SECTOR	V24-VIV CONECTADA A RED ALCANT
V5-PARROQUIA	1=SI
V6-BARRIO O COOPERATIVA	0=NO
V7-# HOGARES EN LA VIVIENDA	V25-VIV CONECTADA A RED A.GUA P
V8-# PERSONAS EN LA VIVIENDA	1=SI 0=NO
V9-# PERSONAS EN EL HOGAR	V26-\$ CREE QUE VALE LA VIVIENDA
V10-TIPO VIVIENDA	V27-\$ LA CASA SI CONECTA A RED AGUA
1=CASA UNIFAMILIAR	V28-\$ LA CASA SI CONECTA A RED ALCA
2=CASA BIFAMILIAR	V29-\$ M2 TIERRA EN EL LUGAR
3=DEPARTAMENTO	V30-TENENCIA
4=CUARTOS	1=PROPIA TITULO
5=OTROS	2=PROPIA NO TITULO
V11-AREA LOTE	3=ARRENDATARIO
V12-AREA CONSTRUIDA	4=ANTICRESIS
V13-# CUARTOS EN LA VIVIENDA	5=OTRO
V14-# DORMITORIOS EN LA VIVIENDA	V31-# CUARTOS OCUPADOS HOGAR
V15-# BANOS EN LA VIVIENDA	V32-# DORMITORIOS HOGAR
V16-ANOS DE CONSTRUIDA	V33-# BANOS HOGAR
V17-SANITARIO LO USA SOLO LA VIVIENDA	V34-ANOS VIVIR AQUI
1=SI	V35-\$ POR ARRIENDO MENSUAL
0=NO	V36-\$ POR CREDITO MENSUAL
V18-COCINA LA USA SOLO LA VIVIENDA	V37-PRINCIPAL FUENTE DE AGUA
1=SI	1=CONEX RED PUB.
0=NO	2=CONEX RED PRI.
V19-PISOS EN MATERIAL DIF A TIERRA	3=TANQUERO
1=SI	4=AGUATERO
0=NO	5=VECINO
V20-PAREDES EN MATERIAL DURABLE	6=POZO
1=SI	7=GRIFO PUB.
0=NO	8=LLUVIA
V21-TECHOS EN MATERIAL DURABLE	9=VERTIENTE
1=SI	0=NINGUNA
0=NO	V38-CONSUMO MES FUENTE PRINCIPAL
V22-TIENE SERVICIO ENERGIA	
1=SI	
0=NO	

V39-UNIDAD DE VOLUMEN FUENTE PPAL
 1=TANQUE 55 GAL
 2=GALON 3.8 LTS
 3=TINA 10 LTS
 4=BALDE 10LTS
 5=LATA 5 GAL
 6=BALDE 20 LTS
 7=CISTERNA 1 M3
 V40-UNIDAD FUENTE PPAL EN LITROS
 V41-PAGA POR FUENTE PPAL
 1=SI,POR UNIDAD
 2=SI,GLOBAL
 3=NO PAGA
 V42-\$ PAGA POR UNIDAD FUENTE PPAL
 V43-\$ PAGA MENSUAL FUENTE PPAL
 V44-VIAJES SEMANA POR FUENTE PPAL
 V45-CANTIDAD POR VIAJE FUENTE PPAL
 V46-DISTANCIA CUADRAS A FUENTE PPAL
 V47-TIEMPO VIAJE FUENTE PPAL
 V48-TRABAJA QUIEN VIAJE FUENTE PPAL
 1=SI
 0=NO
 V49-CALIDAD AGUA FUENTE PPAL
 2=BUENA
 1=REGULAR
 0=MALA
 V50-SEGUNDA FUENTE DE AGUA
 1=CONEX RED PUB.
 2=CONEX RED PRI.
 3=TANQUERO
 4=AGUATERO
 5=VECINO
 6=POZO
 7=GRIFO PUB.
 8=LLUVIA
 9=VERTIENTE
 0=NINGUNA
 V51-CONSUMO MES FUENTE SEGUNDA
 V52-UNIDAD DE VOLUMEN FUENTE SECU
 1=TANQUE 55 GAL
 2=GALON 3.8 LTS
 3=TINA 10 LTS
 4=BALDE 10 LTS
 5=LATA 5 GAL
 6=BALDE 20 LTS
 7=CISTERNA 1 M3
 V53-UNIDAD FUENTE SECUN EN LITROS

V54-PAGA POR FUENTE SECUNDARIA
 1=SI,POR UNIDAD
 2=SI,GLOBAL
 3=NO PAGA
 V55-\$ PAGA POR UNIDAD FUENTE SECUND
 V56-\$ PAGA MENSUAL FUENTE SECUND
 V57-VIAJES SEMANA POR FUENTE SECUND
 V58-CANTIDAD POR VIAJE FUENTE SECUND
 V59-DISTANCIA CUADRAS A FUENTE
 SECUND
 V60-TIEMPO VIAJE FUENTE SECUNDARIA
 V61-TRABAJA QUIEN VIAJE FUENTE
 SECUND
 1=SI
 0=NO
 V62-CALIDAD AGUA FUENTE SECUNDARIA
 2=BUENA
 1=REGULAR
 0=MALA
 V63-SUFICIENTE AGUA CONSUMIDA
 1=SI
 0=NO
 V64-CONSUMO SI CONECTA A RED AGUA
 1=LO MISMO
 2=UN POCO MAS
 3=MAS DEL DOBLE
 V65-FUENTE AGUA BEBER
 1=CONEXION
 2=EMBOTELLADA
 3=TANQUERO
 4=AGUATERO
 5=VECINO
 6=POZO
 7=GRIFO
 8=LLUVIA
 9=VERTIENTE
 V66-FUENTE AGUA COCINAR
 1=CONEXION
 2=EMBOTELLADA
 3=TANQUERO
 4=AGUATERO
 5=VECINO
 6=POZO
 7=GRIFO
 8=LLUVIA
 9=VERTIENTE

V67-FUENTE AGUA BANARSE

- 1=CONEXION
- 2=EMBOTELLADA
- 3=TANQUERO
- 4=AGUATERO
- 5=VECINO
- 6=POZO
- 7=GRIFO
- 8=LLUVIA
- 9=VERTIENTE

V68-FUENTE AGUA LAVAR ROPA

- 1=CONEXION
- 2=EMBOTELLADA
- 3=TANQUERO
- 4=AGUATERO
- 5=VECINO
- 6=POZO
- 7=GRIFO
- 8=LLUVIA
- 9=VERTIENTE

V69-FUENTE AGUA LAVAR UTENS

- 1=CONEXION
- 2=EMBOTELLADA
- 3=TANQUERO
- 4=AGUATERO
- 5=VECINO
- 6=POZO
- 7=GRIFO
- 8=LLUVIA
- 9=VERTIENTE

V70-FUENTE AGUA BANAR ANIM

- 1=CONEXION
- 2=EMBOTELLADA
- 3=TANQUERO
- 4=AGUATERO
- 5=VECINO
- 6=POZO
- 7=GRIFO
- 8=LLUVIA
- 9=VERTIENTE

V71-PAGA 10 S * 55 GALONES

- 1=SI
- 0=NO

V72-PAGA 20 S * 55 GALONES

- 1=SI
- 0=NO

V73-PAGA 50 S * 55 GALONES

- 1=SI
- 0=NO

V74-PAGA 100 S * 55 GALONES

- 1=SI
- 0=NO

V75-MAX PAGAR * 55 GALONES

V76-MAX PAGAR * ACOMETIDA AGUA POTABLE

V77-\$ A PAGAR AL MES * ACOMETIDA

V78-EVACUA AGUAS SERVIDAS

- 1=RED ALC. PUB.
- 2=RED ALC. PRI.
- 3=POZO S.

4=LETRINA

5=ACEQUIA-RIO

6=CIELO ABIERTO

V79-VECES/ANO LIMPIA POZO SEPTICO

V80-\$ * CADA LIMPIEZA POZO SEPTICO

V81-CADA /MESES REMPLAZA LETRINA

V82-\$ * REPLAZO LETRINA

V83-INDISPENSABLE ALCANTARILLADO

- 1=SI
- 0=NO

V84-PAGA 100 S/MES * ALCANTARILLADO

- 1=SI
- 0=NO

V85-PAGA 200 S/MES * ALCANTARILLADO

- 1=SI
- 0=NO

V86-PAGA 500 S/MES * ALCANTARILLADO

- 1=SI
- 0=NO

V87-PAGA 1000 S/MES * ALCANTARILLADO

- 1=SI
- 0=NO

V88-MAX A PAGAR/MES *

ALCANTARILLADO

V89-SE INUNDA O LLUVIA ES PROBLEMA

- 1=SI
- 0=NO

V90-\$ * EVITAR DANOS LLUVIA

V91-# MUJERES EN HOGAR

V92-# NINOS 0-11

V93-# JOVENES 12-17

V94-# PERSONAS 18-40

V95-# PERSONAS 41-65

V96-# PERSONAS + 65

V97-INGRESO JEFE HOGAR

V98-EDAD-JEFE-HOGAR

V99-ESCOLARIDAD JEFE HOGAR

V100-SEXO JEFE HOGAR
 1=HOMBRE
 0=MUJER

V101-NACIO CIUDAD JEFE HOGAR
 1=SI
 0=NO

V102-SITU LABORAL JEFE HOGAR
 1=TRABAJA T. COMP.
 2=TRABAJA T. PARC.
 3=BUSCA TRABAJO
 4=JUBILADO
 5=OTRA

V103-ACTI ECONOMICA JEFE HOGAR
 1=AGRICULT-GANADE.
 2=MINAS-CANTERAS
 3=INDUSTRIA
 4=AGUA-ELECTRIC.
 5=CONSTRUCCION
 6=COMERCIO
 7=TRANSP-COMUNIC.
 8=SERV. FINANCIER.
 9=SERV. PERSONAL.
 0=ADMON. PUBLICA

V104-CATE OCUPACION JEFE HOGAR
 1=OBRERO
 2=EMPLEADO
 3=PATRONO-EMPLE
 4=CTA. PROPIA
 5=OTRA

V105-INGRESO PERSONA 2
 V106-EDAD PERSONA 2
 V107-ESCOLARIDAD PERSONA 2
 V108-SEXO PERSONA 2
 1=HOMBRE
 0=MUJER

V109-NACIO CIUDAD PERSONA 2
 1=SI
 0=NO

V110-SITU LABORAL PERSONA 2
 1=TRABAJA T. COMP.
 2=TRABAJA T. PARC.
 3=BUSCA TRABAJO
 4=JUBILADO
 5=OTRA

V111-ACTI ECONOMICA PERSONA 2
 1=AGRICULT-GANADE.
 2=MINAS-CANTERAS
 3=INDUSTRIA
 4=AGUA-ELECTRIC.
 5=CONSTRUCCION
 6=COMERCIO
 7=TRANSP-COMUNIC.
 8=SERV. FINANCIER.
 9=SERV. PERSONAL.
 0=ADMON. PUBLICA

