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Report No. 1076b-BO

Bolivia: Appraisal of the Urban and Rural Communities Water Supply and Sewerage Project

August 30, 1976

Regional Projects Department
Latin America and Caribbean Regional Office

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CURRENCY AND EQUIVALENT

Currency Unit	=	Bolivian Peso B\$
US\$1	=	B\$20.00
B\$1	=	US\$0.05
B\$1 million	=	US\$50,000

MEASURES AND EQUIVALENTS

Kilometer (km)	=	0.62 miles
Square Kilometer (km ²)	=	0.386 square feet
Cubic Meter (m ³)	=	35.3 cubic feet
		264 gallons (US)
		220 gallons (Imperial)

ABBREVIATIONS AND ACRONYMS

AAPOS	=	Sanitary Works Administration for Potosi.
BANVI	=	National Bank for Housing and Urban Development.
BC	=	Central Bank of Bolivia
CODECH	=	Departmental Development Organization for the Department of Chuquisaca
CODEPO	=	Departmental Development Organization for the Department of Potosi
CNT	=	National Tariff Council
CODECO	=	Departmental Development Organization for the Department of Cochabamba.
CORDEOR	=	Departmental Development Organization for the Department of Oruro
CORDENO	=	Departmental Development Organization for the Department of Pando.
CORPAGUAS	=	Water and Sewerage Corporation.

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CWC	=	Community Water Committees
DDO	=	Departmental Development Organization
DIU	=	Division of Urban Engineering
ELAPAS	=	Water Supply and Sewerage Company of Sucre
IDB	=	Inter-American Development Bank
MUV	=	Ministry of Housing and Urban Development
PAHO	=	Pan American Health Organization
UNDP	-	United Nations Development Programme
UNICEF	=	United Nations Children's Fund
USAID	=	United States Agency for International Development
WHO	=	World Health Organization

FINANCIAL YEAR

January 1 - December 31

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BOLIVIA
APPRAISAL OF THE
URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

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BOLIVIA
APPRAISAL OF
URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

SUMMARY AND CONCLUSIONS

- i. This report appraises a water supply and sewerage project which will implement changes in sector policies in Bolivia through the financing of construction in two cities, Potosi and Sucre, and in approximately 70 rural communities. The project, including a technical assistance program, has an estimated cost of US\$15.0 million. A Bank loan of US\$11.5 million equivalent is proposed to cover US\$11.13 million of foreign costs and US\$0.37 million of local consulting costs.
- ii. The project's rural communities are located largely in the Altiplano where subsistence agriculture predominates. The two cities are both economic centers, Potosi (population 75,000), being the main mining center, and Sucre (55,000), the legal capital of Bolivia.
- iii. During project implementation, the Government proposes to decentralize responsibilities for rural water supply from a Central Government organization - the Water and Sewerage Corporation (CORPAGUAS) - to existing Departmental Development Organizations (DDOs). ^{1/} This change would facilitate the coordination of water supply projects with other development activities and improve the standard of operation and maintenance by providing local control. In addition, national standards for water tariffs would be implemented with the aim of increasing revenues in the urban centers to make water supply activities self-financing.
- iv. The Borrower would be the Government of Bolivia (GOB), represented by the Ministry of Housing and Urban Affairs (MUV). There would be individual project agreements between the Bank and each of the executing agencies.
- v. The Project will provide a supply of safe water to about 100,000 people in the villages and to an additional 50,000, principally poor, in the two cities. In both cities, the canals which carry the main supply of water will be protected to end service interruptions and rationing. Additional supplies of water in Potosi will also serve a new mineral processing plant.
- vi. All the goods and services to be financed out of the proceeds of the loan will be procured in accordance with the Bank's guidelines. With the exception of small diameter plastic pipe, all contracts for pipe, accessories, pumps and equipment are expected to be won by foreign firms. Because of the remote locations and the small size of the civil works, local contractors are expected to win all the civil works contracts although foreign firms would not be excluded from bidding.

^{1/} Bolivia is divided into nine regions known as Departments.

vii. The Project is the least-cost alternative for supplying the urban and rural communities with adequate supplies of water.

viii. During negotiations agreement was reached on the conditions listed in Chapter VI. The Project is therefore suitable for a Bank loan of US\$11.5 million equivalent, for a term of 20 years, including a 4 1/2 - year grace period.

BOLIVIA
APPRAISAL OF
URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

I. INTRODUCTION

1.01 The Government of Bolivia has requested a loan to help finance a US\$15.0 million equivalent water supply and sewerage program. The program has a rural component to bring water service to about 100,000 people in some seventy communities and an urban component for the cities of Potosi and Sucre. A US\$11.5 million loan is proposed to the Government of Bolivia. There would be separate project agreements with:

- (i) The Water and Sewerage Corporation (CORPAGUAS) for the rural component;
- (ii) The Sanitary Works Administration for Potosi (AAPOS) for a water supply project in the city of Potosi; and
- (iii) The Water Supply and Sewerage Company of Sucre (ELAPAS) for a water supply and sewerage project in the city of Sucre.

1.02 A Sector Report No. 712-B0, prepared by a WHO/IBRD mission, was issued in April 1975. The Government of Bolivia has developed sector policies based on this study and subsequent Bank mission recommendations. These policies will be implemented as a part of this project. This would be the first loan made by the Bank for water supply and sewerage in Bolivia.

1.03 The studies and designs for the urban component were prepared by local and foreign consultants; those for the rural component by CORPAGUAS and were financed from local funds.

1.04 This report is based on the findings of a Bank appraisal mission of October 1975 comprised of Messrs. J. Freedman, L. Jeurling, C. Fernandez, E. Pogson and K. Ringskog. The report was written by J. Freedman and E. Pogson, with the assistance of C. Fernandez for the financial projections.

II. THE SECTOR

2.01 This chapter contains a brief overview of the sector and outlines the policies of the Government of Bolivia. More detailed descriptions of the proposed institutional changes are given in Section III, and of the national standards for tariffs, in Section VI.

Background

2.02 The water supply and sewerage sector of Bolivia was studied by a WHO/IBRD mission in October 1973, and a sector report was issued on April 15, 1975. This has been the only Bank involvement in the sector to date. Significant features of the sector are:

- (i) low service levels which were estimated in 1973 to be:

	<u>URBAN</u> % Population Served	<u>RURAL</u> % Population Served
Water Supply	56	4
Sewerage or Sanitation Facilities	23	3

- (ii) the high percentage of the population who live in the countryside. Of the 1975 estimated population of 5.5 million, 3.8 million (70%) were rural dwellers; and
- (iii) the small number of urban centers. There are 18 centers with populations over 10,000, including 6 with populations over 50,000.

2.03 In Latin America, only Haiti and Paraguay have lower service levels. The need for rural water supply is particularly great since over 90% of the families in rural areas rely on unsafe sources of water. Although health statistics are incomplete, a clear picture of the overall situation exists. Health standards are low; infant mortality is around 77 per 1,000 live births compared with an infant mortality rate of 19 per 1,000 for the USA. Diseases linked to the lack of safe water supply or unsanitary conditions cause about 12% of the total number of reported deaths for all ages.

2.04 Service levels in urban centers are higher in larger cities than in smaller towns; each of the cities with over 50,000 inhabitants has some form of sewage disposal. Only 2 of the other 12 centers have any municipal service.

Government Policies

2.05 The Government has adopted modest targets for future service levels since the principal direction of government investment will be for the development of minerals and other natural resources. The target figures for 1980 service levels are:

	<u>Urban</u>	<u>Rural</u>
Water Supply	67%	16%
Sewerage or Sanitation Facilities	26%	4%

To help attain these targets, the Government wishes to use the Project to make institutional changes and to implement new tariff policies.

Institutions

2.06 Presently, principal responsibility for the provision of water supply and sewerage services is divided between two central government departments:

- (i) The Ministry of Housing and Urban Affairs - rural water supply systems and urban water and sewerage systems, and
(Division of Urban Engineering, DIU)
- (ii) The Ministry of Public Health - rural sanitation services
(Division of Environmental Sanitation, DIE)

The execution of projects is carried out:

- (iii) In the rural areas by:
 - (a) CORPAGUAS - a Government corporation under the authority of the Ministry of Housing and Urban Affairs which constructs rural water supply systems;
 - (b) The Division of Environmental Sanitation (DIE) of the Ministry of Public Health which includes, among other responsibilities, the provision of latrines;
 - (c) Some of the nine Departmental Development Committees (DDOs) - (in practice the DDOs of Chuquisaca and Santa Cruz have had active programs of water supply in recent years).
- (iv) In the urban area by:
 - (a) Semi-autonomous water undertakings in the eight largest cities - For water supply projects;
 - (b) Municipal councils - For sewerage schemes (except in the cities of Cochabamba and Sucre);

- (c) Certain DDOs - For water supply schemes in small towns.

2.07 The Division of Environmental Sanitation (DIE) of the Ministry of Public Health is responsible for providing water and sanitation services to communities with populations under 2,000. On paper, there appears to be a duplication of responsibility with CORPAGUAS which constructs water supply systems for populations between 200 and 10,000. In practice, however, there is no conflict because unsatisfied demand is beyond the capacity of both organizations and the work of DIE is very largely confined to the provision of latrines.

2.08 No new institutions are proposed but, during project implementation, existing institutions will be strengthened and responsibilities clarified. In the rural areas, plans will be made for the transfer from CORPAGUAS to some Departmental Development Committees of: (i) overall responsibility for the supervision of operation and maintenance; (ii) specified responsibilities for construction of new rural water systems. The extent to which these responsibilities can be transferred will depend on the financial and technical capabilities of the individual DDO. CORPAGUAS will maintain an overall national responsibility for design standards. The policy will overcome the difficulties of travel and communications from La Paz to the rural areas and will build on the strong regional characteristics and relative wealth of some of the DDOs. In the urban sector, the Division of Urban Engineering will be given responsibility for the technical and financial evaluation of future urban water supply and sewerage projects. Technical assistance will be provided to train the staff of DIU for this role. The provision of a national urban project evaluation unit should help ensure that future projects are economically viable (para. 3.13).

Finances

2.09 Bolivia has relied heavily on external financing for sector development and has received about US\$75 million in grants and loans in the last seven years. This has come from multilateral agencies, including the Inter-American Development Bank (IDB) and UNICEF and bilateral donors including France, the Federal Republic of Germany and the United States Agency for International Development (USAID). Currently, projects are being executed in the cities of La Paz, with a US\$23.0 million loan from Germany, Cochabamba, a second loan from IDB of US\$12.0 million, and a rural latrine program in three departments (UNICEF). This external financing has been almost entirely in the form of concessionary loans of the order of 3% interest, supplemented by government grants. Until recently, water charges in the urban centers have barely covered the costs of operation and maintenance.

Financial Policies

2.10 The Government intends over a period of five or six years to require the water undertakings in the urban centers to increase the charges for water services so that the consumers pay for the cost of operation, maintenance and debt service and, additionally, the six largest cities should also generate some capital for future investment.

2.11 A National Tariff Council (CNT) has been established in the MUV with powers to approve all new tariffs; National Standards for tariff classification and rate structure were published in April 1974 (Ministerial Order No. 133) and modified in July 1976. The National Tariff Standard is soundly based and would permit the development of charges for water and sewerage service which are both financially sound and socially just. The CNT has recently begun to implement the National Tariff Standard and will benefit from proposals to make DIU its technical arm and by a proposed ministerial order which would require the prior consent of DIU for project evaluation and CNT for proposed tariffs for any future water supply or sewerage project in the urban areas (paras. 2.08 and 3.13).

III. THE INSTITUTIONS

3.01 This chapter discusses the organization of the Borrower, Executing Agencies and the Beneficiaries and describes the institutional changes to be made during the project period.

3.02 The Borrower will be the Government of Bolivia, represented by the Ministry of Housing and Urban Affairs (MUV). The Ministry has responsibilities for the supervision and coordination of all Urban Development and Housing, including sector responsibilities for Water and Sewerage, other than that held by the Ministry of Health for small communities (para. 2.06).

3.03 The DIU is located in the Subsecretariat for Urban Affairs. CORPAGUAS is a state corporation under the direction of the Ministry. MUV is also a supervisory authority over the autonomous water undertakings in the urban centers, though this power is little used other than in the approval of tariff increases by the CNT. (Chart No. 15996 shows MUV's organization.)

Administration of the Loan

3.04 The Government of Bolivia will open three separate project accounts in the Central Bank of Bolivia to receive the Bank and local counterpart funds. The Borrower will execute separate loan agreements with AAPOS and ELAPAS and a grant agreement with CORPAGUAS. Funds will be lent to ELAPAS and AAPOS at the same interest rate as the Bank loan, but with a 3-year grace period (to match the construction period) and for 22 years. Disbursements will be made separately to the three executing agencies under the terms of individual project agreements with:

- (i) CORPAGUAS for the rural subproject;
- (ii) AAPOS for the subproject in Potosi; and
- (iii) ELAPAS for the subproject in Sucre.

Rural Component - CORPAGUAS

3.05 The Corporation was formed in 1967 to design, build and finance water supply and sewerage systems for communities of up to 10,000 inhabitants throughout the country. CORPAGUAS executed the first stage of a National Water Plan which provided 68 systems in the period 1969-74. This project was partially financed by a loan of US\$1.8 million from IDB. The Corporation will act as Executing Agent for the rural component under the terms of a separate project agreement with the Bank.

3.06 CORPAGUAS is a compact and well managed institution - its normal staff complement is 45; it does not have offices outside La Paz. It has a demonstrated expertise in the design and construction of rural water supply systems in the particular conditions of Bolivia where the conditions range from tropical zones to very cold mountain regions. It has considerable experience in developing community institutions to participate in new projects and in securing finance and self-help from villagers. The Corporation has benefitted from technical assistance from the Pan American Health Organization (PAHO) in recent years.

Departmental Development Committees

3.07 Each Department of Bolivia has a Development Organization which is responsible for economic development in the region and receives mineral and other royalties. The organizations have different titles which reflect the range of their responsibilities. Originally, the organizations executed works of basic infrastructure under the control of the MUV, but since 1967 the area of activities has been widened and, with the exception of Beni, the Departmental Organizations are autonomous bodies known as Development Committees or Development Corporations. Their work includes agro-industrial projects, and forestry projects, in addition to conventional public works. The Development Organizations receive a part of their revenue from royalties on the sale of minerals, oil and gas produced in the department. The sums received vary -- Santa Cruz (population about 504,000) was budgeted to receive approximately US\$17 million in 1975 from the State Petroleum Company, Chuquisaca (population about 500,000) around US\$4 million and Cochabamba (population about 860,000) US\$80,000. The Government attempts to balance this inequality by budgetary grants. During the last three years, the DDOs of Santa Cruz and Chuquisaca have executed water supply projects using their own funds; the DDO of Potosi (CODEPO) has worked with CORPAGUAS in joint ventures where the Corporation designed and partly financed village water systems and CODEPO acted as executing agent and co-financier.

3.08 Bolivia's size, mountainous terrain and lack of all-weather roads make supervision of construction and maintenance difficult, time-consuming and costly when operated from La Paz. Because of the relatively low level of technology involved and the existence of the DDOs as regional development agencies, the Government's policy is to gradually decentralize responsibility from CORPAGUAS to the DDOs (para. 4.05). CORPAGUAS would continue to function as the national design and bulk purchasing agency and would continue to construct rural water supply systems in regions where it is not feasible for the DDO to undertake this role.

3.09 Assurances were obtained from CORPAGUAS during negotiations that a plan to transfer responsibilities for maintenance support and specified aspects of construction to the four DDOs of Cochabamba, Oruro, La Paz and Potosi will be submitted to the Bank for approval not later than June 30, 1978 and would thereafter be promptly executed.