V112-CATE OCUPACION PERSONA 2
 1=OBRERO
 2=EMPLEADO
 3=PATRONO-EMPLE
 4=CTA. PROPIA
 5=OTRA

V113-INGRESO PERSONA 3
 V114-EDAD PERSONA 3
 V115-ESCOLARIDAD PERSONA 3
 V116-SEXO PERSONA 3
 1=HOMBRE
 0=MUJER

V117-NACIO CIUDAD PERSONA 3
 1=SI
 0=NO

V118-SITU LABORAL PERSONA 3
 1=TRABAJA T. COMP.
 2=TRABAJA T. PARC.
 3=BUSCA TRABAJO
 4=JUBILADO
 5=OTRA

V119-ACTI ECONOMICA PERSONA 3
 1=AGRICULT-GANADE.
 2=MINAS-CANTERAS
 3=INDUSTRIA
 4=AGUA-ELECTRIC.
 5=CONSTRUCCION
 6=COMERCIO
 7=TRANSP-COMUNIC.
 8=SERV. FINANCIER.
 9=SERV. PERSONAL.
 0=ADMON. PUBLICA

V120-CATE OCUPACION PERSONA 3
 1=OBRERO
 2=EMPLEADO
 3=PATRONO-EMPLE
 4=CTA. PROPIA
 5=OTRA

V121-INGRESO PERSONA 4
V122-EDAD PERSONA 4
V123-ESCOLARIDAD PERSONA 4
V124-SEXO PERSONA 4
1=HOMBRE
0=MUJER
V125-NACIO CIUDAD PERSONA 4
1=SI
0=NO
V126-SITU LABORAL PERSONA 4
1=TRABAJA T. COMP.
2=TRABAJA T. PARC.
3=BUSCA TRABAJO
4=JUBILADO
5=OTRA
V127-ACTI ECONOMICA PERSONA 4
1=AGRICULT-GANADE.
2=MINAS-CANTERAS
3=INDUSTRIA
4=AGUA-ELECTRIC.
5=CONSTRUCCION
6=COMERCIO
7=TRANSP-COMUNIC.
8=SERV. FINANCIE.
9=SERV. PERSONAL.
0=ADMN. PUBLICA
V128-CATE OCUPACION PERSONA 4
1=OBRERO
2=EMPLEADO
3=PATRONO-EMPLE
4=CTA. PROPIA
5=OTRA
V129-INGRESO PERSONA 5
V130-EDAD PERSONA 5
V131-ESCOLARIDAD PERSONA 5
V132-SEXO PERSONA 5
1=HOMBRE
0=MUJER
V133-NACIO CIUDAD PERSONA 5
1=SI
0=NO
V134-SITU LABORAL PERSONA 5
1=TRABAJA T. COMP.
2=TRABAJA T. PARC.
3=BUSCA TRABAJO
4=JUBILADO
5=OTRA
V135-ACTI ECONOMICA PERSONA 5
1=AGRICULT-GANADE.
2=MINAS-CANTERAS
3=INDUSTRIA
4=AGUA-ELECTRIC.
5=CONSTRUCCION
6=COMERCIO
7=TRANSP-COMUNIC.
8=SERV. FINANCIE.
9=SERV. PERSONAL.
0=ADMN. PUBLICA
V136-CATE OCUPACION PERSONA 5
1=OBRERO
2=EMPLEADO
3=PATRONO-EMPLE
4=CTA. PROPIA
5=OTRA
V137-INGRESO PERSONA 6
V138-EDAD PERSONA 6
V139-ESCOLARIDAD PERSONA 6
V140-SEXO PERSONA 6
1=HOMBRE
0=MUJER
V141-NACIO CIUDAD PERSONA 6
1=SI
0=NO
V142-SITU LABORAL PERSONA 6
1=TRABAJA T. COMP.
2=TRABAJA T. PARC.
3=BUSCA TRABAJO
4=JUBILADO
5=OTRA
V143-ACTI ECONOMICA PERSONA 6
1=AGRICULT-GANADE.
2=MINAS-CANTERAS
3=INDUSTRIA
4=AGUA-ELECTRIC.
5=CONSTRUCCION
6=COMERCIO
7=TRANSP-COMUNIC.
8=SERV. FINANCIE.
9=SERV. PERSONAL.
0=ADMN. PUBLICA
V144-CATE OCUPACION PERSONA 6
1=OBRERO
2=EMPLEADO
3=PATRONO-EMPLE
4=CTA. PROPIA
5=OTRA

V145-INGRESO PERSONA 7
V146-EDAD PERSONA 7
V147-ESCOLARIDAD PERSONA 7
V148-SEXO PERSONA 7
1=HOMBRE
0=MUJER
V149-NACIO CIUDAD PERSONA 7
1=SI
0=NO
V150-SITU LABORAL PERSONA 7
1=TRABAJA T. COMP.
2=TRABAJA T. PARC.
3=BUSCA TRABAJO
4=JUBILADO
5=OTRA
V151-ACTI ECONOMICA PERSONA 7
1=AGRICULT-GAN,^DE.
2=MINAS-CANTERAS
3=INDUSTRIA
4=AGUA-ELECTRIC.
5=CONSTRUCCION
6=COMERCIO
7=TRANSP-COMUNIC.
8=SERV. FINANCIER.
9=SERV. PERSONAL.
0=ADMON. PUBLICA
V152-CATE OCUPACION PERSONA 7
1=OBRERO
2=EMPLEADO
3=PATRONO-EMPLE
4=CTA. PROPIA
5=OTRA
V153-\$ MENSUAL EN ALIMENTOS
V154-\$ MENSUAL EN VIVIENDA
V155-\$ MENSUAL EN AGUA POTABLE
V156-\$ MENSUAL EN ENERGIA ELECTRICA
V157-\$ MENSUAL EN ROPA
V158-\$ MENSUAL EN OTROS
V159-DIA DE ENTREVISTA
V160-ENTREVISTADO ES JEFE DEL HOGAR
1=SI
0=NO
V161-MANZANA
V162-INGRESO-FLIAR-TOTAL
V163-GASTO-FLIAR-TOTAL
V164-INGRESO-FLIAR-PERCAP
V165-RELACION-GASTO-VIV/INGRESO
V166-#PERS/CUARTO-HOGAR
V167-#PERSONAS/DORMIT-HOGAR
V168-VALOR-TERRENO
V169-VALOR-CONSTRUCCION
V170-VR-ADICIONAL-VIV-POR-ALCANT
V171-CONS-FUENTE1
V172-CONS-FUENTE2
V173-PRECIO-FUENTE1
V174-PRECIO-FUENTE2
V175-TIEMPO-FUENTE1
V176-TIEMPO-FUENTE2
V177-GASTO-FUENTE1
V178-GASTO-FUENTE2
V179-COSTO-OPORT-FUENTE1
V180-COSTO-OPORT-FUENTE2
V181-CONSUMO-AGUA-TOTAL
V182-TIEMPO-FUENTES-1Y2
V183-PAGO-REAL-AGUA-TOTAL
V184-PAGO-REAL-AGUA/M3
V185-DISPOS-PAGAR-AGUA/M3
V186-COSTO-LIMP-POZO-MES
V187-COSTO-LETRINA-MES
V188-COSTO-OPORT-AGUA-TOTAL
V189-PAGO+COSTO-PORT-AGUA-TOTAL
V190-PAGO+COSTO-PORT-AGUA/M3
V191-RELACION-GASTO-AGUA/INGRESO
V192-RELACION-GASTO-ENER/INGRESO
V193-COSTO-OPORT-AGUA/M3
V194-AUX1
V195-AUX2
V196-LOG-INGRESO
V197-LOG-VR-ADIC-ACUEDUC
V198-LOG-VR-ADIC-ALCANTA
V199-LOG-CONS-AGUA
V200-LOG-GAST-AGUA
V201-LOG-GAST-AGUA/M3
V202-LOG-DISP-PAGAR-AGUA/M3
V203-LOG-COSTO-PORT-AGUA
V204-LOG-GAST+COSTO-PORT-AGUA
V205-LOG-COSTO-PORT-AGUA/M3
V206-LOG-GAST+COSTO-PORT-AGUA/M3
V207-LOG-DISP-PAGAR-ACOMET-ACUE
V208-LOG-DISP-PAGAR-ACOMET-ACUE/ME
V209-LOG-DISP-PAGAR-ALCANTA
V210-LOG-DISP-PAGAR-EVITAR-LLUVIA
V211-CONSUMO-PAGADO
V212-CONSUMO-CON-COSTO-PORT
V213-LOG-CONSUMO-PAGADO
V214-LOG-CONS-CON-COSTO-PORT
V215-AGUA-BUENA-O-REGULAR
V216-DISP-PAGAR-AGUA-MES

V170-REL-ARRIEN-AMORT/INGRESO
V171-CONSUMO-FUENTE1
V172-CONSUMO-FUENTE2
V173-VR-PAGADO-FUENTE1
V174-VR-PAGADO-FUENTE2
V175-PRECIO-FUENTE1
V176-PRECIO-FUENTE2
V177-VR-PAGADO-TOTAL
V178-RELAC-VR-PAGO-AGUA/INGRESO
V179-RELAC-GASTO-AGUA/INGRESO
V180-RELAC-GASTO-ENERG/INGRESO
V181-DAP/M3-AGUA
V182-CONECTADA-RED-AP-Y-ALCAN
1=ESTA CONECTADA
0=NO ESTA CONECT
V183-CONECT-SOLO-RED-AP
1=ESTA CONECTADA
0=NO ESTA CONECT
V184-CONECT-SOLO-RED-ALCA
1=ESTA CONECTADA
0=NO ESTA CONECT
V185-VR-ADIC-POR-RED-AP-Y-ALCA
V186-VR-ADIC-POR-RED-AP
V187-VR-ADIC-POR-RED-ALCAN
V188-COSTO-LETRINA-MES
V189-COSTO-LIMP-POZO-MES
V190-COSTO-OPORT-DESAG-MES
V191-COSTO-OPORT-AGUA-MES
V192-CANT-AGUA-NO-PAGADA
V193-COSTO-OPORT-AGUA/M3
V194-VALOR-TOTAL-AGUA-MES
V195-CANT-TOTAL-AGUA-MES
V196-PRECIO-OPORT/M3
V197-COMBINACION-SERVICIOS
1=AGUA POT Y ALCAN
2=SOLO AGUA POTABL
3=SOLO ALCANTARILL
4=NINGUNO
V198-CONS-PAGADO-FUENTE1
V199-CONS-PAGADO-FUENTE2
V200-CONS-PAGADO-TOTAL
V201-LOG-INGRESO-FLJAR
V202-LOG-CONS-PAGADO-FUENTE1
V203-LOG-CONS-PAGADO-FUENTE2
V204-LOG-PRECIO-FUENTE1
V205-VR-ADICIONAL-VIV-POR-
ACUEDUCTO
V206-VR-ADICIONAL-VIV-POR-ALCANTARI
V207-LOG-DISP-PAGAR-AGUA
V208-PRECIO-O-COSTOP/M3-FUENTE1
V209-LOG-PRECIO-O-COSTOP/M3-FUENTE1

Appendix H

FREQUENCY VARIABLES, STATISTICS, AND TABLES FOR THE HOUSEHOLD SURVEY

DISTRIBUCIONES DE FRECUENCIA DE VARIABLES DE LA ENCUESTA DE HOGARES

V30-TENENCIA	Number	Percent
1 = PROPIA TITULO	160	52.5 %
2 = PROPIA NO TITULO	100	32.8 %
3 = ARRENDATARIO	43	14.1 %
5 = OTRO	2	0.7 %
Total	305	100.0 %
Missing cases = 3		
Response percent = 99.0 %		

V37-PRINCIPAL FUENTE DE AGUA	Number	Percent
1 = CONEX RED PUB.	43	14.0 %
2 = CONEX RED PRI.	42	13.6 %
3 = TANQUERO	140	45.5 %
5 = VECINO	2	0.6 %
6 = POZO	2	0.6 %
7 = GRIFO PUB.	58	18.8 %
8 = LLUVIA	4	1.3 %
9 = VERTIENTE	17	5.5 %
Total	308	100.0 %
Missing cases = 0		
Response percent = 100.0 %		

DISTRIBUCIONES DE FRECUENCIA DE VARIABLES DE LA ENCUESTA DE HOGARES

V41-PAGA POR FUENTE PPAL	Number	Percent
1 = SI, POR UNIDAD	64	21.1 %
2 = SI, GLOBAL	155	51.2 %
3 = NO PAGA	64	27.7 %
Total	303	100.0 %
Missing cases = 5		
Response percent = 98.4 %		

V49-CALIDAD AGUA FUENTE PPAL	Number	Percent
0 = MALA	22	8.4 %
1 = REGULAR	144	55.2 %
2 = BUENA	95	36.4 %
Total	261	100.0 %
Missing cases = 47		
Response percent = 84.7 %		

DISTRIBUCIONES DE FRECUENCIA DE VARIABLES DE LA ENCUESTA DE HOGARES

V56-SEGUNDA FUENTE DE AGUA	Number	Percent
0 = NINGUNA	149	57.5 %
2 = CONEX RED PRI.	2	0.8 %
3 = TANQUERO	1	0.4 %
5 = VECINO	2	0.8 %
6 = POZO	7	2.7 %
7 = GRIFO PUB.	4	1.5 %
8 = LLUVIA	79	30.5 %
9 = VERTIENTE	15	5.8 %
Total	259	100.0 %

Missing cases = 49
Response percent = 84.1 %

V54-PAGA POR FUENTE SECUNDARIA	Number	Percent
1 = SI, POR UNIDAD	3	3.2 %
2 = SI, GLOBAL	4	4.3 %
3 = NO PAGA	86	92.5 %
Total	93	100.0 %

Missing cases = 215
Response percent = 30.2 %

DISTRIBUCIONES DE FRECUENCIA DE VARIABLES DE LA ENCUESTA DE HOGARES

V62-CALIDAD AGUA FUENTE SECUNDARIA	Number	Percent
-----	-----	-----
0 = MALA	23	20.4 %
1 = REGULAR	58	51.3 %
2 = BUENA	32	28.3 %
	-----	-----
Total	113	100.0 %
Missing cases = 195		
Response percent = 36.7 %		

V64-CONSUMO SI CONECTA A RED AGUA	Number	Percent
-----	-----	-----
1 = LO MISMO	103	40.9 %
2 = UN POCO MAS	144	57.1 %
3 = MAS DEL DOBLE	5	2.0 %
	-----	-----
Total	252	100.0 %
Missing cases = 56		
Response percent = 81.8 %		

ESTADÍSTICAS DESCRIPTIVAS DE VARIABLES DE LA ENCUESTA DE HOGARES

V26-¿ CREE QUE VALE LA VIVIENDA

Minimum = 80

Maximum = 20000

Mean = 2602.1162

Median = 2000

Mode = 2000

Standard deviation = 2591.8859

Standard error of the mean = 167.3055

95 Percent confidence interval around the mean = 2274.1975 - 2930.0349

99 Percent confidence interval around the mean = 2171.3044 - 3032.9280

Skewness = 2.8708

Quartiles:

1 = 1000

2 = 2000

3 = 3000

Deciles:

1 = 500

2 = 920.0001

3 = 1000

4 = 1500

5 = 2000

6 = 2000

7 = 3000

8 = 4000

9 = 5000

Valid cases = 241

Missing cases = 67

Response percent = 78.2 %

ESTADÍSTICAS DESCRIPTIVAS DE VARIABLES DE LA ENCUESTA DE HOGARES

V27-4 LA CASA SI CONECTA A RED AGUA

Minimum = 100

Maximum = 17000

Mean = 2716.6145

Median = 2300

Modes (Bimodal) = 2500 & 3000

Standard deviation = 2288.1959

Standard error of the mean = 171.5075

95 Percent confidence interval around the mean = 2380.4597 - 3052.7693

99 Percent confidence interval around the mean = 2274.9827 - 3158.2463

Skewness = 2.9695

Quartiles:

1 = 1200

2 = 2300

3 = 3200

Deciles:

1 = 700

2 = 1100

3 = 1500

4 = 2000

5 = 2300

6 = 2500

7 = 3000

8 = 3500

9 = 5000

Valid cases = 179

Missing cases = 129

Response percent = 58.1 %

ESTADÍSTICAS DESCRIPTIVAS DE VARIABLES DE LA ENCUESTA DE HOGARES

V26-6 LA CASA SI CONECTA A RED ALCA

Minimum = 150

Maximum = 10000

Mean = 2960.3571

Median = 2500

Modes (Binodal) = 2000 & 3000

Standard deviation = 2310.9460

Standard error of the mean = 219.3453

95 Percent confidence interval around the mean = 2530.4404 - 3390.2739

99 Percent confidence interval around the mean = 2395.5430 - 3525.1711

Skewness = 1.5121

Quartiles:

1 = 1300

2 = 2500

3 = 3500

Deciles:

1 = 800

2 = 1100

3 = 1400

4 = 2000

5 = 2500

6 = 3000

7 = 3340.0002

8 = 4000

9 = 6000

Valid cases = 112

Missing cases = 196

Response percent = 36.4 %

ESTADÍSTICAS DESCRIPTIVAS DE VARIABLES DE LA ENCUESTA DE HOSARES

V205-VR-ADICIONAL-VIV-FOR-ACUEDUCTO

Minimum = 20
Maximum = 5000
Mean = 661.1930
Median = 500
Mode = 500
Standard deviation = 666.9763

Standard error of the mean = 51.1547

95 Percent confidence interval around the mean = 560.9297 - 761.4563

99 Percent confidence interval around the mean = 529.4695 - 792.9164

Skewness = 2.4640

Quartiles:

1 = 200
2 = 500
3 = 1000

Deciles:

1 = 100
2 = 200
3 = 250
4 = 400
5 = 500
6 = 500
7 = 569.9997
8 = 1000
9 = 2000

Valid cases = 171
Missing cases = 137
Response percent = 55.5 %

ESTADÍSTICAS DESCRIPTIVAS DE VARIABLES DE LA ENCUESTA DE HOGARES

V201-VF-ADICIONAL-VIV-PO⁰-ALCANTARI

Mínimo = 50
 Máximo = 7000
 Mean = 1129.0079
 Median = 800
 Mode = 1000
 Standard deviation = 1312.5506
 Standard error of the mean = 131.2551
 95 Percent confidence interval around the mean = 871.7500 - 1386.2698
 95 percent confidence interval around the mean = 791.0281 - 1466.9917
 Skewness = 2.6592

Quartiles:

1 = 400
 2 = 800
 3 = 1000

Deciles:

1 = 200
 2 = 300
 3 = 400
 4 = 500
 5 = 800
 6 = 1000
 7 = 1000
 8 = 1380.0003
 9 = 2950.0008

Valid cases = 101
 Missing cases = 207
 Response percent = 32.8 %

ESTADÍSTICAS DESCRIPTIVAS DE VARIABLES DE LA ENCUESTA DE HOGARES

VIBS-VK-ADIC-POP-RED-AP-Y-ALCA

Minimum	=	100
Maximum	=	9000
Mean	=	1822.2222
Median	=	1300
Mode	=	1500
Standard deviation	=	1789.4006
Standard error of the mean	=	180.7568
95 Percent confidence interval around the mean	=	1467.9390 - 2176.5054
99 Percent confidence interval around the mean	=	1356.7736 - 2287.6709
Skewness	=	2.1523
Quartiles:		
1	=	600
2	=	1300
3	=	2000
Deciles:		
1	=	345.0000
2	=	600
3	=	800
4	=	1000
5	=	1300
6	=	1500
7	=	2000
8	=	2500
9	=	4000
Valid cases	=	99
Missing cases	=	209
Response percent	=	32.1 %

PROMEDIOS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterio Variable : V26-¿ CREE QUE VALE LA VIVIENDA

	Mean	S.D.	N	Pct.
For entire sample (Missing = 67)	2602.116	2597.280	241	78.2
V37-PRINCIPAL FUENTE DE AGUA				
1=CONEX RED PUB.	4913.793	4289.584	29	12.0
2=CONEX RED PRI.	3616.129	3026.890	31	12.9
3=TANQUERO	2054.360	1864.255	117	48.5
5=VECINO	1000.000	0.000	2	0.8
6=POZO	2000.000	1414.213	2	0.8
7=GRIFO PUB.	1960.227	1512.759	44	18.3
8=LLUVIA	2500.000	2121.321	2	0.8
9=VERTIENTE	2492.857	2397.904	14	5.8
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	2378.012	2302.176	161	65.8
2=CASA BIFAMILIAR	3053.125	3074.284	80	33.2
V6-BARRIO O COOPERATIVA				
01=S JOSE DE MONJ	2231.818	1697.048	33	13.7
02=ARGELIA	1950.000	1478.986	26	10.8
03=ORRERO INDEP	2723.529	2414.676	17	7.1
04=NUEVA AURORA	2480.000	1575.366	10	4.1
05=S ANITA NORTE	1780.000	1830.846	5	2.1
06=ECUATORIANA	2938.461	2074.815	26	10.8
07=LUCHA POBRES	1553.514	1580.923	37	15.4
08=COOP CARCELEN	2068.276	1933.180	29	12.0
09=COOP S FRANCIS	4807.692	3859.719	13	5.4
10=S ENRIQUE DE V	2296.154	2064.458	26	10.8
11=LA TOLA	7700.000	5945.119	10	4.1
12=EL PANECILLO	3300.000	2129.554	9	3.7
V30-TENENCIA				
=(missing)	1350.000	919.239	2	0.8
1=PROPIA TITULO	3091.539	2973.137	130	53.9
2=PROPIA NO TITULO	1907.177	1829.806	85	35.3
3=ARRENDATARIO	2582.609	2322.940	23	9.5
5=OTRO	1000.000	0.000	1	0.4
V41-PAGA POR FUENTE P PAL				
=(missing)	3112.500	2795.942	4	1.7
1=SI, POR UNIDAD	1608.039	1309.580	51	21.2
2=SI, GLOBAL	3228.000	3128.656	125	51.9
3=NO PAGA	2117.213	1738.219	61	25.3

PROMEDIOS DESASÍSEADOS (breakdown) DE LA ENCUESTA DE HOGARES

(Criterion Variable : V162-INGRESO-FLIAR-TOTAL)