The Beneficiaries

3.10 The Beneficiaries would be the Community Water Committees (CWCs), organizations set up to represent the villagers in the negotiations to acquire a potable water supply system and to subsequently maintain it. CORPAGUAS has found that it is essential for a community to demonstrate its willingness to participate in the Project. After the villagers have formally indicated their desire to have a potable water supply system, the village is required to form a CWC as the first step in the process. The CWC discusses with CORPAGUAS the type of system it would like constructed, including a decision on the number of standpipes and house connections. The CWC undertakes to raise a contribution to the cost of construction which is at least 15%, partly in cash, partly in materials and labor. Some of the cash is collected and deposited with CORPAGUAS before construction begins. When agreement is reached, the system is designed, and a contract is signed defining contributions, responsibilities and tariff conditions. During construction, the villagers complete their commitments by supplying the promised cash, labor and materials. When the system is handed over, the CWC collects the monthly contributions from households and is responsible for routine operation and maintenance. This method of rural organizational development has been proven in practice over recent years. Under the proposed project, CORPAGUAS will sign a contract with each CWC, supported by a guarantee agreement with the respective DDOs. The DDO guarantees the contribution of the community (cash or donated labor and materials). During negotiations assurances were obtained that prior to the commencement of construction for any individual system, CORPAGUAS will execute such contracts and guarantee agreements with the respective CWCs and DDOs, on terms and conditions acceptable to the Bank.

Urban Component - AAPOS

3.11 While AAPOS is legally an autonomous agency responsible for water and sewerage services in the city of Potosi, in practice it is financially weak and relies on subsidies from CODEPO. The sewer system for the city is being installed, maintained and subsidized by the municipal council. AAPOS has a sound engineering staff but a deficient commercial and accounting section. The proposed loan includes funds for technical assistance to strengthen the commercial and accounting activities of the institution (para. 4.09). AAPOS has executed contracts of a similar size to the proposed project works and is competent to act as executing agency.

ELAPAS

3.12 ELAPAS has operated as an autonomous water undertaking in Sucre since April 1, 1973, and has competently tackled the problems of water supply

in the city, including extension of the distribution network and the construction of a new water treatment plant. It is the only water authority in Bolivia which has installed water meters to the majority of its connections. The organization is well run and requires only a small input of technical assistance (para. 4.12) in the area of financial accounting and costing. ELAPAS has legal personality, and would act as executing agent for the sub-project.

DIU

3.13 Within the Division of Urban Engineering, a Project Evaluation Unit is being established for the urban sector and as the executive arm of the National Tariff Council. Assurances were obtained during negotiations that MUV will, not later than December 30, 1976, issue the necessary regulation to require that any public entity which is seeking Bolivian or foreign funds to finance a water supply or sewerage project for a community of 10,000 or more be required to obtain the prior approval of:

- (i) The Project Evaluation Unit, for the size of the investment and the amount of financing;
- (ii) The National Tariff Council, for the level of tariffs prior to, during and after the proposed project.

The use of these existing organizations, strengthened by the project's technical assistance (para. 4.14), should help to direct a greater part of the scarce funds to smaller and poorer urban centers. Organization charts are provided for CORPAGUAS (No. 15679), AAPOS (No. 15678), ELAPAS (No. 15677) and MUV (No. 15996).

IV. THE PROJECT

Scope of the Project

4.01 The Project is designed to improve and extend water supply in approximately 70 rural communities and two cities in Bolivia in addition to extending sewerage in Sucre. It provides for technical assistance to the Project Evaluation Unit within MUV for urban projects and to the executing agencies, CORPAGUAS, ELAPAS and AAPOS. Detailed descriptions of existing facilities and the project works are given in Annex 1; of technical assistance in Annex 2.

Rural Component

Existing Facilities

4.02 Some of the communities have no public water supply, and the inhabitants resort to water from creeks, shallow wells, or private vendors. Also used are rudimentary systems such as a small pipeline conducting water from a

spring to a public fountain in the central square; others have more complete systems with a small distribution network and a few house connections and fountains. Most of the existing systems provide limited supplies of water, frequently unsafe, and are in various stages of deterioration because of the lack of organized maintenance, poor design or age.

Proposed Facilities

4.03 A national plan for community water supplies has been prepared and is presently being executed by CORPAGUAS. The first stage was financed by IDB and 68 systems were built. The proposed Bank loan would finance a second stage of the National Plan. The staff of CORPAGUAS has a list of 80 communities which have requested a water supply system (for which the villagers are willing to contribute 15% of project cost), and has prepared detailed reports for 35 water supply systems, 17 of which have been reviewed and found acceptable. Reports and plans for the remaining community water systems will be reviewed before the Bank authorizes their construction; distribution of the first 35 subprojects by population size is shown in Table 1. During the project, CORPAGUAS will prepare engineering reports for the remaining systems, which will also be reviewed and approved by the Bank prior to construction. The design work is expected to be substantially completed by December 1977. Selection criteria are discussed in para. 5.03. CORPAGUAS, with its own staff, will do the field work, census, topographic surveys, and procurement as well as supervision of construction since its staff has proven experience in carrying out work and projects of this type.

4.04 From long experience, CORPAGUAS has developed practical criteria for the selection of communities and their water systems. Important elements in these criteria are: (i) desire and initiative of the community to obtain a potable water supply; (ii) community organization to participate in the planning, building and operation and maintenance of the system; (iii) willingness to pay rates and charges for the water supply service; (iv) population, size and density; (v) availability of a safe, easily developed source of water; (vi) accessibility; (vii) per capita cost for the system; (viii) capacity to contribute funds, labor and local materials and to pay for operation and maintenance; (ix) capacity to administer and operate the system. Of these criteria, community interest is given greatest weight. To reduce operation and maintenance costs, safe gravity sources are given preference, followed by well supplies close to the village. Sources requiring treatment such as filtration and extensive pumping are used only as a last resort. Where possible the water supply project is coordinated with a latrine program executed by the Ministry of Public Health. CORPAGUAS has agreed to maintain its selection criteria and to seek prior approval of the Bank for any proposed amendment.

Table 1

DISTRIBUTION BY SIZE OF COMMUNITY OF THE
FIRST 35 RURAL COMMUNITIES WITH DETAILED REPORTS

<u>Present Population (1975)</u>	<u>Number of Communities</u>
Under 500	5
501 - 1,000	11
1,001 - 1,500	7
1,501 - 2,000	4
2,001 - 2,500	2
2,501 - 3,000	3
3,001 - 3,500	2
Over 3,500	<u>1</u>
	35

4.05 Initially CORPAGUAS will supervise the maintenance and operation of the systems by the Community Water Supply Committees, but as part of the proposed decentralization this responsibility would be transferred to the DDOs. Further decentralization will be achieved by transferring construction responsibility to those DDOs that have adequate staff and competence. To achieve this decentralization, CORPAGUAS with the assistance of the consultants will:

- (i) Produce a set of standard designs and bills of materials for typical village water systems based on a restricted range of pipe sizes and standard components;
- (ii) Produce operating manuals for use by village maintenance staff and engineers of the DDOs;
- (iii) Institute procedures for the coordination of supplies and bulk purchase of imported materials by the DDOs; and
- (iv) Prepare plans for the transfer of maintenance and construction responsibilities to the DDOs. These plans will include provisions for operator training and the stocking of spare parts.

CORPAGUAS would retain responsibility for design standards and materials, and would continue to design and, if necessary, construct or supervise systems with unusual technical features. During negotiations, assurances were obtained that CORPAGUAS will hire qualified consultants on terms and conditions satisfactory to the Bank for the preparation of the standard designs and manuals, which will be presented to the Bank for comment not later than June 30, 1978.

Urban Component

4.06 Comprehensive urban development studies have been completed by Bolivian consultants for Potosi and Sucre. Master plans for the expansion of the water supply and sewerage systems have been made for AAPOS and ELAPAS, and these are coordinated with the overall urban development plans. Detailed designs for some of the major works have been completed, including that for the sewer system extension in Sucre; others will be completed by local consultants as part of the Project. Present and future service levels and incremental population served by the Project are shown in the following table:

Table 2

SERVICE LEVELS - URBAN COMMUNITIES

<u>City</u>	<u>1975 Population ('000)</u>	<u>% Served Water</u>		<u>% Served Sewerage</u>		<u>Incremental Population Served in 1983 ('000)</u>	
		<u>'75</u>	<u>'80</u>	<u>'75</u>	<u>'80</u>	<u>Water</u>	<u>Sewerage</u>
Sucre	55.3	74	82	48	80	16	27
Potosi	75.1	49	83	<u>/1</u>	<u>/1</u>	34	Unavailable

/1 The sewer system is the responsibility of the municipal government and not part of the proposed project.

Potosi

Existing Water Supply Facilities

4.07 All water supplied comes from impoundments in the mountains fed by gravity to the city. The distribution system has been developed piecemeal over 300 years in an uncoordinated way. The sewer system is being constructed and operated by the municipality.

4.08 None of the consumer connections are metered, and population estimates vary widely not only because the last census was in 1965 (a national census is proposed for 1976), but also because the number of inhabitants fluctuates with changes in mining output (see Annex 1). Such factors mean that only rough estimates can be made of production, consumption and losses. The average consumption per connection has been estimated at 25 cubic meters a month (90 liters per inhabitant per day) because of the cold climate. System losses are estimated to account for 62% of water produced.

Proposed Water Supply Facilities

4.09 The proposed subproject for Potosi is the second stage of a 20-year program "Improvement of the Water System of the City of Potosi." The subproject provides for the following works and studies:

- (a) Intake Works: repair of dikes and construction of infiltration galleries at Pati-Pati and San Jose;
- (b) Conveyance Improvements: lining of Pati-Pati - San Jose canal to reduce losses;
- (c) Treatment Plant: additional filter area and sedimentation capacity;
- (d) Distribution Network: extension of distribution network to low-income areas and satellite communities;
- (e) Metering: a program to install meters or control devices to 80% of source and consumer connections not later than December 31, 1976;
- (f) Leak Detection and Repair: a program to locate and reduce leakage to 23%;
- (g) Census of Users: a survey to determine the number and size of connections. Assurances were obtained during negotiations that this census will be completed with the help of the technical assistance program not later than April 30, 1977; and
- (h) Technical Assistance: consultant services and training to improve the organization, management and financial condition of AAPOS.

Sucre

Existing Water Supply Facilities

4.10 The main supply for the city of Sucre is a 42 kilometer canal and pipeline which brings water by gravity from the Rio Ravelo. The canal passes through areas subject to landslides which cause interruptions in service. Maintenance camps are found at strategic locations, but a central section of the canal lacks access roads, thus delaying maintenance operations. The water receives complete treatment in a rapid sand filter plant which has adequate capacity to meet the needs until 1980.

Existing Sewer Facilities

4.11 The old part of the city, with about 26,000 inhabitants, is served by a combined sewer. The sewer discharges at several points into natural watercourses draining the city and eventually into the Rio Quirpinchaca which is used for irrigation. The oil refinery on the edge of town also discharges untreated waste into the Rio Quirpinchaca system.

Proposed Water Supply Facilities

4.12 The proposed subproject would reduce the possibility of interruptions in service, extend service to new areas, ensure continuous operation of the treatment plant and increase the number of metered connections. The subproject would include the following works:

- (i) Ravelo Canal: protective masonry works and tunnels around slide areas; construction of connecting access road;
- (ii) Treatment Plant: spare parts to ensure continuous operation;
- (iii) Distribution Network: strengthening of system in the central area and expansion to new areas; additional storage reservoirs;
- (iv) Metering and House Connections: installation of new connections and water meters; and
- (v) Technical Assistance: consultants for training local staff and improving the accounting and financial management of the institution.

Proposed Sewerage Facilities

4.13 The combined sewers would be repaired and provided with overflow devices to handle discharges from heavy rainfall. Normal discharge would go into new collectors functioning as sanitary sewers. The unsewered areas would be provided with separate sanitary sewer systems, the more densely populated areas being served first. The sewage would be conducted to a stabilization pond type treatment plant. The subproject would include the following:

- (i) Combined Sewers: repairs and improvements to the sewers in the Casco Viejo and new collectors;
- (ii) Sanitary Sewers: construction of house connections, laterals, street sewers and trunk mains in new areas; and
- (iii) Treatment Plant: stabilization pond.

TABLE 3

PROJECT COST ESTIMATES

	-----B\$ million-----			-----US\$ million-----		
	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
<u>Construction</u>						
Rural Component	12.0	64.0	76.0	0.60	3.20	3.80
Potosi Subproject	6.0	18.0	24.0	0.30	0.90	1.20
Sucre Subproject	16.0	64.0	80.0	0.80	3.20	4.00
Engineering and Administration <u>1/</u>	4.0	2.0	6.0	0.20	0.10	0.30
	16.0	-	16.0	0.80	-	0.80
Base Cost Estimate	<u>54.0</u>	<u>148.0</u>	<u>202.0</u>	<u>2.70</u>	<u>7.40</u>	<u>10.10</u>
Technical Assistance	2.8	0.6	4.0	0.14	0.03	0.20
Physical Contingencies <u>2/</u>	8.0	22.0	30.0	0.40	1.10	1.50
Price Contingencies <u>3/</u>	12.0	52.0	64.0	0.60	2.60	3.20
Total Project Cost Before Interest	<u>76.8</u>	<u>222.6</u>	<u>300.0</u>	<u>3.84</u>	<u>11.13</u>	<u>15.00</u>
Interest during Construction	0.0	28.0	28.0	0.0	1.40	1.40
TOTAL	<u>76.8</u>	<u>250.6</u>	<u>328.0</u>	<u>3.84</u>	<u>12.54</u>	<u>16.40</u>
To be Financed by IBRD loan <u>4/</u>				<u>0.37</u>	<u>11.13</u>	<u>11.50</u>

Notes

Estimates are based on October 1975 prices.

1/ Engineering and Administration estimated at: Rural component - 16%
Urban component - 10%

2/ Physical contingencies estimated at: Rural component - 10%
Urban component - 15%

3/ For basis of calculation of price contingencies, see Annex 4.

4/ The IBRD loan will finance 100% of the estimated foreign exchange cost and US\$0.37 million of local consultancy costs.

Consultants for Technical Assistance and Engineering

4.14 The project costs include provision for an estimated 91 man/months of consultant services, 47 for technical assistance, 44 for engineering designs. Individual consultants and firms will be employed for the technical assistance program, for details see Annex 2, page 5 and for engineering design and supervision, see Annex 2, pages 3 and 4. The technical assistance program would be carried out by local consultants with the exception of the assignment to train DIU staff in project evaluation for which it is intended to recruit an individual expert from a neighboring South American country who would be familiar with Bank practices. With the exception of the foreign advisor (US\$4,000 per month), the average fee per man/month for consultants is US\$2,000. The estimated total cost for consultants is US\$400,000: US\$173,000 for technical assistance and US\$227,000 for engineering.

Cost Estimates

4.15 The total cost of the proposed works is estimated to be about US\$15.0 million, as shown in Table 3. Interest on loans during construction amounts to US\$1.4 million, making a total estimated financing requirement of US\$16.4 million. An analysis of construction costs is shown in Annex 2.

Procurement

4.16 All contracts for materials would be awarded under international competitive bidding procedures in accordance with the Bank's guidelines for procurement. Bolivian manufacturers would be given a 15% margin of preference of the c.i.f. value or the applicable customs duty, whichever is the lower. The only items expected to be won by local suppliers are small diameter plastic pipe (up to 1" diameter) and cement. All contracts for consulting services would be awarded to qualified consultants on terms and conditions satisfactory to the Bank.

4.17 CORPAGUAS would carry out its works through local competitive bidding, force account and community participation. In very isolated communities where CORPAGUAS experience indicates that contractors would not be interested in bidding or would inflate their prices, CORPAGUAS would build the system by force account. In Potosi and Sucre the works would be awarded after local competitive bidding. Foreign firms are not expected to bid for the civil works but would not be precluded from doing so.

Disbursements

4.18 Disbursements would be made for 100% of the foreign exchange cost of imported equipment, such as pipe, meters, pumps and related equipment. Funds would be disbursed against the cost of locally procured materials and civil works for the foreign exchange component at the rate of 60%.

4.19 The foreign exchange component of local costs varies with the type of material and amount of civil works.

4.20 Disbursements for consultants engaged for the technical assistance program or for engineering will be for 100% of the foreign and US\$0.37 for local consultancy costs. Retroactive financing of up to US\$100,000 is recommended for engineering designs prepared by consultants for the ELAPAS sewer subproject prior to loan signature.