	Mean	S.D.	N	Pct.
For entire sample (Missing = 11)	77.010	49.554	297	96.4
V37-PRINCIPAL FUENTE DE AGUA				
1=CONEX RED PUB.	94.977	63.127	43	14.5
2=CONEX RED PRI.	81.632	52.163	38	12.8
3=TANQUERO	74.463	44.990	136	45.8
5=VECINO	69.000	41.012	2	0.7
6=POZO	46.000	19.799	2	0.7
7=BRIFO PUB.	71.228	50.010	57	19.2
8=LLUVIA	76.000	46.130	3	1.0
9=VERTIENTE	65.063	33.922	16	5.4
V16-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	73.005	45.556	195	65.7
2=CASA BIFAMILIAR	84.667	55.857	102	34.3
V6-BARRIO O COOPERATIVA				
=(missing)	44.000	33.941	2	0.7
01=S JOSE DE MONJ	76.062	57.342	48	16.2
02=ARGELIA	70.214	33.557	28	9.4
03=ORRERO INDEP	102.750	67.235	20	6.7
04=NUEVA AURORA	70.300	65.705	10	3.4
05=S ANITA NORTE	69.600	47.406	5	1.7
06=ECUATORIANA	74.607	58.190	28	9.4
07=LUCHA PORRES	58.692	26.533	39	13.1
08=CCOP CARCELEN	73.757	31.940	37	12.5
09=CCOP S FRANCIS	74.722	35.140	18	6.1
10=S ENRIQUE DE V	70.871	34.490	31	10.4
11=LA TOLA	133.929	76.464	14	4.7
12=EL PANECILLO	90.412	49.138	17	5.7
V30-TENENCIA				
=(missing)	140.000	101.489	3	1.0
1=PROPIA TITULO	84.497	55.342	155	52.2
2=PROPIA NO TITULO	66.375	35.659	96	32.3
3=ARRENDATARIO	69.610	44.400	41	13.8
5=DTRD	64.500	30.406	2	0.7
V41-PAGA POR FUENTE PPAL				
=(missing)	50.000	20.000	3	1.0
1=SI, POR UNIDAD	62.000	27.691	60	20.2
2=SI, GLOBAL	86.795	56.881	151	50.8
3=NO PAGA	71.036	44.459	83	27.9

PROBLEMAS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterion Variable : V171-CONSUMO-FUENTE1

	Mean	S.D.	N	Pct.
For entire sample (Missing = 55)	4.588	5.580	253	82.1
V37-PRINCIPAL FUENTE DE AGUA				
1=CONEX RED PUB.	5.405	7.528	25	9.9
2=CONEX RED PRI.	3.286	3.768	17	6.7
3=TANQUERO	4.439	3.765	133	52.6
5=VECINO	1.957	0.618	2	0.8
6=POZO	1.320	0.622	2	0.8
7=GRIFO PUB.	5.921	8.647	55	21.7
8=LLUVIA	2.347	1.852	3	1.2
9=VERTIENTE	2.516	2.290	16	6.3
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	4.625	6.175	170	67.2
2=CASA RIFAMILIAR	4.513	4.136	83	32.8
V6-BARRIO O COOPERATIVA				
=(missing)	1.120	0.000	1	0.4
01=S JOSE DE MONS	6.656	9.090	46	18.2
02=ARSELIA	2.644	3.361	28	11.1
03=OBRERO INDEP	7.248	3.126	20	7.9
04=NUEVA AURORA	2.971	2.222	9	3.6
05=S ANITA NORTE	3.204	2.472	5	2.0
06=ECUATORIANA	1.334	1.176	15	5.9
07=LUCHA POBRES	3.853	5.356	40	15.8
08=COOP CARCELEN	3.882	1.719	34	13.4
09=COOP S FRANCIS	4.115	4.242	12	4.7
10=S ENRIQUE DE V	4.204	2.659	29	11.5
11=LA TOLA	8.595	9.296	13	5.1
12=EL PANECILLO	2.640	0.000	1	0.4
V30-TENENCIA				
=(missing)	5.940	5.174	3	1.2
1=PROPIA TITULO	4.673	4.132	123	48.6
2=PROPIA NO TITULO	4.650	7.345	95	37.5
3=ARRENDATARIO	3.695	4.297	30	11.9
5=OTRO	7.810	7.311	2	0.8
V41-PAGA POR FUENTE PPAL				
=(missing)	2.347	1.016	3	1.2
1=SI, POR UNIDAD	3.792	4.480	61	24.1
2=SI, GLOBAL	4.713	4.448	112	44.3
3=NO PAGA	5.125	7.580	77	30.4

PRMEDIOS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterion Variable : V173-VR-PASADO-FUENTE1

	Mean	S.D.	N	Pct.
For entire sample (Missing = 100)	2392.236	2375.591	268	67.5
V37-PRINCIPAL FUENTE DE AGUA				
1=CONEX RED. PUB.	1732.024	1739.790	41	19.7
2=CONEX RED. PRI.	492.105	213.885	38	18.3
3=TANQUEO	3229.936	2512.021	126	60.6
9=VERTIENTE	300.000	100.000	3	1.4
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	2348.475	2335.672	139	66.8
2=CASA BIFAMILIAR	2480.391	2469.068	69	33.2
V6-BARRIO O COOPERATIVA				
=(missing)	1320.000	0.000	1	0.5
01=S JOSE DE MONJ	3766.667	3108.591	3	1.4
02=ARIELIA	286.000	207.533	5	2.4
03=OBREIRO INDEP	5906.250	2583.400	16	7.7
04=NUEVA AURORA	696.250	396.194	8	3.8
05=S ANITA MORTE	300.000	0.000	1	0.5
06=ECUATORIANA	385.000	109.190	30	14.4
07=LUCHA PORRES	1685.488	1752.949	41	19.7
08=COOP CARCELEN	4547.000	1969.103	31	14.9
09=COOP S FRANCIS	625.000	262.678	16	7.7
10=S ENRIQUE DE V	3307.692	1974.218	26	12.5
11=LA TOLA	2680.714	2300.329	14	6.7
12=EL PANECILLO	1750.813	1209.232	16	7.7
V30-TENENCIA				
=(missing)	2250.000	1060.660	2	1.0
1=PROPIA TITULO	2591.755	2440.495	110	52.9
2=PROPIA NO TITULO	2569.779	2477.289	68	32.7
3=ARRENDATARIO	1200.259	1510.851	27	13.0
5=DTRO	840.000	0.000	1	0.5
V41-PAGA POR FUENTE PPAL				
1=SI, PDR UNIDAD	2177.679	1860.571	56	26.9
2=SI, GLOBAL	2471.283	2540.099	152	73.1
V78-EVACUA AGUAS SERVIDAS				
=(missing)	2566.667	2372.060	6	2.9
1=RED ALC. PUB.	1912.506	2346.910	89	42.8
2=RED ALC. PRI.	3800.000	2804.282	26	12.5
3=POZO S.	3532.393	2329.882	28	13.5
4=LETRINA	2303.974	2003.706	39	18.8
5=ACEQUIA-RIO	956.667	566.245	3	1.4
6=CIELO ABIERTO	1267.059	1182.808	17	8.2

PRÓMEDIOS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterion Variable : V196-CONE-PASADO-FUENTE1

	Mean	S.D.	N	Pct.
For entire sample (Missing = 132)	4.353	4.439	176	57.1
V37-PRINCIPAL FUENTE DE AGUA				
1=CONEX RED PUB.	5.583	7.636	24	13.6
2=CONEX RED PRI.	2.690	2.913	16	9.1
3=TANQUERO	4.450	3.789	130	73.9
8=LLUVIA	1.760	0.000	1	0.6
9=VERTIENTE	1.818	1.370	5	2.8
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	4.010	4.465	119	67.6
2=CASA BIFAMILIAR	5.071	4.335	57	32.4
V6-BARRIO O COOPERATIVA				
01=S JOSE DE MONJ	4.940	4.147	3	1.7
02=ARGELIA	1.509	0.865	7	4.0
03=OSPERO INDEP	7.248	3.126	20	11.4
04=NUEVA AURORA	2.814	2.033	7	4.0
05=S ANITA NORTE	7.000	0.000	1	0.6
06=ECUATORIANA	1.334	1.176	15	8.5
07=LUCHA PORRES	3.853	5.356	40	22.7
08=COOP CARCELEN	3.973	1.660	33	18.8
09=COOP S FRANCIS	3.309	3.350	11	6.3
10=S ENRIQUE DE V	4.526	2.691	25	14.2
11=LA TOLA	8.595	9.296	13	7.4
12=EL PANECILLO	2.640	0.000	1	0.6
V30-TENENCIA				
=(missing)	5.830	7.311	2	1.1
1=PROPIA TITULO	4.363	3.945	90	51.1
2=PROPIA MD TITULO	4.216	4.883	66	37.5
3=ARRENDATARIO	4.761	5.297	17	9.7
5=DTRD	2.640	0.000	1	0.6
V41-PASA POR FUENTE PPAL				
=(missing)	2.347	1.016	3	1.7
1=SI, POR UNIDAD	3.792	4.480	61	34.7
2=SI, GLOBAL	4.713	4.448	112	63.6
V7B-EVACUA ASUAS SERVIDAS				
=(missing)	4.353	3.670	3	1.7
1=RED ALC. PUB.	5.024	5.407	59	33.5
2=RED ALC. PRI.	4.340	3.344	25	14.2
3=POZO S.	4.129	2.298	28	15.9
4=LETRIA4	4.336	5.357	42	23.9
5=ACEQUIA-RIO	2.567	0.773	3	1.7
6=CIELO ABIERTO	2.675	1.909	16	9.1

PROMEDIOS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterio Variable : V175-PRECIO-FUENTE1

	Mean	S.D.	N	Pct.
For entire sample (Missing = 145)	867.664	1507.311	163	52.9
V37-PRINCIPAL FUENTE DE AGUA				
1=CONEX RED PUB.	744.425	775.506	24	14.7
2=CONEX RED PRI.	363.543	352.412	16	9.8
3=TANQUERO	977.297	1702.621	120	73.6
9=VERTIENTE	156.938	59.834	3	1.8
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	914.382	1720.823	108	66.3
2=CASA BIFAMILIAR	775.926	967.157	55	33.7
V6-BARRIO O COOPERATIVA				
01=S JOSE DE MONJ	5635.101	8905.516	3	1.8
02=ARGELIA	129.735	17.598	4	2.5
03=ORRERO INDEP	930.923	555.409	16	9.8
04=NUEVA AURORA	343.074	268.716	7	4.3
05=S ANITA NORTE	42.857	0.000	1	0.6
06=ECUATORIANA	499.209	439.008	15	9.2
07=LUCHA POBRES	596.759	1007.610	39	23.9
08=COOP CARCELEN	1398.190	1422.875	28	17.2
09=COOP S FRANCIS	374.795	411.576	11	6.7
10=S ENRIQUE DE V	815.344	556.336	25	15.3
11=LA TOLA	930.534	922.009	13	8.0
12=EL PANECILLO	151.515	0.000	1	0.6
V30-TENENCIA				
=(missing)	1272.727	1414.213	2	1.2
1=PROPIA TITULO	1041.295	1959.749	79	48.5
2=PROPIA NO TITULO	749.814	938.662	65	39.9
3=ARRENDATARIO	472.839	496.370	16	9.8
5=OTRO	318.182	0.000	1	0.6
V41-PAGA POR FUENTE PPAL				
1=S1,POR UNIDAD	727.020	874.099	54	33.1
2=S1,GLOBAL	937.341	1737.308	109	66.9
V78-EVACUA AGUAS SERVIDAS				
=(missing)	1276.515	868.135	3	1.8
1=RED ALC. PUB.	940.485	2146.657	55	33.7
2=RED ALC. PRI.	1171.365	1652.487	23	14.1
3=POZO S.	803.028	435.536	25	15.3
4=LETKINA	767.952	1097.758	38	23.3
5=ACEQUIA-RIO	431.818	373.121	3	1.8
6=CIELO ABIERTO	525.644	396.766	16	9.8

PROMEDIOS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterion Variable : V195-CANT-TOTAL-AGUA-MES

	Mean	S.D.	N	Pct.
For entire sample (Missing = 51)	5.954	15.052	257	63.4
V37-PRINCIPAL FUENTE DE AGUA				
1=CONEX RED PUB.	5.662	7.525	25	9.7
2=CONEX RED PRI.	3.293	3.764	17	6.6
3=TANQUERO	6.467	19.272	135	52.5
5=VECINO	2.177	0.307	2	0.8
6=POZO	2.200	1.245	2	0.8
7=GRIFO PUB.	7.076	10.473	56	21.8
8=LLUVIA	2.215	2.601	4	1.6
9=VERTIENTE	2.863	2.594	16	6.2
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	4.891	6.154	172	66.9
2=CASA BIFAMILIAR	8.106	24.626	85	33.1
V6-BARRIO O COOPERATIVA				
=(missing)	1.120	0.000	1	0.4
01=S JOSE DE MONJ	6.599	9.025	47	18.3
02=ARBELIA	3.406	4.599	29	11.3
03=OBRERO INDEP	8.068	3.321	20	7.8
04=NUEVA AURORA	3.533	2.698	9	3.5
05=S ANITA NORTE	12.884	20.584	5	1.9
06=ECUATORIANA	1.828	2.209	15	5.8
07=LUCHA POBRES	9.955	35.159	40	15.6
08=COOP CARCELEN	3.801	1.766	35	13.6
09=COOP S FRANCIS	4.115	4.242	12	4.7
10=S ENRIQUE DE V	4.672	2.759	30	11.7
11=LA TOLA	8.598	9.296	13	5.1
12=EL PANECILLO	2.640	0.000	1	0.4
V30-TENENCIA				
=(missing)	6.087	5.390	3	1.2
1=PROPIA TITULO	4.898	4.390	125	48.6
2=PROPIA ND TITULO	7.860	23.794	97	37.7
3=ARRENDATARIO	4.025	4.341	30	11.7
5=OTRO	8.250	6.689	2	0.8
V41-PAGA POR FUENTE PPAL				
=(missing)	2.347	1.016	3	1.2
1=SI, PDR UNIDAD	7.909	28.517	61	23.7
2=SI, ELORAL	4.934	4.534	114	44.4
3=NO PAGA	6.055	9.124	79	30.7

PROMEDIOS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterion Variable : V33-DAP/M3-ASUA

	Mean	S.E.	N	Pct.
For entire sample (Missing = 48)	319.773	221.339	260	84.4
V37-PRINCIPAL FUENTE DE AGUA				
2=CONEX RED PRI.	318.182	283.371	38	14.6
3=TANQUERO	372.499	193.492	139	53.5
5=VECIND	1022.727	482.118	2	0.8
6=POZO	272.727	257.130	2	0.8
7=ESTIJO PUM.	164.969	114.752	58	22.3
8=LLUVIA	306.818	179.435	4	1.5
9=VERTIENTE	346.257	197.402	17	6.5
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	335.287	236.966	173	65.5
2=CASA DIFAMILIAR	280.924	183.819	87	33.5
V6-BARRIO O COOPERATIVA				
01=S JOSE DE MONJ	184.137	125.365	49	18.8
02=ARDELIA	271.212	190.798	30	11.5
03=OBRERO INDEF	272.727	204.545	19	7.3
04=NUEVA AMORA	238.636	156.454	10	3.8
05=S ANITA NORTE	79.545	22.727	4	1.5
06=ECUATORIANA	354.978	368.608	21	8.1
07=LUCHA POBRES	373.679	193.376	43	16.5
08=COSI' CARCELEN	436.118	170.230	37	14.2
09=CCOP S FRANCIS	252.841	110.057	16	6.2
10=S ENRIQUE DE V	464.223	238.706	31	11.9
V30-TENENCIA				
=(missing)	454.545	0.000	2	0.8
1=PROPIA TITULO	313.230	235.701	123	47.3
2=PROPIA ND TITULO	321.660	198.839	98	37.7
3=ARRENDATARIO	328.571	242.808	35	13.5
5=OTRO	340.909	160.706	2	0.8
V41-PAGA POR FUENTE PPAL				
=(missing)	336.364	168.856	5	1.9
1=SI, POR UNIDAD	371.449	175.682	64	24.6
2=SI, GLOBAL	360.759	244.525	109	41.9
3=NO PAGA	223.947	194.498	82	31.5
V78-EVACUA AGUAS SERVIDAS				
=(missing)	227.273	0.000	2	0.8
1=RED ALC. PUB.	250.675	219.232	101	38.8
2=RED ALC. PRI.	367.187	213.678	32	12.3
3=POZO S.	391.892	215.171	37	14.2
4=LETRINA	376.348	231.515	59	22.7
5=ACEQUIA-RIO	154.040	85.626	9	3.5
6=CIELO ABIERTO	376.364	139.358	20	7.7

PROMEDIOS DESAGREGADOS (breakdown) DE LA ENCUESTA DE HOGARES

Criterion Variable : V28-MAX A PAGAR/MES # ALCANTARILLADO

	Mean	S.D.	N	Pct.
For entire sample (Missing = 159)	591.114	740.169	149	46.4
V37-PRINCIPAL FUENTE DE AGUA				
2=CONEX RED PRI.	375.500	478.191	4	2.7
3=TANQUERO	620.711	714.489	104	69.8
5=VECINO	1150.000	494.975	2	1.5
7=GRIFO PUB.	406.316	474.789	19	12.8
8=LLUVIA	1450.000	2372.762	4	2.7
9=VERTIENTE	387.500	311.716	16	10.7
V10-TIPO VIVIENDA				
1=CASA UNIFAMILIAR	608.287	832.853	108	72.5
2=CASA BIFAMILIAR	545.878	410.673	41	27.5
V6-BARRIO O COOPERATIVA				
01=S JOSE DE MONJ	289.412	225.069	17	11.4
02=ARBELIA	598.947	1107.233	19	12.8
03=ORRERO INDEF	337.500	442.295	4	2.7
04=NUEVA AURORA	345.714	302.151	7	4.7
05=S ANITA MORTE	800.000	909.212	4	2.7
06=ECUATORIANA	600.000	565.685	2	1.3
07=LUCHA PORRES	622.500	786.582	40	26.8
08=COOP CARCELEN	596.571	398.371	28	18.8
09=COOP S FRANCIS	167.333	288.098	3	2.0
10=S ENRIQUE DE V	860.000	933.184	25	16.8
V30-TENENCIA				
=(missing)	1000.000	0.000	1	0.7
1=PROPIA TITULO	613.135	723.890	52	34.9
2=PROPIA NO TITULO	601.571	815.225	77	51.7
3=ARRENDATARIO	481.778	439.179	18	12.1
5=OTRO	200.000	0.000	1	0.7
V41-PAGA POR FUENTE PPAL				
=(missing)	1800.000	2771.281	3	2.0
1=SI, POR UNIDAD	618.687	695.036	53	35.6
2=SI, GLOBAL	609.893	715.034	56	37.6
3=NO PAGA	424.892	441.421	37	24.8
V78-EVACUA AGUAS SERVIDAS				
1=RED ALC. PUB.	200.000	0.000	1	0.7
2=RED ALC. PRI.	440.222	518.167	27	18.1
3=POZO S.	854.286	1089.345	35	23.5
4=LETRINA	600.000	691.789	57	38.3
5=ACEQUIA-RIO	237.778	117.237	9	6.0
6=CIELO ABIERTO	487.500	348.635	20	13.4

ESTADÍSTICAS DESCRIPTIVAS DE VARIABLES DE LA ENCUESTA DE HOGARES

Y153-COSTO-DEPDT-AGUA/M3

Minimum	=	3.1061
Maximum	=	17195
Mean	=	616.3495
Median	=	37.1970
Mode	=	Multi-Modal
Standard deviation	=	2446.8237
Standard error of the mean	=	346.0331
95 Percent confidence interval around the mean	=	-61.8755 - 1294.5745
99 Percent confidence interval around the mean	=	-274.6859 - 1507.3849
Skewness	=	6.1627
Quartiles:		
1	=	14.7738
2	=	37.1970
3	=	159.4185
Deciles:		
1	=	9.3035
2	=	13.9517
3	=	18.6046
4	=	18.8505
5	=	37.1970
6	=	70.6247
7	=	102.3594
8	=	287.9575
9	=	865.3015
Valid cases	=	51
Missing cases	=	257
Response percent	=	16.6 %

Task 3

RECOVERY OF THE COSTS OF INVESTMENT IN INFRASTRUCTURE PROJECTS

Prepared by Jorge Alfredo Infante

Appendix I

**STATUS AND ESTIMATED COMPLETION DATES FOR THE
ACTIVITIES CONTRIBUTING TO THE POLICY CHANGE**

A. EMAP-Q

1. Fees

1.1 Municipal ordinance reform that allows greater flexibility for the incorporation costs in fees.

STATUS: Draft bill in completion stages.

ESTIMATED COMPLETION DATE:

- | | |
|---|---------------|
| a) Approval by the Municipal Company Board: | May, 1990 |
| b) Approval of the Ordinance by the Council: | August, 1990 |
| c) Implementation of automatic correction system: | October, 1990 |

1.2 Gradual incorporation of new elements into the current polynomial formula so that it more truly reflects the costs of production and maintenance.

STATUS: Studies are going to be initiated.

ESTIMATED COMPLETION DATE:

- | | |
|---|---------------|
| a) Study of operating and maintenance costs | May, 1990 |
| b) Revaluation of assets | October, 1990 |

2. Cost Accounting

2.1 Submission of the proposal to the Comptroller General of the State for approval.

STATUS: The system is being implemented.

ESTIMATED COMPLETION DATE: May, 1990

2.2 Approval of the Accounting System

ESTIMATED COMPLETION DATE: June, 1990

3. Registration of Systems and Users

STATUS: The municipality is conducting this task.

ESTIMATED COMPLETION DATE: January, 1990

4. Leakage Analysis and Control

STATUS: This is an ongoing program, which is in the bidding process for macro-measurement, utilizing IDB credit resources.

ESTIMATED COMPLETION DATE: January, 1991

5. Complete Updating of Inventory

STATUS: Developing terms of reference in order to contract with a consulting firm.

ESTIMATED COMPLETION DATE: January, 1991

6. New Billing and Collection Systems

STATUS: The new system is in the testing stage.

ESTIMATED COMPLETION DATE: September, 1990

7. Installation of 27,000 water meters

STATUS: Completed

DATE COMPLETED: April, 1990

B. EMAP-Q

1. Fees

1.1 Study of ordinances and laws in order to determine the legal viability of implementing a sewer system fee.

STATUS: The study will be initiated within several days.