4.21 Surplus loan funds, if any, would be reallocated to other sub-projects within the total project as approved by the Bank. The urban component is expected to be disbursed in 3 years and the rural component in 4 years. The closing date for the loan has been agreed as June 30, 1981.

Project Supervision and Administration

4.22 Contract administration and construction supervision for the rural component would be done by the staff of CORPAGUAS who have successfully performed similar work in the past. Detailed design, cost estimates, tender documents and supervision for the works to be carried out on the Sucre and Potosi water systems would be prepared by the technical staffs of AAPOS and ELAPAS as well as qualified consultants hired on terms and conditions acceptable to the Bank.

Environmental Aspects

4.23 The CORPAGUAS subproject would improve and extend piped water systems to about 70 rural communities, providing them with adequate quantities of safe, easily accessible water. This would eliminate the need to use small amounts of contaminated water and would improve the general health and hygiene of the inhabitants. The communities are dispersed in dry, cold climates, so that wastewater disposal is not a problem.

4.24 The AAPOS and ELAPAS water supply subprojects would provide a continuous supply of safe water, eliminate rationing, and extend services to the low-income areas of Sucre and Potosi. The sewerage subproject for Sucre would reduce the health hazards in the city and adjacent areas where irrigation water has been subject to pollution. In Potosi, the sewer system is being extended by the municipality.

V. PROJECT JUSTIFICATION

5.01 The proposed project is justified both by the tangible economic benefits which will follow from the extension of water supply, though some of these are unquantifiable, and by the contribution made to the development of sector policies (see Section II).

Rural Component - Economic Benefits

5.02 There is little meaningful data with which to measure the economic benefit of a supply of potable water in rural areas. The most important benefit of bettering village water supplies is an improvement in health which recent studies suggest is not measurable. ^{1/} Similarly, the potential benefits of increased productivity and decreased urban migration are not quantifiable. Where a village lacks any community organization, the creation of a CWC can be considered as a step in the rural development process. Furthermore, a habit of paying cash would be introduced into areas where a barter system now predominates. The economic justification rests on the improvement in public health.

Selection of Projects

5.03 The National Plan for village water supply in Bolivia has as its main objectives the provision of better living conditions for the rural poor and the reduction of water-borne or water-related diseases. Thus, during the first stage of the National Plan, water systems were constructed in the larger centers where these conditions were more easily recognized. The second stage includes many small communities (67% of the first 35 systems are for populations under 1,500) where community interest is the most significant factor in project selection. Villagers are required to form a CWC and to contribute cash and labor to the construction. Additionally, CORPAGUAS selects projects on the basis of least cost and engineering designs which simplify operation and maintenance--gravity systems being used wherever possible.

Urban Component - Potosi

Water Supply Requirements

5.04 The present state of water supply in Potosi and Sucre is described in Section IV and Annex 1. The two cities were selected from four projects for various reasons: in Potosi, low service levels and erratic supply justify investment, and the absence of water meters presented an opportunity to introduce a stepped tariff which would give a degree of income transfer to the urban poor. As neither production nor consumption is metered, future demand has been estimated largely on the evidence of areas in the city which have no piped service or standpipe service. Consumption from new connections is estimated at 20 cubic meters per month since new consumers live mainly in poor areas of the city. Population growth is estimated at 1.5% per annum which is lower than other Bolivian cities. Potosi is, however, a high-altitude, cold, bleak city with little attraction for migration from rural areas, and in the past the population has fallen with the decline of mineral production. Thus the estimate is thought reasonable. In 1980, the population is forecasted at 81,000 with service levels of 83% for water.

^{1/} Measurement of the Health Benefits of Investments in Water Supply, Bank Report PUN-20, January 1976.

5.05 The Bolivian State Mining Company (COMIBOL) has a program to re-equip one of its plants and requires an untreated water supply of 40 lps (1.2 million cubic meters a year), representing 40% of the estimated consumption for 1978.

Need to Increase Water Supply

5.06 The additional water sources are from dams constructed in the sixteenth century and now not used or only partially used. The next alternative to the proposed Pati-Pati/San Jose Scheme is to increase the capacity of the San Sebastian impoundment by the construction of a dam in a tributary lagoon, with a connecting tunnel to the San Ildefonso Dam. This work has an estimated cost of US\$1.08 million at 1975 prices. An analysis of the projects and the forecasted growth of demand suggest that, provided the leak detection and repair program is executed to reduce the level of losses from 62% to 25% by 1980, the construction of the San Sebastian Dam can be deferred until 1984. The proposed project is the least-cost solution.

Sucre - Water Supply Requirement

5.07 The needs in Sucre are to protect the Rio Ravelo supply canal, to reduce interruptions in supply, to increase water pressure and to extend water supply and sewerage services to the major part of the town. There is no other adequate source of water besides the Rio Ravelo. The only alternative means of transporting water would be to construct a continuous tunnel through the mountains to replace the canal and short tunnels. No cost estimates were prepared for such a tunnel since such construction would be greatly in excess of the US\$0.3 million proposed to enclose parts of the canal and construct short tunnels.

5.08 Average consumption from existing connections is expected to increase from 27 cubic meters a month to 32 cubic meters per month during the project period because water pressure and availability of service will be more constant and sewerage service will be extended. The population of Sucre is estimated to reach 63,000 by 1980 (a growth rate of 2.5% per annum) when 82% would have water service and 80% sewerage service. These estimates are thought reasonable.

5.09 The proposed charges needed to pay for the Project involve substantial increases in monthly water bills, and tariff structures will be developed so that the increased charges fall more heavily on higher volume consumers. The basic monthly charge for a minimum level of consumption will be kept as low as possible. This will bring about a degree of income transfer since the poor will be shielded by lower percentage increases in the basic monthly charge.

Return on Investment

5.10 The Internal Rate of Return (IRR) for the water supply element of the urban subprojects is estimated at 6.1% for Potosi and 9.5% for Sucre, using the future tariffs and charges proposed in Section VI.

5.11 The proposed charges for water service in both cities would cover the costs of operation and maintenance, debt service on the proposed loans and the generation of some capital for future development. These charges would represent a significant increase in monthly accounts to users, and this would be the first occasion in Bolivia that water charges covered all such costs. By 1983 the average charges per cubic meter would approach the long-run marginal cost of water provided by the Project. It is likely that high-consumption users would be paying marginal rates at or above the marginal cost.

	<u>Average Water Charge BS per cu. meter-1983 Prices</u>	
	<u>Potosi</u>	<u>Sucre</u>
Projected average charge	3.	6.8
Long-run marginal cost at a discount rate of 8%	4.2	8.6

Economic benefits would be higher if a measurement could be made of the benefits from an uninterrupted water supply and the improvement in environment and health conditions.

5.12 There are a number of untested features:

Rural Component

- (i) The program timetable shown in Annex 1 would require CORPAGUAS to build 24 systems in 1978; the highest total in any previous year was 18. There is a risk that CORPAGUAS may not be able to cope with the additional work. By using standard designs and bulk purchase of materials in standard sizes and by decentralizing some of the construction work to CODEPO, this risk is rated moderate and acceptable;
- (ii) Delays in the registration of CWCs and in completing legal agreements between CORPAGUAS, the CWCs and DDOs may delay specific projects. Because the Project permits CORPAGUAS to substitute systems for those listed in Annex 2, Page 1, the risk is rated average and acceptable;

Potosi

- (iii) The paucity of data about the water system in Potosi may have caused errors in forecasting production and consumption, and a combination of errors could lead to water shortage and rationing. The project works have been scheduled to minimize this risk which is rated acceptable; the alternative would be the immediate

construction of a dam at an additional cost of over B\$20 million (US\$1 million) which cannot be justified at this time;

- (iv) The management of AAPOS is reluctant to increase water rates or to introduce meters for fear of strong public reaction in this mining town. The proposed increases have the support of CODEPO and will be explained to the inhabitants by a public relations program. The risk is rated acceptable since the alternative is inadequate service.

VI. FINANCES

6.01 This chapter reviews the financial history of the water authorities concerned, and outlines the policy changes to be implemented with this project. Annex 4 gives the assumptions underlying the financial projections. Annexes 5, 6 and 7 show the financial projections and monitoring indexes for AAPOS and ELAPAS. Examination of the finances of AAPOS and ELAPAS has been hindered by lack of data, particularly for AAPOS. The financial information has been based on data available and many reasonable assumptions; this will entail supervision and revision as the project progresses.

Rural Component - CORPAGUAS

6.02 The financial records of CORPAGUAS are kept in the manner of a Government Department--accounting for expenditures against budgetary allocations, and are subject to annual audit by independent external auditors. Its output passes to local communities in the form of completed water systems. CORPAGUAS finances the construction of systems from both budgetary appropriations and external loan funds.

6.03 The Government will provide CORPAGUAS with funds through normal budget procedures, and CORPAGUAS will design each rural system and have it constructed. Such funds will cover about 20% of the total project cost, and during negotiations assurances were obtained from the Government that CORPAGUAS will be provided with adequate funds to execute the Project. The Government will carry the debt service obligation of the proposed Bank loan but will not make any grants towards the construction costs. The community, through its CWC, will provide about 15% of the Project cost from its village in cash and donated labor. The value of the donated labor is estimated at about 3% of the project cost. The rural component would be financed by contributions as follows:

	% of Project	
	<u>Total Cost /1</u>	<u>Cash Cost /2</u>
Community	15	12
CORPAGUAS	20	21
IBRD Loan	<u>65</u>	<u>67</u>
Total	100	100

/1 Including value of donated labor.

/2 Excluding value of donated labor.

6.04 When IDB loan funds were used, villages were required to pay for operation, maintenance, interest on the loan, and sometimes part of the amortization. As the debt service of the IDB loan is undertaken by the Government, the payment of debt service was intended to provide CORPAGUAS with funds for future investments.

6.05 It is now recognized that the policy of requiring the communities to repay part of the debt service was overly optimistic especially for poor communities in the Altiplano whose villagers are too poor to pay more than operation and maintenance since cash incomes may be as low as US\$45 a year. For this reason the Tariff Decree exempts communities under 10,000 from debt service while permitting exceptions to the rule where CORPAGUAS has reason to believe that the inhabitants of a community have the capacity to pay e.g. where water was formerly supplied at a high cost by tanker.

6.06 Although the total debt service for the rural component will be borne by the Government, this will not be onerous, and by decentralizing responsibility for construction to selected DDOs, the Government will be able to direct its scarce funds to poorer parts of the country.

Urban Component

6.07 Until recently there was no clear financial policy for urban sector construction, and extensions of systems were financed from a variety of sources, largely external, by concessionary loans (e.g. the Federal Republic of Germany loan of US\$23.0 million to the city of La Paz for 30 years at 2% interest). At the same time charges rarely covered the costs of operational maintenance. Sewerage services are operated by the municipality (except in Cochabamba and Sucre) and are financed from municipal revenues which include a sewerage service charge based on property values. Since the property listings are not well maintained and values are rarely updated, this tax provides only a small, uncertain and inadequate revenue. As part of the Government's attempt to reform the finances of the sector, the National Tariff Standard defines the price policies which it ultimately hopes to apply to all centers with populations over 10,000 (see Annex 8 for details). The Tariff Standard's goal is to ensure that the consumer pays according to consumption and user's category, at rates which would generate revenues sufficient to cover operation,

maintenance and debt service. In addition, the same tariff decree which required the water undertakings in the three largest cities (La Paz, Cochabamba and Santa Cruz) to generate some capital for future investment (the amount is not specified) has now been revised to include cities with over 50,000 inhabitants, i.e. Oruro, Potosi and Sucre.

6.08 It will not be an easy matter to achieve the National Tariff Standards. Since water supply is regarded in Bolivia as a "free service" of the Government, the scale of increases in average charges is bound to provoke public resistance. It is hoped to achieve the revised national standards for water charges in Potosi and Sucre during this project by providing more reliable service, in Potosi by extending the service area of the city, and in Sucre by the provision of a sewerage service. It is not considered feasible to attain the desired tariff standard for sewerage service in Sucre in the immediate future, and a subsidy is planned. Thus the Government and ELAPAS will establish a tax on the profits of the cement plant located in Sucre to subsidize the sewer system. A similar charge is levied on the output of Bolivia's other major cement plant for the benefit of the water undertaking in La Paz. During negotiations, the Government gave assurances that it would provide the Bank with details of the proposed decree and information on how the subsidy might be phased out and replaced by a property tax. Any necessary measures will be enacted prior to any disbursements for the Sucre subproject.

Urban Undertakings - AAPOS

6.09 AAPOS was created in 1972 to take over responsibility for the water supply system in the city of Potosi from CODEPO, but it has not functioned as an independent body. It is subsidized by CODEPO, which pays the full debt service for previous loans. The rates charged for the supply of water service are extremely low and were last increased in 1967. Eighty-nine percent of the 4,100 connections are charged a fixed monthly fee of B\$10 (US\$0.50). Some 5,000 water meters have been purchased but none have been installed. A substantial part of the past revenue has come from charges for new connections.

ELAPAS

6.10 ELAPAS has functioned independently of the Municipality of Sucre since July 1972, and maintains autonomy from the Municipality and from the Departmental Development Committee of Chuquisaca (CODECH). Up to now, revenues were sufficient to cover operating and maintenance costs. Previous capital need has been funded by soft term loans from CODECH and the Central Government. ELAPAS has practically completed a program of installing water meters to all users--the first city in Bolivia to carry out such a policy, and users are charged according to the volume consumed (Annex 8). At present there is no direct charge for sewerage service. An estimated summary of the financial records for recent years is given in Table 4.

Table 4: ESTIMATED PAST FINANCIAL RESULTS

	B\$ million			
	AAPOS		ELAPAS	
	1974	1975	1974	1975
Revenues from sale of water	0.62	0.64	3.20	3.02
Other revenue	0.30	0.49	0.00	0.24
Total revenue	0.92	1.13	3.20	3.07
Costs	1.24	1.57	3.59	4.41
Depreciation	0.58	0.84	1.27	1.79
Net Surplus (Deficit)	(0.89)	(1.29)	(1.66)	(2.92)
Financial Rate of Return (%)	-4.40	-4.40	-9.00	-8.70
Average revenue per cubic meter (B\$)	0.79	0.92	1.56	1.62
Average cost per cubic meter (B\$)	1.06	1.28	1.75	2.19
Date of last change in tariff	Jan. 1967		Jan. 1972	

6.11 Both organizations would be provided with technical assistance from local consultants to improve their accounting procedures. ELAPAS needs a management information system based on commercial accounting records. AAPOS requires considerable assistance to improve its accounting system, to develop records of meter installation and consumption, as well as to install sound billing procedures. Assurances were obtained during negotiations that AAPOS and ELAPAS will produce annual financial accounts from the financial year beginning January 1, 1977, in a form appropriate to a commercial utility.

Future Finances

6.12 The Government's financial policies (para. 2.10) will be implemented during this project in Potosi and Sucre. This would be the first time that the "self-financing" principle has been applied in Bolivia. The cities rank fifth and sixth in size of the 6 cities with over 50,000 inhabitants. None of the undertakings in other cities raise sufficient revenues to pay operating costs, and all receive subsidies from either the municipality or the DDO. ELAPAS in Sucre is the only undertaking which operates a sewerage system -- the others being municipally owned and subsidized.