ESTIMATED COMPLETION DATE: July, 1990

1.2 Preparation of the ordinance for application of fees for industrial waste.

STATUS: The industry survey has already been completed, and the fee study is going to be initiated.

ESTIMATED COMPLETION DATE: June, 1990

1.3 Approval of the ordinance and of the fee charged for industrial waste.

ESTIMATED COMPLETION DATE: January, 1991

1.4 Approval of the ordinance authorizing implementation of the sewer system fee.

ESTIMATED COMPLETION DATE: Will depend on the results of the study.

2. Application of the New Cost Accounting System

STATUS: There is an offer of an accounting package, but it is basically a governmental system. The results obtained by EMAP-Q will be awaited.

ESTIMATED COMPLETION DATE: December, 1990

3. Registration of Systems

STATUS: The municipalities are conducting this task.

ESTIMATED COMPLETION DATE: January, 1991

4. Updating of Inventory

STATUS: In process.

ESTIMATED COMPLETION DATE: June, 1990

5. Administrative Strengthening of the Technical and Financial Areas

STATUS: A consultant has been hired and the task is in process.
They are also receiving support from the Training Institute.

ESTIMATED COMPLETION DATE: December, 1990

C. ETAPA-CUENCA

1. Fees

STATUS: Completed

DATE COMPLETED: March, 1990

2. Implementation of the Cost Accounting System

STATUS: The design of structure and programs is in progress.

ESTIMATED COMPLETION DATE: January, 1991

3. Registration of Users and Complete Micro-measurement

STATUS: In process.

ESTIMATED COMPLETION DATE: December, 1990

4. Leakage Control, Entire System

STATUS: The Plan is developed for IDB financing.

ESTIMATED COMPLETION DATE: January, 1991

Appendix J

METHODOLOGY FOR THE FINANCIAL ANALYSIS OF PROJECTS

INTRODUCCION

La metodología que se recomienda y que permite analizar la factibilidad financiera de los proyectos y a su vez nos da las pautas para calcular los niveles de tarifas necesarios para generar los ingresos que junto con otros recursos, tales como contribuciones, transferencias, recursos de préstamos, etc., garanticen cubrir los costos de operación, mantenimiento, administración, el servicio de la deuda, el valor de las inversiones en obras y equipos y las necesidades de capital de trabajo, se describe en este escrito. Lo anterior conduce a que las Empresas de Agua y Alcantarillado tengan una recuperación real de los costos con finanzas sanas y por lo consiguiente sean autosuficientes.

ANÁLISIS DE RENTABILIDAD Y TARIFAS NECESARIAS

Para el análisis y cálculo de los niveles tarifarios se debe tener en cuenta el criterio de autofinanciamiento, para lo cual el nivel de la tarifa media deberá cubrir los costos reales de prestación de los servicios y proveer un remanente que facilite el financiamiento de los programas de expansión de las Empresas. Este remanente se fija en función de una tasa de rentabilidad, la cual se define como la relación entre los ingresos netos de operación y el valor promedio de los activos netos revaluados actuales y proyectados.

CONSIDERACIONES DEL ANALISIS FINANCIERO SEGUN EL CRITERIO DE RENTABILIDAD

Se debe tener en cuenta que no necesariamente con el hecho de fijarse una tasa de rentabilidad se pueda garantizar el financiamiento de niveles razonables de inversiones y el servicio de la deuda, que en un periodo dado, serian necesarios para satisfacer un determinado nivel de demanda. Por lo que es necesario tener en cuenta las siguientes consideraciones para el analisis de los niveles tarifarios según el criterio de rentabilidad:

- a) Impone para fijar racionalmente la rentabilidad, criterios adecuados para estimar el valor de los activos de cada Empresa. Pues este valor depende no solo de su valor histórico (valor de adquisición), que implica un análisis de sus componentes en moneda local y extranjera, sino del costo actualizado de reposición de los mismos, es decir, el valor revaluado de esos activos que estarán representados por los que actualmente se encuentran en operación más los que se incorporarán y que corresponden al proyecto a ejecutarse.

No es extraño, que fallas administrativas y falta de experiencia en algunas Empresas hayan llevado a la ejecución de proyectos sobredimensionados y con costos

mucho mayores que los que serían adecuados. sobre todo en obras para barrios marginados donde las soluciones a la demanda de los servicios no se han diseñado y ejecutado con proyectos de bajo costo. trasladando a los consumidores o usuarios el costo de fallas administrativas o técnicas y resultando por lo tanto a veces casi imposible recuperar los costos y no siendo factibles financieramente los proyectos.

Por otra parte para que los proyectos sean factibles financieramente, es necesario tener en cuenta las permanentes innovaciones en ciertos campos de la técnica que han producido descensos en los costos que deben reflejarse en la proyección de los activos.

- b) Paralelamente, el nivel de depreciación que depende esencialmente del nivel de los activos y de sus probables tasas de obsolescencia, en términos de tiempo y tecnología, presenta el mismo problema ya analizado, que los proyectos estén sobredimensionados, su costo elevado y por consiguiente con un alto valor de depreciación, o en la mayoría de los casos no se cuenta con información confiable al respecto.
- c) Otra consideración que se debe tener en cuenta es que la relación ingreso neto/activos no es aplicable en ciertos casos extremos, pues en sistemas pequeños en donde los activos han sido casi totalmente depreciados estos

pueden generar altas tasas de rentabilidad pero sin que los ingresos sean suficientes para cubrir las necesidades.

ANALISIS DE LOS NIVELES TARIFARIOS PARA LA VIABILIDAD FINANCIERA DE LOS PROYECTOS SEGUN EL CRITERIO DE FLUJO DE CAJA

Por lo expuesto anteriormente, se hace indispensable efectuar la evaluación financiera de los proyectos para determinar los niveles de tarifas no solo con el criterio de rentabilidad, sino también por el análisis de flujo de caja, lo cual permite garantizar además de un estado financiero aceptable, en forma automática, la recuperación de costos, la cobertura del servicio de la deuda y las necesidades de expansión del sistema.

Además de lo anterior, es un buen principio de ordenamiento del proceso de PLANEACION-PROGRAMACION-CONTROL dentro de la empresa y también conduce a determinar el nivel de endeudamiento máximo de la misma y a tender a la autosuficiencia financiera.

VENTAJAS DEL ANALISIS FINANCIERO SEGUN EL CRITERIO DE FLUJO DE CAJA

El análisis según el criterio de flujo de caja tiene las siguientes ventajas:

- a) Orienta hacia la planeación sistemática de la Empresa, al partir de un objetivo principal que es satisfacer un determinado nivel de demanda (especialmente en barrios marginados) mediante un proyecto bien definido y adicionalmente muestra con facilidad los beneficios relativos de suplir dichos niveles.

- b) Permite a los directivos de las Empresas a orientar de un modo práctico recomendaciones concretas sobre el nivel de los gastos corrientes para una adecuada operación y mantenimiento de los sistemas.

- c) Permite empezar a efectuar en forma sistemática análisis sobre la capacidad de pago de los usuarios (mediante encuestas bien elaboradas y evaluación de resultados) para conocer las estructuras del presupuesto familiar, lo cual conlleva a estructuras tarifarias más equitativas, como por ejemplo, atender a las recomendaciones de organismos como la OMS, que sugiere cobrar el equivalente a un día de salario mínimo vital por 20 metros cúbicos de agua al mes a las clases más pobres de la población.

- d) Permite una aproximación racional a los niveles de endeudamiento que se hace necesario, porque vía préstamos se pueden financiar las inversiones en

proyectos, por cuanto el mecanismo de créditos permite extender en el tiempo los gastos de capital causados en intervalos muy cortos con relación a la vida útil de los proyectos.

e) Como consecuencia del logro de un flujo de caja positivo, se producen, en consecuencia, las tasas de rentabilidad necesarias del sistema con la información disponible y actualizada de los activos y depreciación de los mismos: así mismo, se puede usar la tasa de rentabilidad como un índice financiero de las Empresas de tamaño mediano y grande.

f) Finalmente, este procedimiento en sí metodiza adecuadamente la información necesaria para el análisis de la recuperación de los costos en general y por lo consiguiente para la evaluación financiera de los proyectos.

Para facilitar la comprensión de la metodología del análisis financiero de los proyectos y de la fijación de los niveles tarifarios con precios reales, así como de la recuperación de costos, a continuación se hace una explicación de los distintos pasos del análisis, en donde se combinan (según el caso) los criterios de rentabilidad y de flujo o balance de caja, mediante el cual se establecen las necesidades de recursos, las tarifas necesarias en función de la capacidad de pago de los usuarios y la factibilidad financiera de los

proyectos y su impacto en las finanzas de la Empresa.

EXPLICACION DE LOS PASOS DEL ANALISIS

(Los cálculos son para cada uno de los años del período en estudio)

- 1) Para empezar se hace una evaluación y proyección de los gastos de operación, mantenimiento y administración para el período en estudio, incluyendo los que se ocasionaran al entrar en operación el nuevo proyecto, a todos estos gastos los identificaremos con la letra "G".

- 2) Se efectúa el cálculo de la revaluación de todos los activos que se encuentran en operación y de los que se incorporarán durante el período en estudio, esta revaluación se efectúa adoptando un índice que sea representativo para actualizar el costo de los activos. Al valor revaluado de los activos lo representamos con "A".

- 3) Calculamos el valor de la depreciación correspondiente a los activos revaluados, en forma lineal y según los años de vida útil establecidos por grupos de activos, al valor de la depreciación para cada uno de los años del período de estudio lo identificamos con la letra "D".

- 4) Para todos los préstamos que estén vigentes se calcula el servicio de la deuda (capital más intereses) y lo denominamos "SD".
- 5) Se fija una tasa de rentabilidad "R". la cual depende del criterio que se adopte.
- 6) Se calculan los otros ingresos, diferentes de los provenientes por concepto de tarifas o por la venta de los servicios y los denominamos "OI". no se deben incluir ingresos por transferencias, ni recursos del crédito.
- 7) Conocidos los valores de las etapas anteriores y fijada la tasa de rentabilidad, se procede a determinar el nivel de ingresos "VS" por la venta de los servicios que cubran los costos (tarifas costeables) y generen la rentabilidad establecida (tarifas rentables), es decir:

$$VS = G + D + R.A - OI,$$
 donde R.A es el valor obtenido de multiplicar la tasa de rentabilidad R por el valor de los activos netos revaluados A. En este cálculo no se incluye el servicio de la deuda, ésta se incluirá para obtener más adelante el balance de caja; además y por lo general la depreciación de los activos revaluados más la rentabilidad son mayores que el servicio de la deuda.
- 8) Obtenido el nivel de ingresos, el paso siguiente

consiste en analizar la capacidad de pago potencial de los usuarios "F" para compararla con el nivel de ingresos por la venta de los servicios, o sea, establecer si es posible que puedan generar el nivel de ingresos calculados.

Si $VS-F$ es positivo, quiere decir que la capacidad de pago es inferior a los ingresos esperados y por lo tanto es factible reducir la tasa de rentabilidad R , hasta encontrar el equilibrio entre VS y F ; Si $VS-F$ es negativo o igual a cero, esto indica que la capacidad de pago es superior o igual a los ingresos esperados por la venta del servicio y por lo consiguiente se procede a la siguiente etapa.