6.13 Funds will be provided to AAPOS and ELAPAS by the respective Departmental Development Committees. For the purpose of directly focusing attention on the cash position, a cash generation covenant has been designed. During negotiations it was agreed that AAPOS and ELAPAS would gradually increase tariffs as follows:

- (i) Not later than December 1, 1976 and from time to time thereafter AAPOS and ELAPAS would take all such action as shall be necessary or advisable to set and maintain tariffs for the sale of water at such levels as will produce revenues sufficient to cover:

- (a) Beginning in calendar year 1977, at least operating expenses (excluding depreciation of fixed assets and other non-cash operating charges), debt service payments (excluding interest on the proceeds of the Bank loan) and all taxes and payments in lieu of taxes;
 - (b) Beginning in calendar year 1978, at least the expenses and payments referred to in (a) above, including interest on the proceeds of the Bank loan;
 - (c) Beginning in calendar year 1979, at least (1) the expenses and payments referred to in (b) above, (2) the cost of any minor expansion for the current year, and (3) ten percent of the estimated average annual expenses for any major expansion during a period of three calendar years including the current year and the two years immediately following it. For purposes of this paragraph "major expansion" means any project or projects, the aggregate expenditures for which are expected to exceed in any one year US\$100,000 equivalent for AAPOS (or US\$200,000 for ELAPAS).
- (ii) In addition AAPOS and ELAPAS will review before July 1 of each year on the basis of realistic forecasts the adequacy of tariffs to meet the requirements set forth in paragraph (i) for the current year and the year immediately following it, furnish to the Bank the results of such review and afford the Bank the opportunity to comment thereon.

6.14 To help AAPOS attain the desired revenues, it will be required as a condition of disbursement to present the Bank with an action plan (i) to install water meters or water control devices to about 80% of its users and (ii) to introduce charges based on metered water consumption. Having been approved, the plan should be promptly implemented. The water charges would be in accordance with the National Tariff Standard (as amended) for class one cities (Annex 8). The specific measures required to attain the increases required for FY1977 were agreed upon during negotiations.

6.15 AAPOS has indicated its willingness to begin installing meters to its larger users in 1976, and when this is done those users can be charged according to consumption. Metering will enable AAPOS to increase revenues by the high percentages shown below without having to increase charges to the urban poor by the same percentages as will be required from the wealthier users.

6.16 The projected increases in revenues, average water tariffs, and total average revenues are shown in Annexes 5 and 6, Page 1. The following summary illustrates the size of the increases projected:

<u>Estimated Average Charge</u> <u>per cu. meter of water</u>	<u>Potosi</u>					
	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
B\$	0.5	0.5	1.0	1.5	2.3	2.8
US\$	(0.02)	(0.02)	(0.05)	(0.07)	(0.11)	(0.14)
% increase	-	4.0	84.0	50.0	53.0	21.0

<u>Estimated Average Charge</u> <u>per cu. meter of water</u>	<u>Sucre</u>					
	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
B\$	1.5	1.6	2.6	4.8	5.5	5.8
US\$	(0.07)	(0.08)	(0.13)	(0.24)	(0.27)	(0.29)
% increase	-	6.0	63.0	86.0	4.0	10.0

6.17 The projected revenues would result in Financial Rates of Return in 1983 of 4.0% in Potosi and 5.0% in Sucre, calculated on the estimated net revalued fixed assets used in water supply. These rates are reasonable, and, given the relative poverty of Bolivia, the small rate of population growth, and the present tariff levels, they represent an acceptable achievement.

6.18 The Financing Plan (Table 5) is based on the following assumptions:

- (i) The proposed IBRD loan of US\$11.5 million (B\$230.0 million) is assumed to carry an interest rate of 8.9% for a period of 20 years, including 4-1/2 years of grace;
- (ii) CODEPO will provide up to US\$0.5 million (B\$10 million) as a grant to AAPOS for the Potosi project;
- (iii) CODECHO will provide up to US\$2.0 million (B\$40 million) as a grant to ELAPAS for the Sucre subproject;
- (iv) Villagers benefitting from community water systems will provide 15% of the total project cost by cash, donated labor or donated materials (equivalent to 12% of the cash cost when the estimated amount of donated labor is deducted from the project cost estimate).

6.19 During negotiations, assurances were obtained from the Government that it will cause funds to be provided to meet any cost overruns and to meet any additional costs resulting from fluctuations in exchange rates. The Government will assume the exchange risk on the Bank loan.

6.20 The accounts of ELAPAS and AAPOS are subject to audit by the government auditors. The accounts of CORPAGUAS are audited by independent auditors. During negotiations assurances were obtained that the accounts of the three executing agencies will be subject to audit by independent auditors approved by the Bank on terms acceptable to the Bank, and submitted not later than 16 weeks after the close of the financial year.

Table 5: ESTIMATED FINANCING PLAN, 1976-1981

(In US\$ millions)

	D.I.U.	CORPAGUAS Rural	%	AAPOS Potosí	%	ELAPAS Sucre	%	TOTAL	%
<u>APPLICATION OF FUNDS</u>									
Proposed Project Cost	0.04	6.73		2.00		6.28		15.0	87.2
Interest during Construction	-	0.64		0.22		0.56		1.4	8.1
Increase in Working Capital	-	0.30		0.04		0.41		0.8	4.7
<u>Total Application</u>	<u>0.04</u>	<u>7.67</u>		<u>2.24</u>		<u>7.25</u>		<u>17.2</u>	<u>100.0</u>
<u>SOURCES OF FUNDS</u>									
Proposed IBRD Loan	0.04	4.80	63	1.68	75	5.00	69	11.5	67.0
Community Contribution	-	0.80		-		-		0.8	4.6
Development Committee Contribution	-	-		0.50		2.00		2.5	14.5
Government Contribution	-	2.07		-		-		2.1	12.2
Net Internal Generation	-	-		0.06		0.25		0.3	- 1.7
<u>Total</u>	<u>0.04</u>	<u>7.67</u>		<u>2.24</u>		<u>7.25</u>		<u>17.2</u>	<u>100.0</u>

VII. AGREEMENTS REACHED AND RECOMMENDATIONS

7.01 The following assurances were obtained during negotiations:

- (i) From the Government of Bolivia, that it will:
 - (a) Issue a regulation before December 31, 1976 to require that any public entity which is seeking Bolivian or foreign funds to finance a water supply or sewerage project for a community of 10,000 or more will be required to obtain the the prior approval of the Project Evaluation Unit and the National Tariff Council (para. 3.13);
 - (b) Provide details and enact any measures needed to provide an earmarked tax for a sewer subsidy in Sucre as a condition of disbursement (para. 6.08);
 - (c) Provide adequate budgetary funds to CORPAGUAS to cover the Project and its normal operations (para. 6.03);
 - (d) Cause CODEPO and CODECHO to provide adequate funds to AAPOS and ELAPAS for counterpart financing (para. 6.18);
 - (e) Provide the executing agencies with funds to meet any cost overruns and to meet any additional costs resulting from fluctuations in exchange rates (para. 6.19).
- (ii) From CORPAGUAS, that it will:
 - (a) Present to the Bank plans to transfer responsibilities for operation and maintenance and specified responsibilities for construction of water and sewer systems not later than June 30, 1978 for the departments of Cochabamba, Oruro, La Paz and Potosi and will thereafter promptly execute such plans (para. 3.09);
 - (b) Submit for Bank approval the terms and conditions of contracts with the CWCs and guarantee agreements with the DDOs as a condition of disbursement. Individual contracts and agreements would be signed prior to construction of any system (para. 3.10);
 - (c) Continue to use in its selection of rural communities criteria acceptable to the Bank (para. 4.04);
 - (d) Engage qualified consultants on terms and conditions satisfactory to the Bank for the preparation of standard designs and operating manuals which will be presented to the Bank for approval not later than June 30, 1978 (para. 4.05);

- (e) Submit to the Bank not later than 16 weeks after the close of the financial year a set of annual accounts prepared by independent auditors on terms acceptable to the Bank (para. 6.20).
- (iii) From AAPOS and ELAPAS, that they will:
- (a) Produce annual accounts from the year commencing January 1, 1977, in a form appropriate to a commercial utility (para. 6.11);
 - (b) As a condition of disbursement, implement increases in the charges for water service not later than December 1, 1976, to meet the required covenant (para. 6.13);
 - (c) Implement such increases for water services (and in Sucre, sewerage services) after January 1977 as required to meet the financial covenant (para. 6.13);
 - (d) Effective from the financial year ending December 31, 1976, have their accounts subject to annual audit by independent auditors approved by the Bank and submit these to the Bank not later than 16 weeks after the close of the financial year (para. 6.20).
- (iv) From AAPOS, that it will:
- (a) Carry out a survey and census to determine the number of user connections and complete the survey not later than April 30, 1977 (para. 4.09);
 - (b) As a condition of disbursement, present to the Bank an acceptable plan for the installation of water meters or water control devices to about 80% of its users and adopt tariffs with charges based on metered consumption and promptly implement such plan and tariffs (para. 6.14).

7.02 Conditions of disbursement will apply only to the subproject concerned.

7.03 The Project is suitable for a Bank loan of US\$11.5 million for 20 years, with a 4-1/2 year grace period on standard terms.

BOLIVIA

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

EXISTING FACILITIES AND PROJECT WORKS

RURAL COMPONENT

Existing Facilities

1. In the absence of public systems, the villagers obtain water from shallow dug wells, springs, streams and rivers. They must often carry the water considerable distances in open receptacles. The sources are subject to reduced yields in the dry season and are frequently unprotected and contaminated. The result is unsafe water in insufficient quantities for health and hygiene.

2. Many villages have rudimentary systems that derive water from a spring, stream or a well with a pump and convey the water to a central deposit or fountain by means of open canals or small pipelines. More complete systems have been built in a few villages with some distribution lines, a few house connections, and public faucets. At best, these provide only a limited amount of water of doubtful quality. The systems are old, poorly maintained, and in an advanced state of deterioration.

The Subproject

3. The subproject is the second stage of a National Plan to provide water to approximately 600 communities in Bolivia. CORPAGUAS carried out the first stage with a loan from IDB, and built 68 systems during the period 1968-73.

4. Under this subproject which will take four years, CORPAGUAS will build and improve approximately 70 systems in communities of 500 to 5,000 inhabitants, and benefit about 100,000 people. Designs, cost estimates, and rate studies for 35 systems have been prepared. 17 have been reviewed by the Bank and found acceptable. The rest of the systems will be designed as the former are built, and subsequently constructed. The provisional construction schedule is:

<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>Total</u>
8	20	24	18	70

5. The systems will consist of: the development of a suitable source such as a spring, deep well, or infiltration gallery; storage and distribution tanks; pumping stations; distribution networks; house connections for 50-70%

of the houses; a limited number of public faucets; and chlorination facilities. Gravity-type systems will be given preference over pumped systems. When surface sources must be used and treatment is necessary, sedimentation and slow sand filtration are provided to simplify maintenance.

6. For each village, CORPAGUAS requires that a local organization be established such as a committee or cooperative to represent the community and participate in the decision to have a system, its construction and subsequently its operation, maintenance and collection of tariffs. Before building the system, an agreement is signed defining the responsibilities of the community and CORPAGUAS, and establishing that rates for operation, maintenance and house connections will be paid. CORPAGUAS has had extensive and successful experience with such agreements.

7. The design consumption ranges from 40 lpcd to 120 lpcd depending on altitude, climate, type and size of community, local customs, the type of source and experience with water systems in operation in the area. The lower allowances are for the cold, high climates and the higher ones for the low warm climates. The average is about 60 lpcd. Summary of a design for a typical system follows:

Pazna

Background

8. Pazna has a population of 2,307 (CORPAGUAS census 1974). It is a Quechua community 90 km from Oruro, the capital of the department of the same name. It is 3,710 meters (12,100 feet) above sea level with a cold and dry climate. The average temperature is 13°C.

9. There is a limited cultivation of potatoes, beans, quinoa and oats and the raising of some livestock.

10. There are roads to Oruro, Potosi and the railroad to Oruro and Rio Mulato. There is also telegraph and mail service.

11. Pazna has a primary and secondary school and a small hospital with 20 beds.

12. The local water system was built in 1912 and is owned by the national railroad. The water is of poor quality and very limited in quantity. Water is collected from the Santa Rosa spring and brought to an elevated tank at the railroad station and to six public faucets in the village.

The New System

13. The Irupata spring, with a larger yield, has been selected as the new source of water by CORPAGUAS. The water is of good quality and no treatment other than chlorination is required.

14. The system would consist of intake works at the spring, a 4" A-C supply line 4 km in length, a masonry storage tank with 35 m³ capacity, a chlorinator house and chlorinator, a distribution network of 6,500 meters of 4", 3", 2" and 1-1/2" AC and PVC pipe and 450 house connections.

15. The design consumption used was 40 liters per capita per day.

SUCRE SUBPROJECT

Background

1. The city of Sucre, capital of the Republic of Bolivia, was founded on September 29, 1538 by the Spanish Conquistador, Don Pedro de Anzures, Marques de Campo Redondo. It is noted for the architecture and planning of the old center of the city where public buildings and the park are modelled on 17th-century Paris. It houses one of the oldest universities in the Americas. La Universidad Mayor Real y Pontifica de San Francisco Xavier founded in 1624, the Supreme Court of Bolivia, the Arzobispado de la Plata and the residence of his eminence, the Cardinal of Bolivia.
2. The city is 2,750 meters (9,000 feet) above sea level and has a mild and relatively dry climate. It is connected with the rest of the country by highways, railroads and air. A new airport financed with departmental funds is under construction.

Existing Water System

3. The city is supplied by three sources of water. The oldest, built in colonial times between 1556 and 1557, collects about 5 lps of water from springs on Cerro Sica Sica and supplies it directly by gravity to a small number of people on the outskirts of the city such as in Villa Charcas.
4. The Cajamarca springs were developed in 1911. The flow varies from 6 lps in the dry season to 50 lps in the rainy season. Water from the spring intake works is taken by a short canal and 10" cast iron pipeline to the treatment plant. In 1940, the Cerro Sica Sica and Cajamarca systems were joined.
5. The Rio Ravelo is the major source of water and has a minimum flow exceeding 500 lps. Studies to bring water from the Rio Ravelo, 60 km away, were started in 1942 and construction of the works finished in 1951. The facilities consist of a diversion dam, intake works, canal and pipeline, the latter joining the Cajamarca pipeline at Santa Catalina, 11 km from the city. In 1971-72, the canal was improved and additional transmission mains to the treatment plant built.
6. The conveyance facilities have a capacity of 500 lps. The facilities require continuous maintenance because they pass through mountainous areas which are subject to landslides, causing blockages or breaks in the canal. In addition to the open canal, there are about 7 km of pipe, many bridges of masonry and reinforced concrete, and an inverted siphon of cast iron pipe, 1,200 meters long. The canal system includes 2 desilting basins, 20 small tunnels, 52 km of access roads, 50 km of telephone lines and 5 field camps for the staff who maintain and control the supply

facilities. At 33 km, a 400 mm ductile iron cement-lined pressure line conducts the water to the treatment plant.

Treatment Plant

7. This has a capacity of 125 lps and was designed and built for staged expansion.
8. The raw water from the Rio Ravelo contains iron, free CO₂, and considerable turbidity.
9. Treatment includes aeration, flocculation with lime and alum, sedimentation, rapid sand filtration with air and water backwash; pH adjustment with lime, and chlorination.
10. The plant has a diesel-electric plant, which produces all its power and adequate standby equipment.

Distribution Network

11. The distribution network in the old center of the city originally consisted of steel pipe installed around 1911. It had a length of 20,000 mts and ranged in size from 25mm to 200 mm. It was subject to leakage and undersized for the actual demands of the zone it serves. It was changed in 1976 to ductile iron pipe.
12. The rest of the distribution network was installed in 1970 and consists of cement-lined ductile iron pipe. The network is divided into three pressure zones. There are about 6,000 connections, of which 4,762 were metered in September 1975.

Storage

13. Because of the danger of the interruption of the canal supply by landslides, ELAPAS has three storage tanks, each of 2,000 m³ capacity, to serve the three pressure zones.
14. There is also a small 50 m³ tank to serve a high area.

Existing Sewer System

15. The existing sewer system is of the combined type and was built in 1942. It serves the Casco Viejo of the city, with 24,300 inhabitants, about 45% of the population. The house connections are 6" in diameter.

16. The street sewers of 8" to 24" in diameter collected the storm water and sanitary sewage and discharge into 4 trunk sewers ranging in size from 24" to 72", and then into the collectors 1.2 x 1.2 meters and 4.0 x 4.0 meters in size. These collectors discharge into the Rio Quirpinchaca on the western edge of the city.

Waste Disposal Problems

17. The city has 3 natural basins which drain northwest, into which domestic and industrial wastes are discharged.

18. The wastes from the Yacimientos Petroliferas Fiscales Bolivianos (YPFB) oil refinery and its housing area are presently being discharged untreated into the nearest water course which flows through irrigated areas and into the San Juanillo Lake whose waters are used for irrigation. Many of the crops are vegetables, and there is a serious health hazard.

19. Part of the city's wastes flows into another stream and into the Juanillo lake. En route to the lake some of the waste water is used for irrigation and watering livestock. So much waste and sediment has reached the lake that it is quite shallow.

20. After the lake, the water flows into the Quebrada Tinta Mayu which receives additional wastes from the Barrios Fabril and Empleados.

21. Several springs discharge into the Quebrada whose waters are used for washing clothes and irrigation.

22. These waters eventually reach the Rio Quirpinchaca which borders the western side of the city. The main outfall of Sucre discharges into this river where the road to the airport crosses it. A short distance downstream there are three intakes where the river water is diverted for irrigation.

The Water Supply System

The Supply

23. The project would consist of improvements and repairs to the Ravelo Canal, which is the principal supply for the city. The intake works and certain sections of the canal would be protected by retaining walls or covering as required, the anchorages of the main siphon would be strengthened, and specialized masonry work would be executed on the canal-supporting structures. Thirteen short sections would be relocated or lined. In four areas where unstable soil conditions exist, the canal would be rerouted by the construction of four tunnels. ELAPAS has considerable experience in all such work and no difficulties are expected in the execution of the project.

The Treatment Plant

24. Spare parts and replacements for some of the equipment and values in the plant would be provided.

The Distribution Network and Storage

25. Because of the risk of blockages in the canal and interruptions in supply--which may still occur after this subproject--it is thought desirable to install additional storage capacity to give up to 48 hours supply. A storage tank will be built with a capacity of 2,000 m³ and be located in the low pressure zone.

26. The distribution network would be extended to the new areas of the city in accordance with a Master Plan. It would consist of ductile iron and polyvinyl chloride pipe. It would include house connections and meters.

Sewerage

27. The Development Committee of Chuquisaca has financed the studies and final design of the sewers for the city of Sucre. The trunk sewers and collectors in the old part of the city will be repaired and continue to function as combined sewers. Studies will provide for overflow and diversion structures so that during the dry season the sewage will be conducted to the separate main collectors for the new sanitary sewer system and during the rainy season excess flows will be conducted to the river and the balance to the sanitary sewer system. The tributary areas with the densest populations will be provided in a first stage with separate sanitary sewers to conduct the sewage to new collectors which will eventually be conducted to a suitable site for treatment and a treatment plant.

28. Trunk mains, street sewers, and laterals would be built in selected areas according to density and need as defined in the first stage of the master plan.

29. Locally manufactured pipe utilizing cement from the Sucre plant, and locally produced lime and bricks will be used. However, some asphalt will need to be imported for repaving some of the streets.

30. The subproject for Sucre includes:

Water Supply

(a) Replacement and increased size of the distribution network in the Casco Viejo of the city--already under construction;

- (b) Stabilization of the Ravelo Canal. This will be done by means of protective masonry and concrete work and tunnels;
- (c) Extension of the distribution network to the newer parts of the city;
- (d) Improvements and expansion of the supply lines, treatment plant, and storage facilities of the system; and
- (e) Installation of house connections and water meters.

Sewerage

- (a) Construction of sanitary sewers, house connections, and trunk mains for the new areas of the city;
- (b) Repairs and Improvements of the sewer system in the Casco Viejo of the city;
- (c) Treatment plant; and
- (d) Final design (being done by Centro Profesional Multi-disciplinario de la Paz).

Technical Assistance

31. Short-term consultants to provide on the spot training and to improve the accounting and financial management of the institution would be provided.

POTOSI SUBPROJECT

Background

-- 32. Potosí is the oldest and most economically important city in Bolivia. It was founded in 1545 by Captain Juan de Villaroel of Spain for the exploitation of the rich mineral deposits (mainly silver) of the Cerro Rico of Potosí which continues until today. At one time practically all the silver coins of the Spanish Empire were minted there. As a result of these activities the city grew rapidly, reaching its peak in 1690 and then, because of political upheavals and decrease in mining, the population declined as shown in the following table:

POPULATION OF POTOSI

<u>Year</u>	<u>Population</u>
1690	160,000
1719	60,000
1800	8,000
1900	20,000
1929	28,000
1934	35,000
1937	38,000 (Census)
1945	46,000 (Census)
1950	45,800
1965	65,000 (Census)
1975	75,000 (Estimated)

33. The city is one of the highest in the world, lying at an elevation of 3,986 meters above sea level. It has a rather bleak and forbidding aspect compared to Sucre. On the outskirts of the city there is practically no vegetation other than the tough Altiplano bunch grass and within the city only a few shrubs and trees that must be carefully tended and protected from the rigorous climate. The climate is dry and cold with an average temperature less than 50°F and temperatures that go below freezing.

34. There is a limited rainy season lasting from December to March during which an average of about 400 mm occurs. Occasionally there are light snows and hailstorms.

35. The University of Potosi is located here. The city is connected with Antofagasta by a railroad built to export ore, and with Sucre and La Paz by railroad, highway, and air. It is served by telegraph and radio.

36. The principal minerals now being mined, in order of importance, are tin, silver, zinc, wolfram, copper, antimony, and sulfur. Small processing plants have been built by the Corporacion Minera de Bolivia (COMIBOL).

Existing Facilities

37. The first supply of water for the inhabitants was obtained from several small springs on the slopes of the mountains around the city. By 1572, the mining activity had increased so greatly, that it was decided to process the ore hydraulically. To obtain this power, a series of dams and canals was built in the valleys high above the city.

38. In 1574, King Philip II of Spain, by royal decree assigned a force of 20,000 Indians who labored for 43 years to construct and maintain these facilities. The dams were repaired in 1613-1616 and in 1930-1936. The system was expanded under a loan from IDB in 1967-1973. Some of these works are in use today (Chalviri Dam for example).

39. The city is supplied with water from two systems of lakes, those of the Chalviri basin and San Ildefonso basin, where a new dam has recently been built. The dam is not yet in service. During certain periods of the year, water is also obtained from the San Sebastian Basin.

40. There are five systems:

<u>Chalviri Basin:</u>	Illimani and Chalviri Lakes
<u>San Ildefonso Basin:</u>	San Pablo and San Ildefonso Lakes
<u>San Sebastian Basin:</u>	Muniza and San Sebastian Lakes
<u>San Jose Basin:</u>	Huacani, Providencia, San Jose Lakes
<u>Pati-Pati Basin:</u>	Santa Lucia, Atocha, Candelaria Lakes

41. The principal lake is Chalviri with a capacity of 2,480,000 m³, a depth of 7.5 meters and a drainage area of 16.5 km². It is formed by a dike 9 meters high, made of three parallel masonry walls with a compacted earth fill. The intake is of 12" diameter steel pipe with a gate valve. The capacity has been increased to 3,050,000 m³ by raising the spillway 70 cm.

42. The second lake in importance is San Ildefonso with a capacity of 2,000,000 m³ and a drainage area of 9.3 km². The dam height was increased 70 cm under the IDB loan.

43. The next system in order of amount of water supplied is San Sebastian with a drainage area of 13 m². It is used only during the rainy season. San Sebastian accumulates 288,000 m³ and Muniza 180,000 m³.

44. The San Jose system has a drainage area of 7.5 m² and three low dikes, Llama Miku, Buena Ventura and San Jose. There are two lakes, Huacani and Providencia (practially abandoned). The storage capacity is as follows:

San Jose Dikes	40,000 m ³
Huacani Lakes	320,000 m ³

45. The Pati-Pati system has a drainage area of 6 km². It contains three lakes connected to San Jose by means of a masonry canal.

Proposed Water Supply Facilities

46. The proposed subproject for Potosi is the second stage of a 20-year program "Improvement of the Water System of the City of Potosi." The first stage was completed under a loan from IDB.

47. The subproject is necessary to remedy the present deficient service and to meet the residential and industrial growth of the city. There is no firm data on production or consumption, and no population census since 1965; consequently, the consumption and production figures for the subproject are based on best estimates by the AAPOS and Bank staff. Hydrological data to determine variations in the monthly availability of water and storage requirements are lacking.

48. The subproject provides for the early installation of source meters, a census of consumers and metering of 80% of the consumer connections. As information becomes available it may be necessary to revise the projections. Additional water would be obtained from small impoundments and conveyance losses reduced by lining and covering canals.

49. The subproject would include the following works and studies:

Intake Works: The existing dikes at Pati-Pati and San Jose would be repaired, and infiltration galleries would be constructed to collect groundwater. During colonial times as much as 100 lps were obtained from these sources.

Conveyance Improvements: The open canal that conducts water from the Pati-Pati and San Jose drainage basins to the Milner Tank would be covered and lined to eliminate losses. The total length is 12,600 meters.

Treatment Plant Expansion: To match the increased supply, the filter area will be increased and a settling basin will be added.

Distribution Network: The distribution network will be extended to unserved areas of the city, the fringe areas, and several satellite communities, thus increasing the area served by 5.4 km².

Leak Detection and Repair: A survey to locate and determine the magnitude of the leaks would be carried out, and the major leaks would be repaired first.

Census of Users: A house-to-house survey to verify the location and number of water and sewer connections and public faucets.

Metering and House Connections: Meters would be installed at all the sources, on all the existing connections and new house connections for users in the additional areas served by the extension of the distribution network.

Technical Assistance: Consultant advisory services and training to improve the organization, management, and financial condition of AAPOS would be provided. Tariff studies would also be carried out.

Public Relations: An intensive and continuing program to inform the public about the benefits of the subproject and the need for metering and tariffs will be carried out by AAPOS with the assistance of advisors. This is necessary to assure the goodwill and cooperation of the public.

BOLIVIA
URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

RURAL COMPONENT
SCHEDULE OF WORKS
FIRST 35 SUBPROJECTS
(In B\$ Millions)

<u>CORPAGUAS</u> <u>FILE NO.</u>	<u>DEPARTMENT &</u> <u>COMMUNITY</u>	<u>ACTUAL</u> <u>POPULATION</u>	<u>FUTURE</u> <u>POPULATION</u> (Year 2000)	<u>BASE COST</u> <u>ESTIMATE</u>
	<u>POTOSI</u>			
5	Chayanta	1813	2687	1,114,887
6	Pocoata	964	1380	1,247,954
7	Ocuri	1265	1690	893,365
8	Otavi	309	685	633,260
9	Porco	1070	1530	880,008
10	Llica	2146	4320	1,621,047
11	Torotoro	515	736	665,108
12	Macha	1172	1674	1,294,351
	<u>ORURO</u>			
13	Tomas Barron	3442	5507	3,923,694
14	Caracollo	1527	2608	2,290,631
37	Pazna	2307	4235	1,520,889
	<u>LA PAZ</u>			
15	Palca	805	1232	855,364
16	Ynacachi	822	1175	619,122
17	Irupana	2212	4063	1,241,357
18	Quime	3120	5604	1,716,645
19	Tipuani	1416	2020	1,061,594
20	Umala	376	537	974,553
21	Cangalli	264	1000	539,003
22	Guanay	1241	1972	1,698,344
23	Puerto Acosta	1672	2390	1,368,715
24	Stgo De Huata	870	1246	790,407
25	Ayo Ayo	632	968	750,113
26	Calamarca	506	723	617,626
39	Charana	400	572	846,338
40	Pelechuco	627	896	298,533
	<u>COCHABAMBA</u>			
27	Vacas	1079	1726	1,565,463
28	Anzaldo	863	1227	892,352
29	Cocapata	481	583	470,972
30	Tapacari	721	1029	952,112
31	Tiquipaya	1124	1547	1,257,804
32	Arani	2633	3762	2,136,828
33	Santivanez	633	904	1,044,612
34	Capinota	2960	4736	4,595,054
35	Cliza	3626	5182	6,157,952
38	Colomi	1830	2438	1,157,162
	TOTAL:	<u>47,443</u>	<u>74,584</u>	<u>49,693,219</u>

1/ The 35 projects scheduled are those for which CORPAGUAS has completed studies. Should delays occur in obtaining community participation, subprojects for other communities will be substituted.

B O L I V I A

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

CORPAGUAS

RURAL COMPONENT

SUBPROJECT COST ESTIMATES ^{1/}

	-----B\$ million-----			-----US\$ million-----		
	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
Construction of 70 systems	12.0	64.0	76.0	0.60	3.20	3.80
Administration and Engineering	13.4	--	13.4	0.67	--	0.67
Base Cost	<u>25.4</u>	<u>64.0</u>	<u>89.4</u>	<u>1.27</u>	<u>3.20</u>	<u>4.47</u>
Technical Assistance	1.0	--	1.0	0.05	--	0.05
Physical Contingencies	3.0	9.6	12.6	0.15	0.48	0.63
Price Contingencies	2.8	28.8	31.6	0.14	1.44	1.58
Total Project Cost	<u>32.2</u>	<u>102.4</u>	<u>134.6</u>	<u>1.61</u>	<u>5.12</u>	<u>6.73</u>

^{1/} Estimates are based on price levels as of October 1975.

B O L I V I A

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

AAPOS - SUBPROJECT - POTOSI

COST ESTIMATES ^{1/}

	<u>-----B\$ Million-----</u>			<u>-----US\$ Million-----</u>		
	<u>LOCAL</u>	<u>FOREIGN</u>	<u>TOTAL</u>	<u>LOCAL</u>	<u>FOREIGN</u>	<u>TOTAL</u>
Construction Equipment	-	6.8	6.8	0.00	0.34	0.34
Canals: Pati Pati and San Jose	3.8	2.8	6.6	0.19	0.14	0.33
Water Treatment Plant	0.6	0.4	1.0	0.03	0.02	0.05
Distribution System	0.8	4.0	4.8	0.04	0.20	0.24
Connections and Meters	0.2	1.6	1.8	0.01	0.08	0.09
Leak Detection	-	2.4	2.4	0.00	0.12	0.12
User Census	0.6	-	0.6	0.03	0.00	0.03
Subtotal	<u>6.0</u>	<u>18.2</u>	<u>24.0</u>	<u>0.30</u>	<u>0.90</u>	<u>1.20</u>
Administration and Engineering (Design)	2.4 0.2	- 0.4	2.4 0.6	0.12 0.01	0.00 0.02	0.12 0.03
Basic Cost	<u>8.6</u>	<u>18.6</u>	<u>27.0</u>	<u>0.43</u>	<u>0.93</u>	<u>1.35</u>
Technical Assistance	1.4	-	1.4	0.07	0.00	0.07
Physical Contingencies	1.4	2.8	4.2	0.07	0.14	0.21
Price Contingencies	2.4	5.0	7.4	0.12	0.25	0.37
Total Cost	<u>13.8</u>	<u>26.4</u>	<u>40.0</u>	<u>0.69</u>	<u>1.32</u>	<u>2.00</u>

^{1/} Estimates are based on price levels as of October 1975.

B O L I V I A

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

ELAPAS - SUBPROJECT - SUCRE

COST ESTIMATES 1/

	<u>B\$ Million</u>			<u>US\$ Million</u>		
	<u>LOCAL</u>	<u>FOREIGN</u>	<u>TOTAL</u>	<u>LOCAL</u>	<u>FOREIGN</u>	<u>TOTAL</u>
Canal Works	2.2	1.8	4.0	0.11	0.09	0.20
Maintenance Equipment	-	2.2	2.2	0.00	0.11	0.11
Water Treatment Plant Extension	0.6	0.1	0.8	0.03	0.05	0.08
Distribution System	4.0	25.4	29.4	0.20	1.27	1.47
Extension Sewerage System	9.2	33.6	42.8	0.46	1.68	2.14
Subtotal	<u>16.0</u>	<u>64.0</u>	<u>80.0</u>	<u>0.80</u>	<u>3.20</u>	<u>4.00</u>
Administration and Engineering (Design)	3.0 2.2	- 1.8	3.0 4.0	0.15 0.11	- 0.09	0.15 0.20
Basic Cost	<u>21.2</u>	<u>65.8</u>	<u>87.0</u>	<u>1.06</u>	<u>3.29</u>	<u>4.35</u>
Technical Assistance	0.2	-	0.2	0.01	0.00	0.01
Physical Contingencies	3.6	9.6	13.2	0.18	0.48	0.66
Price Contingencies	6.8	18.2	25.0	0.34	0.91	1.25
Total Project Cost	<u>31.8</u>	<u>95.6</u>	<u>125.4</u>	<u>1.59</u>	<u>4.78</u>	<u>6.27</u>

1/ Estimates are based on price levels as of October 1975.