- 9) Establecer la estructura de tarifas que genere los ingresos necesarios "VS" y la rentabilidad "R".
- 10) A partir de esta etapa se procede a analizar el flujo de caja, es decir, se establecen las inversiones en obras con los recursos disponibles "rd", tanto los propios como de los créditos vigentes "C", de la siguiente manera:

$$\text{Recursos Disponibles: } rd = (VS - G - SD) + C$$

- 11) Se obtiene del Área de Ingeniería el programa de

inversiones necesario "I". con las debidas prioridades, para satisfacer la demanda potencial para lograr una cobertura determinada de población en un periodo dado de tiempo.

- 12) Con base en el programa de inversiones se calcula el balance de caja "EC" para el periodo de tiempo definido, con el fin de establecer si con los recursos disponibles, tanto propios como de créditos vigentes, se pueden acometer las inversiones, así:

$$EC = rd + C - I$$

- 13) Si el balance de caja da superávit o es igual a cero, las tarifas rentables calculadas son suficientes y se pueden ejecutar las obras, en caso que sea deficitario se pasa a la siguiente etapa.

- 14) Se determina que parte del déficit para poder ejecutar las inversiones se puede financiar con nuevos recursos del crédito "C1".

- 15) Definida la parte del déficit que puede ser financiada con nuevos créditos, se calcula el servicio de la deuda para el posible nuevo crédito y la denominamos "SD1".

- 16) En seguida se procede a calcular el nuevo balance de caja "EC1", así:

$$EC1 = rd + C + C1 - (I + SD1)$$

17) Si el nuevo balance de caja resulta equilibrado o registra superávit, esto indica, que las tarifas originalmente calculadas son suficientes y se pueden acometer las obras. en caso contrario, que se presente nuevamente deficit en dicho balance, a pesar de disponer de un posible nuevo crédito, la siguiente etapa es:

18) Calcular los recaudos o ingresos necesarios, para suplir el deficit y ejecutar las obras con ingresos adicionales por la venta de los servicios "VS1", así:

$$VS1 = VS + EC1$$

lo cual indica que a los ingresos inicialmente calculados por venta del servicio se les agrega el deficit de caja y se obtienen los ingresos necesarios para suplirlo.

19) Una vez obtenido el nuevo nivel de ingresos por venta de los servicios se compara con la capacidad potencial de pago de los usuarios "F". Si $VS1 - F$ es negativo o igual a cero, indica que la capacidad de pago es superior o igual a los nuevos ingresos esperados y por lo tanto se puede ajustar la estructura de tarifas para generar ingresos en la magnitud VS1. Pero si $VS1 - F$ es positivo, quiere decir que la capacidad de pago es

inferior a los ingresos necesarios y por lo tanto se pasa a la última etapa.

- 20) Se presenta como último recurso una solicitud al Gobierno por una transferencia de capital equivalente a la diferencia entre VS_1 y F , diseñándose una nueva estructura de tarifas que produzca ingresos equivalentes a F . Si no es posible obtener los recursos del Gobierno se deben reducir las inversiones en un monto equivalente a la diferencia $VS_1 - F$.

Appendix K

MECHANISM FOR RECOVERING THE COSTS OF INVESTING IN DRINKING WATER AND/OR SEWER SYSTEMS IN IRREGULAR BARRIOS

ESCENARIO: No.1.- CON PASOS IGUALES - SISTEMA TRADICIONAL
 INFLACION: VARIABLE
 TASA DE INTERES ANUAL: 36% CON 5 AÑOS DE PLAZO TASA FIJA
 TASA DE DESCUENTO: IGUAL A LA INFLACION ANUAL
 COSTO ESTIMADO DE LA RED POR USUARIO: S/ 250,000
 AUMENTO DEL SALARIO MINIMO VITAL: 75% DE LA INFLACION ANUAL

AÑO	INFLACION	SALARIO MINIMO VITAL			PAGO NOMINAL		PAGO REAL (PR DEL NOMINAL)	
		ANUAL	ANUAL	MENSUAL	ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	S/ 384,000	S/ 32,000	29,852	S/ 114,624	9,552	S/ 76,416	6,368
2	40%	528,000	44,000	21,712	114,624	9,552	54,580	4,548
3	30%	686,400	57,220	16,787	114,624	9,552	41,567	3,449
4	20%	848,840	70,070	13,607	114,624	9,552	32,298	2,680
5	25%	1,030,029	85,835	11,107	114,624	9,552	25,838	2,153
6								
7								
8								
9								
10								
TOTAL:		S/ 3,439,249			S/ 570,120		S/ 231,122	

PAGO REAL TOTAL: S/ 231,122 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 92.45%

ESCENARIO:	NO.3 CON PAGOS IGUALES - SISTEMA TRADICIONAL
INFLACION:	VARIABLE
TASA DE INTERES ANUAL:	36% CON 10 AÑOS DE PLAZO (TASA FIJA)
TASA DE DESCUENTO:	IGUAL A LA INFLACION ANUAL
COSTO ESTIMADO DE LA RED POR USUARIO:	S/ 250,000
AUMENTO DEL SALARIO MINIMO VITAL:	75% DE LA INFLACION ANUAL

AÑO	INFLACION ANUAL	SALARIO MINIMO VITAL ANUAL		% DE PAGO DEL SMV	PAGO NOMINAL		PAGO REAL=VPN DEL NOMINAL	
		ANUAL	MENSUAL		ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	S/ 304,000	S/ 30,000	24.57%	S/ 94,359	S/ 7,863	S/ 62,900	S/ 5,240
2	40%	S/ 526,000	S/ 44,000	17.87%	S/ 94,359	S/ 7,863	S/ 44,933	S/ 3,744
3	30%	S/ 656,400	S/ 57,200	13.75%	S/ 94,359	S/ 7,863	S/ 34,504	S/ 2,888
4	25%	S/ 840,640	S/ 70,070	11.22%	S/ 94,359	S/ 7,863	S/ 27,651	S/ 2,304
5	25%	S/ 996,490	S/ 83,200	9.45%	S/ 94,359	S/ 7,863	S/ 22,121	S/ 1,840
6	25%	S/ 1'185,716	S/ 98,810	7.96%	S/ 94,359	S/ 7,863	S/ 17,697	S/ 1,475
7	25%	S/ 1'406,037	S/ 117,336	6.70%	S/ 94,359	S/ 7,863	S/ 14,157	S/ 1,180
8	25%	S/ 1'672,045	S/ 139,337	5.64%	S/ 94,359	S/ 7,863	S/ 11,326	S/ 944
9	25%	S/ 1'985,553	S/ 165,463	4.75%	S/ 94,359	S/ 7,863	S/ 9,061	S/ 755
10	25%	S/ 2'357,644	S/ 196,487	4.00%	S/ 94,359	S/ 7,863	S/ 7,249	S/ 604
TOTAL:		S/12'846,933			S/ 943,590	S/ 78,630	S/ 251,665	

PAGO REAL TOTAL: S/ 251,665 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 100.67%

ESCENARIO:	No.4 CON PAGOS IGUALES - SISTEMA TRADICIONAL
INFLACION:	IGUAL TODOS LOS AÑOS
TASA DE INTERES ANUAL:	36% CON 10 AÑOS DE PLAZO (TASA FIJA)
TASA DE DESCUENTO:	IGUAL A LA INFLACION ANUAL
COSTO ESTIMADO DE LA RED POR USUARIO:	S/ 250,000
AUMENTO DEL SALARIO MINIMO VITAL:	75% DE LA INFLACION ANUAL

AÑO	INFLACION ANUAL	SALARIO MINIMO VITAL			TASA DE PAGO DEL SRV	PAGO NOMINAL		PWSC REAL=VFN DEL NOMINAL	
		ANUAL	ANUAL	MENSUAL		ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	S/ 364,000	S/ 364,000	30,000	24.57%	S/ 94,359	S/ 7,963	S/ 62,900	S/ 5,242
2	50%	526,000	526,000	44,000	17.67%	94,359	7,963	41,937	3,455
3	50%	726,000	726,000	60,500	17.00%	94,359	7,963	27,956	2,300
4	50%	990,250	990,250	83,167	5.45%	94,359	7,963	16,639	1,557
5	50%	1 372,594	1 372,594	114,383	6.67%	94,359	7,963	12,426	1,030
6	50%	1 887,316	1 887,316	157,276	5.00%	94,359	7,963	8,264	0.98
7	50%	2 595,060	2 595,060	216,255	3.64%	94,359	7,963	5,523	4.58
8	50%	3 565,288	3 565,288	297,351	2.64%	94,359	7,963	3,682	3.07
9	50%	4 906,265	4 906,265	408,857	1.92%	94,359	7,963	2,454	2.05
10	50%	6 746,142	6 746,142	562,176	1.40%	94,359	7,963	1,636	1.36
TOTAL:		S/ 23 711,655				S/ 943,590		S/ 185,445	

PWSC REAL TOTAL: S/ 185,445 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 74.18%

ESCENARIO:
 INFLACION:
 TASA DE INTERES ANUAL:
 TASA DE DESCUENTO:
 COSTO ESTIMADO DE LA RED POR USUARIO:
 MOMENTO DEL SALARIO MINIMO VITAL:

NO. DE LOS PASES POR EL 1% DEL SP. : VECE LOS PASES
 VARIABLE
 NO SE PREDEFINE
 IGUAL A LA INFLACION ANUAL
 S/ 250,000
 75% DE LA INFLACION ANUAL

AÑO	INFLACION ANUAL	SALARIO MINIMO VITAL		% DE PAGO DEL SMV	PASE NOMINAL		PASE REAL=VPR DEL NOMINAL	
		ANUAL	MENSUAL		ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	S/ 354,000	S/ 32,000	14.00%	S/ 53,760	4,480	S/ 35,840	2,987
2	40%	S/ 528,000	S/ 44,000	14.00%	S/ 73,920	6,160	S/ 51,200	2,530
3	30%	S/ 686,400	S/ 57,200	14.00%	S/ 96,896	8,029	S/ 68,208	2,930
4	25%	S/ 848,848	S/ 70,070	14.00%	S/ 117,710	9,818	S/ 84,496	2,975
5	25%	S/ 998,498	S/ 83,208	14.00%	S/ 139,790	11,649	S/ 101,771	2,771
6	25%	S/ 1 185,716	S/ 96,810	14.00%	S/ 166,000	13,833	S/ 121,133	2,564
7	25%	S/ 1 408,037	S/ 117,336	14.00%	S/ 197,125	16,427	S/ 145,576	2,465
8	25%	S/ 1 672,045	S/ 139,337	14.00%	S/ 234,026	19,507	S/ 178,097	2,341
9	25%	S/ 1 985,553	S/ 165,463	14.00%	S/ 277,977	23,165	S/ 216,692	2,224
10	25%	S/ 2 357,544	S/ 196,487	14.00%	S/ 330,098	27,529	S/ 263,359	2,110
TOTAL:		S/ 12 046,933			S/ 1 686,571		S/ 314,363	

PASE REAL TOTAL: S/ 314,363 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 125.75%