	Man Months	Average Fee per man-months U.S.\$	Total Cost U.S.\$
<u>DIU</u>			
a. <u>Consultant for:</u>			
(i) review and improvement of administration and organization	1	2,000	2,000
(ii) definition of functions and responsibilities of DIU, position descriptions, policy	3	2,000	6,000
b. <u>Consultant for:</u>			
(i) project evaluation training	4	4,000	16,000
(ii) travel (2 round trips - foreign)	-	--	1,200
(iii) internal travel	-	--	300
(iv) per diem	-	--	4,500
	Sub-total:		<u>30,000</u>
(v) contingency			<u>3,000</u>
			33,000
c. <u>Consultant for:</u>			
(i) metering programs and effect in Sucre and Potosi	1	2,000	2,000
(ii) tariff structures and effects in Sucre and Potosi	1	2,000	2,000
	Sub-total:		<u>37,000</u>
(iii) contingency			<u>3,000</u>
	Total:		<u>40,000</u>
<u>CORPAGUAS</u>			
a. <u>Consultants for:</u>			
Standardization of designs, materials, specifications bidding documents	4	2,000	8,000
b. <u>Consultants for:</u>			
Manuals for operation and maintenance personnel at village level	3	2,000	6,000
c. <u>Consultants for:</u>			
(i) planning the transfer of operation and maintenance support to DDO's (agreements, responsibilities, schedules)	3	2,000	6,000
(ii) planning other transfer of construction to DDO's (agreements, responsibilities, schedules)	3	2,000	6,000
(iii) internal travel	-	--	1,200
(iv) per diem (90 days x \$20)	-	--	1,800
d. <u>Consulting Firm for:</u>			
Review and improvement of accounting procedures	4	4,000	16,000
e. <u>Printing expenses</u>	-	--	2,000
	Sub-total:		<u>47,000</u>
f. <u>Contingency</u>			<u>5,000</u>
	Total:		<u>52,000</u>
<u>AAPOS</u>			
a. <u>Consulting Firm for:</u>			
i) review and establishment of sound accounting procedures	6	4,000	14,000
(ii) review and improve commercial practices, billing and collecting	4	4,000	16,000
(iii) internal travel	-	--	200
(iv) per diem (6 months or 180 days x \$20)	-	--	3,600
b. <u>Consultant for:</u>			
(i) establishing a meter repair shop and maintenance program	2	2,000	4,000
c. <u>Consultant for:</u>			
public relations program	4	2,000	8,000
	Sub-total:		<u>62,000</u>
d. <u>Contingency</u>			<u>6,200</u>
	Total:		<u>72,000</u>
<u>ELAPAS</u>			
a. <u>Consultants for:</u>			
developing financial and reporting practices	4	2,000	8,000
b. <u>Contingency</u>			<u>1,000</u>
			<u>9,000</u>
<u>SUMMARY</u>			
DIU	10		40,000
CORPAGUAS	17		52,000
AAPOS	16		72,000
ELAPAS	4		9,000
	TOTAL:		<u>173,000</u>

BOLIVIAAPPRAISAL OF THEURBAN AND RURAL WATER SUPPLY AND SEWERAGE PROJECTESTIMATED SCHEDULE OF LOAN DISBURSEMENTS

<u>IBRD Fiscal Year and Quarter Ending</u>	<u>Quarterly Disbursement</u> (US\$ millions)	<u>Cumulative Disbursement</u>
<u>1977</u>		
December 30, 1976	0.10	0.10
March 31, 1977	0.70	0.80
June 30, 1977	1.00	1.80
<u>1978</u>		
September 30, 1977	1.20	3.00
December 31, 1977	1.00	4.00
March 31, 1978	1.50	5.50
June 30, 1978	1.00	6.50
<u>1979</u>		
September 30, 1978	1.50	8.00
December 31, 1978	1.00	9.00
March 31, 1979	1.25	10.25
June 30, 1979	0.25	10.50
<u>1980</u>		
September 30, 1979	0.50	11.00
December 31, 1979	0.20	11.20
March 31, 1980	0.10	11.30
June 30, 1980	0.10	11.40
<u>1981</u>		
September 30, 1980	0.10	11.50

August 1976

BOLIVIA
APPRAISAL OF THE
URBAN AND RURAL WATER SUPPLY AND SEWERAGE PROJECT
ASSUMPTIONS FOR FINANCIAL PROJECTIONS

The financial projections have been made using the ECOFI Computer Projection System. The following are the significant assumptions.

Assumptions Common to all Subprojects

1. Price Inflation Domestic inflation has been estimated using the La Paz Consumer Price Index as a base. The estimates for imported material are based on average trend figures for world prices. The rates adopted are:

%	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Domestic	12	10	9	8	8
Foreign	12	10	8	8	8

2. For asset revaluation, 85% of the Domestic inflation factor has been used as a proxy for a nationwide construction cost index. Assets are depreciated at an average rate of 2.8% per annum.

3. The Bolivian Peso is presumed to maintain its present relationship of 20.0 to 1 US Dollar.

4. The executing agencies are exempt from taxes other than social security and are assumed to remain in that status.

Urban Component

AAPOS - Potosi

1. The demand projections are based on the assumption that the present consumption is 25 cu. metres per month per connection (9 people per connection) and that water losses in the system are 62% of water produced, but are reduced as shown in Annex 5.

2. The new connections are assumed to have a demand of 20 cu. metres per month, rising to 22.0 cu. metres in 1987 and to serve 7.5 people per connection. This takes into account CODEPO plans for urban renewal and new housing.

3. The population of Potosi is assumed to grow at 1.5% per annum. This low figure is adopted because of the unattractive location of the city in high bleak mountains. There is little rural-urban migration as the relative attractions of the city are not strong.

ELAPAS - Sucre

1. The demand projections are based on the assumption that the present residential water consumption is 20 cubic meters per connection (6.5 people per connection) and that initial water losses are 48% of production, but are reduced as shown in Annex 6.

2. The new connections are presumed to use 20,00 cu. metres per month but as the regularity of the service improves and the sewer system is installed, the average for all connections will increase to 28 cu. metres per month in 1979.

3. The population is assumed to grow at 2.5% per annum, slightly below the annual national growth rate of 2.6 as Sucre has physical and planning restrictions on its expansion.

4. ELAPAS is expected to introduce both a sewerage service surcharge of 10% of the monthly water bill effective January 1, 1978 and a tax on cement to yield around US\$0.2 million per year starting in 1979.

BOLIVIA

APPRAISAL OF THE

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

AAPOS POTOST	INCOME STATEMENT									
	MILLION B\$									
	AUG 1976									
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
POPULATION-THOUSAND	74.00	75.11	76.24	77.38	78.54	79.72	80.91	82.13	83.36	84.61
POPULATION SERVED-WATER	30.60	36.90	43.20	48.72	55.05	61.21	67.71	67.66	68.49	70.53
POPULATION SERVED-SEWER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% POPULATION SERVED-WATER	41.35	49.13	56.67	62.96	70.09	76.78	83.06	82.38	82.64	83.36
WATER CONNECTIONS-THOUS.	3.40	4.10	4.80	5.60	6.40	7.20	8.00	8.20	8.40	8.60
VOLUME SOLD-MILLION M3	1.17	1.23	1.40	1.59	2.98	3.17	3.37	3.51	3.57	3.62
CONSUMPTION/CONNEC/MONTH	28.68	25.00	24.27	23.66	38.82	36.73	35.06	35.69	35.36	35.05
UNACCOUNTED FOR WATER %	62.00	62.00	55.00	40.00	35.00	30.00	25.00	25.00	23.00	23.00
WATER PRODUCTION-MILL. M3	3.08	3.24	3.11	2.65	4.59	4.53	4.49	4.68	4.63	4.70
PER CAPITA PRODUCTION LCD	279.50	243.66	199.76	151.09	231.50	205.78	185.49	192.27	186.70	185.06
WATER REVENUES	0.62	0.64	0.76	1.59	4.47	7.30	9.39	10.05	10.30	11.94
OTHER OPERATIONAL REVENUE	0.30	0.49	0.49	0.56	0.56	0.56	0.56	0.14	0.14	0.14
TOTAL REVENUES	0.92	1.13	1.25	2.15	5.03	7.86	9.95	10.19	10.44	12.08
WATER WAGES	0.91	1.15	1.26	1.52	1.78	2.06	2.35	2.56	2.78	3.01
CHEMICALS	0.03	0.04	0.04	0.03	0.06	0.07	0.07	0.08	0.09	0.09
POWER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MATERIALS	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06
DIRECT COSTS-WATER	0.96	1.21	1.33	1.58	1.88	2.17	2.47	2.69	2.92	3.17
DIRECT COSTS SEWERAGE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL DIRECT COSTS	0.96	1.21	1.33	1.58	1.88	2.17	2.47	2.69	2.92	3.17
ADMINISTRATION	0.25	0.33	0.40	0.49	0.58	0.68	0.79	0.86	0.93	1.02
OTHER INDIRECT COSTS	0.02	0.04	0.05	0.10	0.27	0.44	0.56	0.60	0.62	0.72
TOTAL COSTS	1.24	1.57	1.78	2.17	2.73	3.30	3.83	4.15	4.47	4.90
INCOME BEFORE DEPRECIATION	-0.31	-0.44	-0.53	-0.02	2.31	4.56	6.12	6.03	5.97	7.18
DEPRECIATION	0.58	0.84	0.97	1.06	1.48	2.17	2.60	2.87	3.10	3.35
INCOME BEFORE INTEREST	-0.89	-1.29	-1.50	-1.08	0.82	2.40	3.52	3.17	2.87	3.83
INTEREST CHARGED OPER.	0.00	0.00	0.00	0.00	0.00	1.12	2.91	2.75	2.60	2.44
NET SURPLUS (+)	-0.89	-1.29	-1.50	-1.08	0.82	1.28	0.61	0.41	0.27	1.39
AVERAGE RATE BASE	20.32	29.15	32.60	34.60	48.29	70.47	83.24	89.24	93.88	96.57
*OPERATING RATIO %	133.90	139.13	142.14	100.77	54.20	41.92	34.45	40.75	42.80	40.56
*RATE OF RETURN %	-4.38	-4.42	-4.59	-3.11	1.70	3.40	4.23	3.55	3.06	3.88
AVERAGE WATER TARIFF \$/ M3	0.53	0.52	0.54	1.00	1.50	2.30	2.79	2.86	2.89	3.30
TOTAL AVER. REVENUES \$/ M3	0.79	0.92	0.89	1.35	1.69	2.48	2.96	2.90	2.93	3.34
% ANNUAL INCREASE WATER TARIFF		-1.89	4.42	84.16	50.00	53.33	21.30	2.51	1.05	14.19
% ANNUAL INCR. TOTAL REVENUES		16.40	-2.71	51.34	24.84	46.71	19.38	-1.91	1.01	13.98
TOTAL COST/VOL. SOLD \$/ M3	1.06	1.28	1.27	1.36	0.91	1.04	1.14	1.18	1.25	1.35

BOLIVIA

APPRAISAL OF THE

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

AAPOS POTOST

FLOW OF FUNDS

MILLION B6

AUG 1976

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
SOURCES OF FUNDS										
INCOME BEFORE DEPRECIATION	-0.31	-0.44	-0.53	-0.02	2.31	4.56	6.12	6.03	5.97	7.18
NON OPER. REVENUES (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GROSS INTERNAL GENERATION	-0.31	-0.44	-0.53	-0.02	2.31	4.56	6.12	6.03	5.97	7.18
GRANTS	0.57	0.54	2.97	4.49	2.54	0.00	0.00	0.00	0.00	0.00
INCREASE IN RESERVES	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IBRD LOAN	0.00	0.00	5.56	20.37	7.67	0.00	0.00	0.00	0.00	0.00
NATIONAL LOANS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOANS	0.00	0.00	5.56	20.37	7.67	0.00	0.00	0.00	0.00	0.00
TOTAL SOURCES	0.36	0.10	8.00	24.85	12.52	4.56	6.12	6.03	5.97	7.18
APPLICATIONS OF FUNDS										
INVESTMENT IN PROJECT	0.00	0.00	6.00	22.75	11.51	0.00	0.00	0.00	0.00	0.00
CAPITALIZED INTEREST	0.00	0.00	0.18	1.54	2.68	1.87	0.00	0.00	0.00	0.00
OTHER INVESTMENT	0.00	3.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	3.00
OTHER WORKS EXCESS CASH	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL INVESTMENT	0.21	3.00	6.18	24.28	14.19	1.87	1.00	1.00	1.00	3.00
IBRD AMORTIZATION	0.00	0.00	0.00	0.00	0.00	0.88	1.77	1.77	1.77	1.77
NATIONAL PROJECT LOAN AMORT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL AMORTIZATION	0.00	0.00	0.00	0.00	0.00	0.88	1.77	1.77	1.77	1.77
OPER. INTEREST LONG T. LOAN	0.00	0.00	0.00	0.00	0.00	1.12	2.91	2.75	2.60	2.44
TOTAL DEBT SERVICE	0.00	0.00	0.00	0.00	0.00	2.01	4.68	4.52	4.37	4.21
INCREASE IN WORK. CAPITAL	0.15	-2.90	1.83	0.56	-1.67	0.69	0.44	0.51	0.61	-0.03
TOTAL APPLICATIONS	0.36	0.10	8.00	24.85	12.52	4.56	6.12	6.03	5.97	7.18
DEBT SERVICE RATIO	0.00	0.00	*****	*****	*****	*****	*****	*****	*****	*****
						2.28	1.31	1.33	1.37	1.71

BOLIVIA

APPRAISAL OF THE

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

AAPOS POTCSI

BALANCE SHEET

MILLION B\$

AUG 1976

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
A S S E T S										
FIXED ASSETS IN OPER.	27.21	33.15	36.13	39.52	66.55	88.21	97.76	106.92	114.66	124.88
MINUS ACCUM.DEPRECIATION	0.58	1.48	2.59	3.86	5.62	8.19	11.31	14.89	18.93	23.47
NET FIXED ASSETS	26.63	31.66	33.54	35.66	60.93	80.02	86.45	92.04	95.73	101.41
WORK IN PROGRESS	0.00	0.00	6.18	30.00	20.00	5.00	2.00	0.00	0.00	0.00
CASH AND BANKS	1.37	0.13	2.99	4.23	3.61	3.95	3.76	4.20	4.72	4.20
ACCOUNTS RECEIVABLE	2.13	0.79	0.75	1.08	2.01	2.36	2.99	3.06	3.13	3.62
INVENTORIES	0.10	0.03	0.04	0.04	0.06	0.07	0.07	0.08	0.09	0.09
SPARE PART INVENTORY	4.90	4.00	3.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER CURRENT ASSETS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL CURRENT ASSETS	8.50	4.96	6.78	7.34	5.68	6.37	6.82	7.33	7.94	7.92
TOTAL ASSETS	35.13	36.62	46.50	73.00	86.61	91.39	95.27	99.37	103.67	109.32
EQUITY AND LIABILITIES										
EQUITY	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
CONTRIBUTIONS	20.57	21.11	24.08	28.57	31.11	31.11	31.11	31.11	31.11	31.11
REVALUATION SURPLUS	0.00	2.88	5.73	8.44	11.01	15.40	20.44	25.88	31.68	37.71
OPERATIONAL SURPLUS	0.21	-1.08	-2.57	-3.65	-2.83	-1.55	-0.94	-0.53	-0.25	1.13
TOTAL EQUITY	21.32	23.45	27.77	33.90	39.83	45.49	51.14	57.00	63.08	70.50
LONG TERM DEBT (NET)	13.00	13.00	18.56	38.93	45.72	43.95	42.18	40.41	38.64	36.87
ACCOUNTS PAYABLE	0.69	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
CURRENT MATURITIES	0.00	0.00	0.00	0.00	0.88	1.77	1.77	1.77	1.77	1.77
OTHER CURRENT LIABILITIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL CURRENT LIABILITIES	0.69	0.01	0.01	0.01	0.90	1.79	1.79	1.79	1.79	1.79
RESERVES	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
TOTAL LIABILITIES	13.82	13.17	18.73	39.10	46.78	45.90	44.13	42.36	40.59	38.83
TOTAL EQUITY-LIABILITIES	35.13	36.62	46.50	73.00	86.61	91.39	95.27	99.37	103.67	109.32
CURRENT RATIO	13.04	573.99	708.24	741.57	6.32	3.57	3.82	4.10	4.44	4.42
% DEBT/(DEBT+EQUITY)	37.88	35.67	40.06	53.45	53.44	49.14	45.20	41.48	37.99	34.34
WORKING CAPITAL - MILLION	7.85	4.95	6.77	7.33	5.66	6.35	6.80	7.31	7.92	7.89

BOLIVIA

APPRAISAL OF THE

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

AAPOS - POTOSI

MARGINAL COSTS AND BENEFITS

YEAR	TOTAL COSTS + OTHER REVENUES	VOLUME SOLD	AVERAGE REVENUES \$/M ³	TARIFF REVENUES	NET BENEFITS
1976	-5.711	0.168	0.543	0.091	-5.619
1977	-20.712	0.360	0.009	0.327	-20.385
1978	-10.095	1.752	1.251	2.192	-7.903
1979	-0.899	1.944	1.776	3.453	2.554
1980	-1.212	2.136	1.095	4.261	3.049
1981	-1.630	2.282	1.011	4.362	2.732
1982	-1.723	2.335	1.805	4.215	2.492
1983	-1.942	2.362	1.926	4.550	2.608
1984	-1.942	2.362	1.926	4.550	2.608
1985	-1.942	2.362	1.926	4.550	2.608
1986	-1.942	2.362	1.926	4.550	2.608
1987	-1.942	2.362	1.926	4.550	2.608
1988	-1.942	2.362	1.926	4.550	2.608
1989	-1.942	2.362	1.926	4.550	2.608
1990	-1.942	2.362	1.926	4.550	2.608
1991	-1.942	2.362	1.926	4.550	2.608
1992	-1.942	2.362	1.926	4.550	2.608
1993	-1.942	2.362	1.926	4.550	2.608
1994	-1.942	2.362	1.926	4.550	2.608
1995	-1.942	2.362	1.926	4.550	2.608
1996	-1.942	2.362	1.926	4.550	2.608
1997	-1.942	2.362	1.926	4.550	2.608
1998	-1.942	2.362	1.926	4.550	2.608
1999	-1.942	2.362	1.926	4.550	2.608
2000	-1.942	2.362	1.926	4.550	2.608
2001	-1.942	2.362	1.926	4.550	2.608
2002	-1.942	2.362	1.926	4.550	2.608
2003	-1.942	2.362	1.926	4.550	2.608
2004	-1.942	2.362	1.926	4.550	2.608
2005	-1.942	2.362	1.926	4.550	2.608
2006	-1.942	2.362	1.926	4.550	2.608
2007	-1.942	2.362	1.926	4.550	2.608
2008	-1.942	2.362	1.926	4.550	2.608

PRESENT VALUE OF COSTS AND BENEFITS AT A DISCOUNT OF

0.0 %	44.72
5.0 %	4.48
10.0 %	-10.09
20.0 %	-18.89

INCREMENTAL RATE OF RETURN FOR WATER % = 6.11 FOR 33 YEARS

BOLIVIA
APPRAISAL OF THE

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

10-ELAPAS SURF	INCOME STATEMENT ALTERNATIVE 1					MILL R9		AUG 1976		
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
POPULATION-THOUSAND	54.00	55.35	56.73	58.15	59.61	61.10	62.62	64.19	65.79	67.44
POPULATION SERVED-WATER	37.05	41.02	44.27	46.78	49.20	50.69	51.66	53.46	55.86	57.06
POPULATION SERVED-SEWER	25.38	26.57	31.20	34.89	38.74	45.82	50.10	51.35	52.64	53.95
% POPULATION SERVED-WATER	68.61	74.10	78.02	80.45	82.55	82.97	82.49	83.29	84.90	84.61
WATER CONNECTIONS-THOUS.	5.70	6.31	6.81	7.31	7.81	8.31	8.61	8.91	9.31	9.51
SEWER CONNECTIONS-THOUSAN	3.90	4.09	4.80	5.45	6.15	7.51	8.35	8.56	8.77	8.99
% POPULATION SERVED-SEWER	47.00	48.00	55.00	60.00	65.00	75.00	80.00	80.00	80.00	80.00
VOLUME SOLD-MILLION M3	2.05	2.02	2.14	2.26	2.74	3.26	3.37	3.47	3.60	3.67
CONSUMPTION/CONNEX/MONTH	29.97	26.63	26.15	25.73	29.20	32.74	32.57	32.42	32.23	32.14
UNACCOUNTED FOR WATER %	48.00	48.00	45.00	35.00	30.00	30.00	25.00	25.00	20.00	20.00
WATER PRODUCTION-MILL. M3	3.94	3.88	3.88	3.47	3.91	4.66	4.49	4.62	4.50	4.50
PER CAPITA PRODUCTION LCD	295.57	262.65	243.78	206.13	220.71	255.56	241.28	240.14	223.81	223.19
WATER REVENUES	3.20	3.02	3.38	5.83	13.14	16.32	18.51	20.10	22.32	24.94
SEWER REVENUES	0.00	0.00	0.00	0.00	1.03	1.48	1.80	1.93	2.10	2.36
OTHER OPERATIONAL REVENUE	0.00	0.24	0.20	0.20	0.20	4.20	4.12	4.12	4.16	4.08
TOTAL REVENUES	3.20	3.27	3.58	6.03	14.37	22.00	24.42	26.16	28.59	31.38
WATER WAGES	1.84	2.26	2.64	3.05	3.47	3.98	4.34	4.78	5.29	5.76
CHEMICALS	0.30	0.34	0.37	0.40	0.44	0.47	0.50	0.54	0.58	0.62
POWER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MATERIALS	0.20	0.24	0.27	0.31	0.35	0.39	0.43	0.47	0.52	0.56
DIRECT COSTS-WATER	2.34	2.83	3.29	3.77	4.26	4.81	5.28	5.78	6.39	6.94
SEWER WAGES	0.21	0.24	0.26	0.28	0.30	0.33	0.35	0.38	0.40	0.43
DIRECT COSTS SEWERAGE	0.21	0.24	0.26	0.28	0.30	0.33	0.35	0.38	0.40	0.43
TOTAL DIRECT COSTS	2.55	3.07	3.55	4.05	4.57	5.14	5.63	6.16	6.79	7.37
ADMINISTRATION	1.00	1.16	1.30	1.45	1.60	1.76	1.90	2.06	2.23	2.40
OTHER INDIRECT COSTS	0.00	0.18	0.20	0.35	0.85	1.07	1.22	1.38	1.47	1.64
TOTAL COSTS	3.59	4.41	5.05	5.85	7.01	7.96	8.75	9.54	10.69	11.41
INCOME BEFORE DEPRECIATION	-0.39	-1.14	-1.47	0.18	7.36	14.03	14.68	16.41	18.10	19.97
DEPRECIATION	1.27	1.79	2.08	3.11	4.92	6.48	7.29	7.79	8.32	8.93
INCOME BEFORE INTEREST	-1.66	-2.92	-3.55	-2.93	2.44	7.56	8.38	8.62	9.78	11.04
INTEREST CHARGED OPER.	0.00	0.00	0.08	0.15	0.15	3.49	8.82	8.35	7.88	7.41
NET SURPLUS (+)	-1.66	-2.92	-3.63	-3.08	2.29	4.07	-0.43	0.47	1.90	3.63
AVERAGE RATE BASE	17.95	33.62	39.44	70.72	128.57	175.42	194.09	200.56	206.68	214.40
*OPERATING RATIO %	112.26	134.80	140.99	96.99	48.81	36.20	35.82	36.48	36.68	36.36
*RATE OF RETURN %	-9.25	-8.70	-9.00	-4.14	1.90	4.31	4.32	4.40	4.73	5.15
AVERAGE WATER TARIFF \$/ M3	1.56	1.50	1.58	2.58	4.40	5.00	5.50	5.80	6.20	6.80
SEWER REVENUE \$/CONN/MONTH	0.00	0.00	0.00	0.00	14.02	16.37	17.91	18.40	19.99	21.86
TOTAL AVER.REVENUES \$/ M3	1.56	1.62	1.68	2.67	5.25	6.74	7.26	7.55	7.94	8.56
% ANNUAL INCREASE WATER TARIFF		-3.85	5.53	63.17	85.83	4.17	10.00	5.45	6.90	9.68
% ANNUAL INCR. TOTAL REVENUES		3.91	3.43	59.35	96.55	28.33	7.70	3.97	5.22	7.76
TOTAL COST/VOL. SOLD \$/ M3	1.75	2.19	2.36	2.59	2.56	2.44	2.60	2.75	2.91	3.11

BOLIVIA

APPRAISAL OF THE

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

11-ELAPAS SUCRF

FLOW OF FUNDS

MILL BS

AUG 1976

ALTERNATIVE 1

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
SOURCES OF FUNDS										
INCOME BEFORE DEPRECIATION	-0.39	-1.14	-1.47	0.18	7.36	14.03	15.68	16.61	18.10	19.97
NON OPER. REVENUES (NET)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GROSS INTERNAL GENERATION	-0.39	-1.14	-1.47	0.18	7.36	14.03	15.68	16.61	18.10	19.97
GRANTS	0.56	5.27	14.11	17.47	8.42	0.00	0.00	0.00	0.00	0.00
INCREASE OTHER LIABILITIES	0.37	0.03	-0.40	0.40	-0.40	0.40	0.00	0.00	0.00	0.00
INCREASE IN RESERVES	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IBRD LOAN	0.00	0.00	11.41	46.82	41.77	0.00	0.00	0.00	0.00	0.00
NATIONAL LOANS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL LOANS	0.00	0.00	11.41	46.82	41.77	0.00	0.00	0.00	0.00	0.00
SHORT TERM LOANS	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL SOURCES	0.61	4.66	23.65	64.87	57.15	14.43	15.68	16.61	18.10	19.97
APPLICATIONS OF FUNDS										
INVESTMENT IN PROJECT	0.00	0.00	14.02	58.56	53.33	0.00	0.00	0.00	0.00	0.00
CAPITALIZED INTEREST	0.00	0.00	0.46	3.59	7.20	5.56	0.00	0.00	0.00	0.00
OTHER INVESTMENT	0.50	4.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	5.00
TOTAL INVESTMENT	0.50	4.00	14.48	62.15	60.53	6.56	1.00	1.00	1.00	5.00
IBRD AMORTIZATION	0.00	0.00	0.00	0.00	0.00	2.63	5.26	5.26	5.26	5.26
NATIONAL PROJECT LOAN AMORT.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SHORT TERM LOANS AMORTIZ.	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL AMORTIZATION	0.00	0.00	0.50	0.00	0.00	2.63	5.26	5.26	5.26	5.26
OPER. INTEREST LONG T. LOAN	0.00	0.00	0.08	0.15	0.15	3.49	8.82	8.35	7.88	7.41
TOTAL OPERATIONAL INTEREST	0.00	0.00	0.08	0.15	0.15	3.49	8.82	8.35	7.88	7.41
TOTAL DEBT SERVICE	0.00	0.00	0.58	0.15	0.15	6.12	14.08	13.61	13.14	12.67
INCREASE IN WORK. CAPITAL	0.11	0.66	8.59	2.57	-3.53	1.75	0.60	2.00	3.96	2.30
TOTAL APPLICATIONS	0.61	4.66	23.65	64.87	57.15	14.43	15.68	16.61	18.10	19.97
DEBT SERVICE RATIO	0.00	0.00	-2.51	1.21	49.04	2.29	1.11	1.22	1.38	1.58

BOLIVIA

APPRAISAL OF THE

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

12-ELAPAS SUCRF

BALANCE SHEET
ALTERNATIVE 1

MILL BS

AUG 1976

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
<u>A S S E T S</u>										
FIXED ASSETS IN OPER.	60.54	67.07	81.59	140.35	210.99	251.74	269.10	247.55	306.67	330.99
MINUS ACCUM. DEPRECIATION	21.96	26.12	30.55	36.14	43.66	53.28	63.93	75.75	88.84	103.36
NET FIXED ASSETS	38.57	40.95	51.04	104.21	167.33	198.46	205.17	211.81	217.83	227.63
WORK IN PROGRESS	0.00	4.00	10.00	20.00	20.00	1.00	0.50	0.00	0.00	0.00
CASH AND BANKS	0.03	0.37	9.41	11.59	6.03	5.93	5.97	7.59	11.01	12.67
ACCOUNTS RECEIVABLE	0.78	1.31	0.90	1.21	2.87	4.40	4.88	5.23	5.72	6.28
INVENTORIES	0.86	0.17	0.19	0.21	0.24	0.26	0.28	0.30	0.33	0.35
SPARE PARTS IN	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
OTHER CURRENT ASSETS	0.12	0.16	0.18	0.30	0.72	1.10	1.22	1.31	1.43	1.57
TOTAL CURRENT ASSETS	2.28	2.52	11.17	13.81	10.35	12.19	12.86	14.94	18.99	21.36
TOTAL ASSETS	40.85	47.47	72.21	138.02	197.68	211.65	218.53	226.74	236.82	248.99
<u>EQUITY AND LIABILITIES</u>										
EQUITY	59.90	59.90	59.90	59.90	59.90	59.90	59.90	59.90	59.90	59.90
CONTRIBUTIONS	0.56	5.83	19.94	37.41	45.83	45.83	45.83	45.83	45.83	45.83
REVALUATION SURPLUS	0.00	4.17	7.85	11.99	19.49	31.54	44.04	56.97	70.31	84.03
OPERATIONAL SURPLUS	-21.54	-24.46	-28.09	-31.17	-28.88	-24.81	-25.24	-24.77	-22.87	-19.23
TOTAL EQUITY	38.92	45.43	59.60	78.13	96.34	112.45	124.52	137.93	153.17	170.53
LONG TERM DEBT (NET)	0.44	0.44	11.85	58.67	97.81	92.54	87.28	82.02	76.75	71.49
ACCOUNTS PAYABLE	0.40	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.18
CURRENT MATURITIES	0.00	0.00	0.00	0.00	2.63	5.26	5.26	5.26	5.26	5.26
OTHER CURRENT LIABILITIES	0.16	0.34	0.40	0.46	0.52	0.59	0.65	0.72	0.79	0.86
TOTAL CURRENT LIABILITIES	0.85	0.43	0.49	0.56	3.27	5.98	6.05	6.13	6.22	6.30
SHORT TERM DEBT	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OTHER LIABILITIES	0.37	0.40	0.00	0.40	0.00	0.40	0.40	0.40	0.40	0.40
RESERVES	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
TOTAL LIABILITIES	1.92	2.03	12.60	59.89	101.34	99.19	94.00	88.81	83.04	78.46
TOTAL EQUITY+LIABILITIES	40.85	47.47	72.21	138.02	197.68	211.65	218.53	226.74	236.82	248.99
CURRENT RATIO	2.68	5.92	22.66	24.45	3.17	2.04	2.12	2.44	3.05	3.39
% DEBT/(DEBT+EQUITY)	1.12	0.96	16.58	42.89	50.38	45.14	41.21	37.29	33.38	29.54
WORKING CAPITAL-MILLION	1.43	2.09	10.68	13.25	9.71	11.47	12.06	14.07	18.03	20.32