ESCENARIO:	NO.6 LOS PAGOS SON EL 14% DEL SMV TODOS LOS AÑOS
INFLACION:	IGUAL TODOS LOS AÑOS
TASA DE INTERES ANUAL:	NO SE PREDEFINE
TASA DE DESCUENTO:	IGUAL A LA INFLACION ANUAL
COSTO ESTIMADO DE LA RED POR USUARIO:	S/ 250.000
AUMENTO DEL SALARIO MINIMO VITAL:	75% DE LA INFLACION ANUAL

AÑO	INFLACION ANUAL	SALARIO MINIMO VITAL		% DE PAGO DEL SMV	PAGO NOMINAL		PAGO REAL = PPA DEL NOMINAL	
		ANUAL	MENSUAL		ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	57,384,000	4,782,000	14.00%	8,037,600	4,468,900	29,642	2,967
2	50%	526,800	44,000	14.00%	73,920	6,102	32,850	2,708
3	50%	726,000	60,500	14.00%	103,640	8,470	38,116	2,518
4	50%	990,250	83,167	14.00%	139,755	11,640	27,000	2,300
5	50%	1,372,594	114,383	14.00%	192,163	16,813	25,300	2,100
6	50%	1,887,316	157,276	14.00%	264,224	22,819	23,197	1,933
7	50%	2,595,060	216,255	14.00%	362,306	30,276	21,264	1,772
8	50%	3,569,286	297,351	14.00%	499,549	41,629	19,492	1,624
9	50%	4,980,285	408,857	14.00%	686,888	57,240	17,667	1,489
10	50%	6,746,142	562,178	14.00%	944,460	78,705	16,370	1,365
TOTAL:		5/23,711,855			5/3,319,659		5/ 249,918	

PAGO REAL TOTAL: S/ 249,918 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 99.97

EJEMPLO: NO.7 LOS PAGOS SON EL 7.5% DEL SMV TODOS LOS AÑOS
 INFLACION: IGUAL TODOS LOS AÑOS
 TASA DE INTERES ANUAL: NO SE PREDEFINE
 TASA DE DESCUENTO: IGUAL A LA INFLACION ANUAL
 COSTO ESTIMADO DE LA RED POR USUARIO: S/ 250.000
 AUMENTO DEL SALARIO MINIMO VITAL: 7.5% DE LA INFLACION ANUAL

AÑO	INFLACION	SALARIO MINIMO VITAL			TASA DE PAGO DEL SMV	PAGO NOMINAL		PAGO REAL=VEN DEL NOMINAL	
		ANUAL	ANUAL	MENSUAL		ANUAL	MENSUAL	ANUAL	MENSUAL
1	5%	364,000	364,000	32,000	7.50%	26,800	2,400	19,200	1.000
2	5%	528,000	528,000	44,800	7.50%	39,600	3,300	17,600	1.457
3	5%	726,000	726,000	62,500	7.50%	54,450	4,537	16,137	1.344
4	5%	998,250	998,250	87,187	7.50%	74,869	6,239	14,769	1.200
5	5%	1 372,564	1 372,564	114,383	7.50%	102,945	8,579	13,556	1.100
6	5%	1 887,316	1 887,316	157,276	7.50%	141,549	11,790	12,427	1.000
7	5%	2 595,000	2 595,000	216,255	7.50%	194,630	16,219	11,391	949
8	5%	3 568,208	3 568,208	297,351	7.50%	267,616	22,301	10,442	870
9	5%	4 906,285	4 906,285	408,857	7.50%	367,971	30,664	9,572	790
10	5%	6 746,142	6 746,142	562,178	7.50%	505,961	42,163	8,774	701
TOTAL:		5/23'711,055				5/1'778,391		5/ 133,864	

PAGO REAL TOTAL: S/ 133,864 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 53.55

ESCENARIO:	NO.8 LOS PAGOS SON EL 14% DEL SMV TODOS LOS AÑOS
INFLACION:	IGUAL TODOS LOS AÑOS
TASA DE INTERES ANUAL:	NO SE PREDEFINE
TASA DE DESCUENTO:	IGUAL A LA INFLACION ANUAL
COSTO ESTIMADO DE LA RED POR USUARIO:	S/ 250,000
AUMENTO DEL SALARIO MINIMO VITAL:	85% DE LA INFLACION ANUAL

AÑO	INFLACION ANUAL	SALARIO MINIMO VITAL		% DE PAGO DEL SMV	PAGO NOMINAL		PAGO REAL=VPN DEL NOMINAL	
		ANUAL	MENSUAL		ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	S/ 384,000	S/ 32,000	14.00%	S/ 53,760	S/ 4,480	S/ 35,040	2,957
2	50%	S/ 547,000	S/ 45,600	14.00%	S/ 76,689	S/ 6,384	S/ 54,048	2,877
3	50%	S/ 779,700	S/ 64,980	14.00%	S/ 109,166	S/ 9,097	S/ 82,346	2,699
4	50%	S/ 1,111,150	S/ 92,596	14.00%	S/ 155,562	S/ 12,963	S/ 120,728	2,561
5	50%	S/ 1,563,480	S/ 131,950	14.00%	S/ 221,676	S/ 18,473	S/ 175,192	2,433
6	50%	S/ 2,256,345	S/ 188,829	14.00%	S/ 315,888	S/ 26,324	S/ 255,732	2,311
7	50%	S/ 3,215,292	S/ 267,941	14.00%	S/ 458,141	S/ 37,512	S/ 380,346	2,195
8	50%	S/ 4,581,791	S/ 381,816	14.00%	S/ 641,451	S/ 53,454	S/ 530,288	2,086
9	50%	S/ 6,529,052	S/ 544,880	14.00%	S/ 914,067	S/ 76,172	S/ 777,777	1,981
10	50%	S/ 9,303,899	S/ 775,325	14.00%	S/ 1,302,546	S/ 108,545	S/ 1,158,625	1,882
TOTAL:		S/30,291,897			S/4,240,865	S/ 287,625		

PAGO REAL TOTAL: S/ 257,625 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 115.85

ESCENARIO:	NO.9 LOS PAGOS SON EL 10% DEL SMA (TODOS LOS AÑOS)
INFLACION:	IGUAL TODOS LOS AÑOS
TASA DE INTERES ANUAL:	NO SE PREDEFINE
TASA DE DESCUENTO:	IGUAL A LA INFLACION ANUAL
COSTO ESTIMADO DE LA RED POR USUARIO:	S/ 250,000
AUMENTO DEL SALARIO MINIMO VITAL:	8% DE LA INFLACION ANUAL

AÑO	INFLACION	SALARIO MINIMO VITAL			% DE PAGO	PAGO NOMINAL		PAGO REAL=VPN DEL NOMINAL	
		ANUAL	ANUAL	MENSUAL		ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	384,000	32,000	10.00%	38,400	3,200	25,000	2,100	
2	50%	547,200	45,600	10.00%	54,720	4,560	24,320	2,027	
3	50%	779,760	64,980	10.00%	77,976	6,498	23,104	1,929	
4	50%	1,111,150	92,596	10.00%	111,116	9,260	21,949	1,829	
5	50%	1,583,400	131,950	10.00%	158,340	13,155	20,851	1,737	
6	50%	2,256,345	188,029	10.00%	225,635	18,803	19,809	1,651	
7	50%	3,215,292	267,941	10.00%	321,529	26,794	18,818	1,566	
8	50%	4,581,791	381,816	10.00%	458,179	38,182	17,677	1,480	
9	50%	6,529,052	544,088	10.00%	652,905	54,409	16,984	1,415	
10	50%	9,303,899	775,325	10.00%	930,390	77,532	16,134	1,344	
TOTAL:		S/30,291,697			S/3,029,190		S/ 205,446		

PAGO REAL TOTAL: S/ 205,446 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 82.18

ESCENARIO:	No.10. LOS PAGOS SON EL 10% DEL SMV (TODOS LOS AÑOS
INFLACION:	IGUAL TODOS LOS AÑOS
TASA DE INTERES ANUAL:	NO SE PREDEFINE
TASA DE DESCUENTO:	IGUAL A LA INFLACION ANUAL
COSTO ESTIMADO DE LA RED POR USUARIO:	S/ 250.000
AUMENTO DEL SALARIO MINIMO VITAL:	100% DE LA INFLACION ANUAL

AÑO	INFLACION	SALARIO MINIMO VITAL		% DE PAGO		PAGO NOMINAL		PAGO REAL=VPA DEL NOMINAL	
		ANUAL	ANUAL	MENSUAL	DEL SMV	ANUAL	MENSUAL	ANUAL	MENSUAL
1	50%	S/ 354,000	S/ 35,400	10.00%	S/ 35,400	S/ 3,260	S/ 25,600	S/ 2,133	
2	50%	576,000	48,000	10.00%	57,600	4,800	25,600	2,133	
3	50%	864,000	72,000	10.00%	86,400	7,200	25,600	2,133	
4	50%	1'290,000	108,000	10.00%	129,600	10,800	25,600	2,133	
5	50%	1'944,000	162,000	10.00%	194,400	16,200	25,600	2,133	
6	50%	2'916,000	243,000	10.00%	291,600	24,300	25,600	2,133	
7	50%	4'374,000	364,500	10.00%	437,400	36,450	25,600	2,133	
8	50%	6'561,000	546,750	10.00%	656,100	54,675	25,600	2,133	
9	50%	9'841,500	820,125	10.00%	984,150	82,012	25,600	2,133	
10	50%	14'762,250	1'230,187	10.00%	1'476,225	123,019	25,600	2,133	
TOTAL:		S/43'516,750			S/4'351,875		S/ 256,000		

PAGO REAL TOTAL: S/ 256.000 COSTO DE LA RED: S/ 250,000 PORCENTAJE DE RECUPERACION: 102,40

Appendix I.

AN ANALYSIS OF THE RELATIONSHIP BETWEEN THE MINIMUM WAGE AND INFLATION

PERIODO: 1975-1989

AÑOS:	SALARIO MÍNIMO MENSUAL NOMINAL		PORCENTAJE DE INFLACION ANUAL		RELACION ANUAL SALARIO MÍNIMO	
	SUFRES POR MEE	AUMENTO ANUAL	AUMENTO ACUMULADO	AUMENTO ANUAL	VITAL INFLACION ANUAL	INFLACION ACUMULADA
1975:5	1,250	---	---	---	---	---
1976:	1,500	20.0%	20.0%	11.6%	11.6%	181.6%
1977:	1,500	0.0%	20.0%	12.0%	25.0%	0.0%
1978:	1,500	0.0%	20.0%	12.0%	40.0%	0.0%
1979:	2,000	33.3%	60.0%	10.0%	54.9%	333.6%
1980:	4,000	100.0%	220.0%	13.0%	74.0%	769.2%
1981:	4,000	0.0%	220.0%	16.7%	103.0%	0.0%
1982:	4,600	15.0%	238.0%	16.7%	136.0%	92.0%
1983:	5,600	21.7%	340.0%	40.3%	250.0%	44.9%
1984:	6,600	17.9%	420.0%	31.1%	359.0%	57.6%
1985:	8,500	28.0%	500.0%	26.1%	400.0%	102.5%
1986:	10,000	17.6%	700.0%	23.1%	624.0%	76.2%
1987:	14,500	45.0%	1,060.0%	29.4%	837.0%	53.1%
1988:	22,000	51.7%	1,660.0%	50.3%	1,383.0%	80.7%
1989:	27,000	22.7%	2,060.0%	60.5%	2,399.0%	33.1%