BOLIVIAAPPRAISAL OF THEURBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECTELAPAS - SUCRE

17-ECONOMICAL RATE OF RETURN = ALTERNATIVE 1

MARGINAL COSTS AND BENEFITS

YEAR	TOTAL COSTS + OTHER REVENUES	VOLUME SOLD	AVERAGE REVENUES \$/M3	TARIFF REVENUES	NET BENEFITS
1976	-7.278	0.120	1.583	0.190	-7.088
1977	-27.137	0.240	2.348	0.564	-26.574
1978	-1.875	0.720	4.003	2.882	1.007
1979	-2.432	1.248	3.861	4.819	2.387
1980	-2.840	1.349	3.933	5.304	2.464
1981	-3.156	1.450	3.876	5.619	2.462
1982	-3.488	1.584	3.872	6.134	2.646
1983	-3.817	1.651	3.969	6.554	2.737
1984	-4.092	1.760	3.969	6.986	2.934
1985	-4.361	1.900	3.969	7.542	3.181
1986	-4.697	2.045	3.969	8.116	3.419
1987	-5.043	2.194	3.969	8.709	3.665
1988	-5.401	2.348	3.969	9.321	3.920
1989	-5.771	2.508	3.969	9.954	4.183
1990	-6.064	2.621	3.969	10.403	4.339
1991	-6.334	2.737	3.969	10.863	4.530
1992	-6.610	2.856	3.969	11.335	4.725
1993	-6.893	2.978	3.969	11.818	4.925
1994	-7.183	3.102	3.969	12.314	5.130
1995	-7.481	3.230	3.969	12.822	5.341
1996	-7.786	3.362	3.969	13.342	5.557
1997	-8.098	3.496	3.969	13.876	5.778
1998	-8.419	3.634	3.969	14.423	6.004
1999	-8.747	3.775	3.969	14.984	6.236
2000	-9.084	3.920	3.969	15.558	6.474
2001	-9.230	3.983	3.969	15.810	6.580
2002	-9.320	3.983	3.969	15.810	6.490
2003	-9.320	3.983	3.969	15.810	6.490
2004	-9.320	3.983	3.969	15.810	6.490
2005	-9.320	3.983	3.969	15.810	6.490
2006	-9.320	3.983	3.969	15.810	6.490
2007	-9.320	3.983	3.969	15.810	6.490
2008	-9.320	3.983	3.969	15.810	6.490

PRESENT VALUE OF COSTS AND BENEFITS AT A DISCOUNT OF

0.0 %	112.39
5.0 %	27.35
10.0 %	-1.48
20.0 %	-17.81

INCREMENTAL RATE OF RETURN FOR WATER % = 9.61 FOR 33 YEARS

BOLIVIA
URBAN AND RURAL COMMUNITY WATER SUPPLY AND SEWERAGE PROJECT
URBAN SUBPROJECT
TECHNICAL MONITORING INDICATORS

	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
<u>POTOSI</u>									
Population (000 ³)	75.1	76.2	77.4	78.5	79.7	80.9	82.1	83.3	84.6
% Population Served Water	49.1	56.7	63.0	70.0	76.8	83.1	82.4	82.6	83.3
Number of Connections Water (thousands)	4.1	4.8	5.6	6.4	7.2	8.0	8.2	8.4	8.6
% Unaccounted-for Water	62	55	40	35	30	25	25	23	23
Total Production - Million m ³	3.2	3.1	2.7	4.6	4.5	4.5	4.7	4.6	4.7
Total Sales - Million m ³	1.2	1.4	1.6	3.0	3.2	3.4	3.5	3.6	3.6
 <u>SUCRE</u>									
Population	55.3	56.7	58.1	59.6	61.1	62.6	64.2	65.8	67.4
% Population Served Water	74.0	78.0	80.0	83.0	83.0	82.0	83.0	85.0	85.0
Number of Connections Water (thousands)	6.3	6.8	7.3	7.8	8.3	8.6	8.9	9.3	9.5
% Unaccounted-for Water	48	45	35	30	30	25	25	20	20
Total Production (million cubic meters)	3.9	3.8	3.5	3.9	4.7	4.5	4.6	4.5	4.6
Total Sales (million cubic meters)	2.0	2.1	2.3	2.7	3.3	3.4	3.5	3.6	3.7
% Population Served Sewerage	48	55	60	65	75	80	80	80	80
No. of Connections Sewerage (thousands)	4.1	4.8	5.5	6.2	7.5	8.4	8.6	8.8	9.0

BOLIVIA
URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT
URBAN SUBPROJECT
FINANCIAL MONITORING INDICATORS

	1975	1976	1977	1978	1979	1980	1981	1982	1983
<u>POTOSI</u>									
Average Water Tariff (B\$/m ³)	0.52	0.54	1.00	1.50	2.30	2.80	2.86	2.90	3.30
Total Revenue (B\$/m ³) <u>1/</u>	0.92	0.89	1.35	1.69	2.48	2.96	2.90	2.93	3.34
Cost per m ³ Sold	1.28	1.27	1.36	0.91	1.04	1.14	1.18	1.25	1.35
Rate of Return <u>2/</u>	-4.40	-4.60	-3.10	1.70	3.40	4.20	3.60	3.10	3.90
Operating Ratio <u>3/</u>	139	142	100	54	42	39	41	43	41
<u>SUCRE</u>									
Average Water Tariff (B\$/m ³)	1.5	1.58	2.58	4.80	5.00	5.50	5.80	6.20	6.80
Total Revenue (B\$/m ³) <u>1/</u>	1.6	1.70	2.70	5.30	6.50	7.3	7.6	7.9	8.6
Cost per m ³ Sold	2.2	2.40	2.60	2.60	2.40	2.60	2.70	2.90	3.10
Rate of Return <u>2/</u>	-5.4	-5.70	-3.00	1.60	1.70	1.20	1.20	0.90	1.60
Operating Ratio <u>3/</u>	135	141	97	49	44	47	47	50	46

1/ Total revenue includes sewer, water and connection fees.

2/ Income before interest divided by average rate base where rate base is Net Revalued Fixed Assets.

3/ Total Operating Expenses divided by Total Revenue.

BOLIVIA

URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT

TARIFFS

1. The Government of Bolivia established a National Tariff Council (CNT) in 1973 as a part of MUV. Ministerial Order No. 133 of April 3, 1974 established national tariff standards and was amended July 1976. The order is now being enforced and is an adequate instrument to attain sector policies.

2. The tariff order divides communities into 4 classes by size of population:

SUMMARY OF TARIFF ORDER 133 (AS AMENDED)

Charges for Water and Sewerage to be Sufficient to cover the cost of:	Class 1 <u>Over 50,000</u>	Class 2 <u>10,000-50,000</u>	Class 3 <u>2,000-10,000</u>	Class 4 <u>Under 2,000</u>
Operation	X	X	X	X
Maintenance	X	X	X	X
Interest on Loans	X	X		
Repayment of Loan Principal	X	X		
Some Capital for Future Investment	X			
Number of Communities	<u>6</u>	<u>12</u>		

3. The tariffs for water and sewerage services are defined by category and by structure with a fixed monthly charge for a fixed quantity of water consumed with an additional charge for additional consumption. The charges for additional consumption can be stepped to give an increasing block tariff.

The rate categories for Classes 1, 2 and 3 are: (a) Residential, (b) Commercial, (c) Industrial, (d) Public Buildings, (e) Special.

The water charges for small communities in Class 4 are levied as a fixed monthly charge equal for all users.

Charges for Sewerage Services

The tariff order provides that the costs of operating a sewerage service should be recovered by a fixed monthly charge or a percentage of the water bill. Whilst the intention is that sewerage services should be fully financed by users, this does not apply in practice. With the exception of the cities of Cochabamba and Sucre, the sewerage systems are owned and operated and subsidized by the municipalities and not the Water Undertaking.

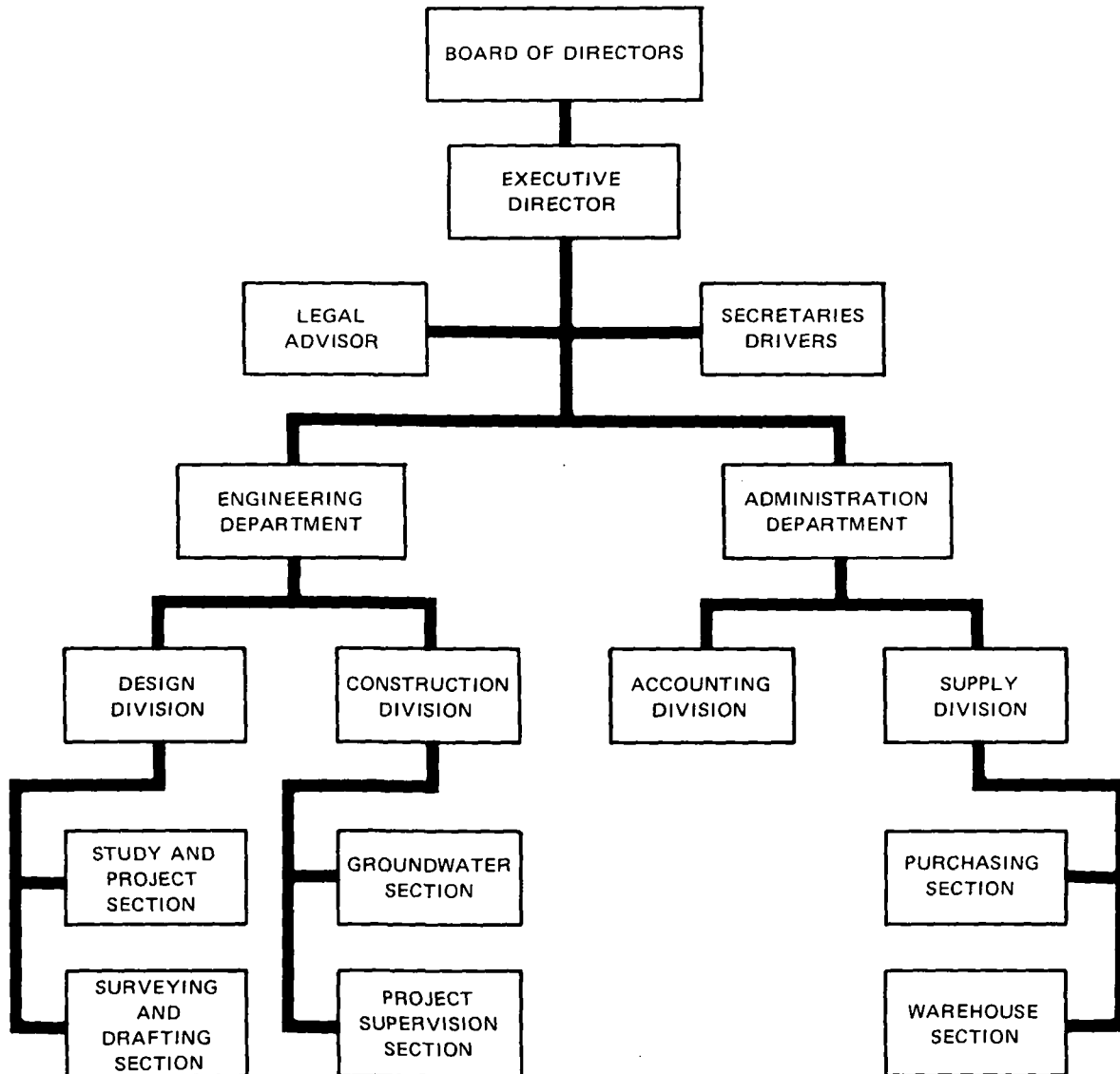
Sucre

4. The present (1975) tariff for Sucre is as shown below. During the project, the increase in charges will be varied so that the cost of extending the service will be borne proportionately heavier by the larger users by varying the charges for consumption above the basic quota and by introducing differential charges for higher quantities. A tariff based on those principles will be applied in Potosí.

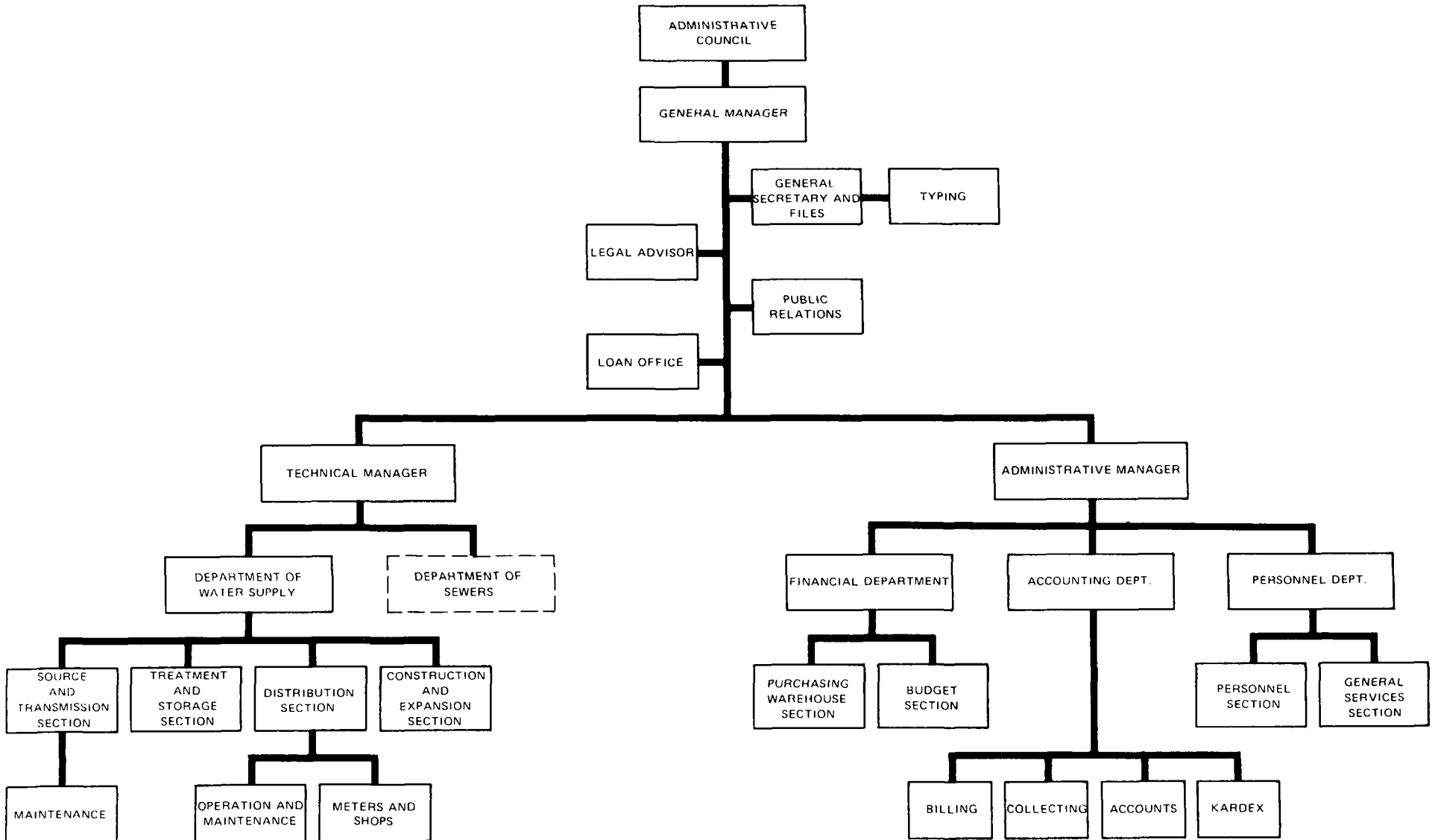
MONTHLY WATER TARIFF - ELAPAS/SUCRE (1975)

<u>Category</u>	<u>- B\$ - Fixed Charge</u>	<u>- M³ - Fixed Quota</u>	<u>Charge for Additional M³</u>
Residential	18	10	1.0
Commercial	18	10	1.5
Industrial	18	10	1.5
Public Buildings	18	10	1.0
Special	18	10	1.0

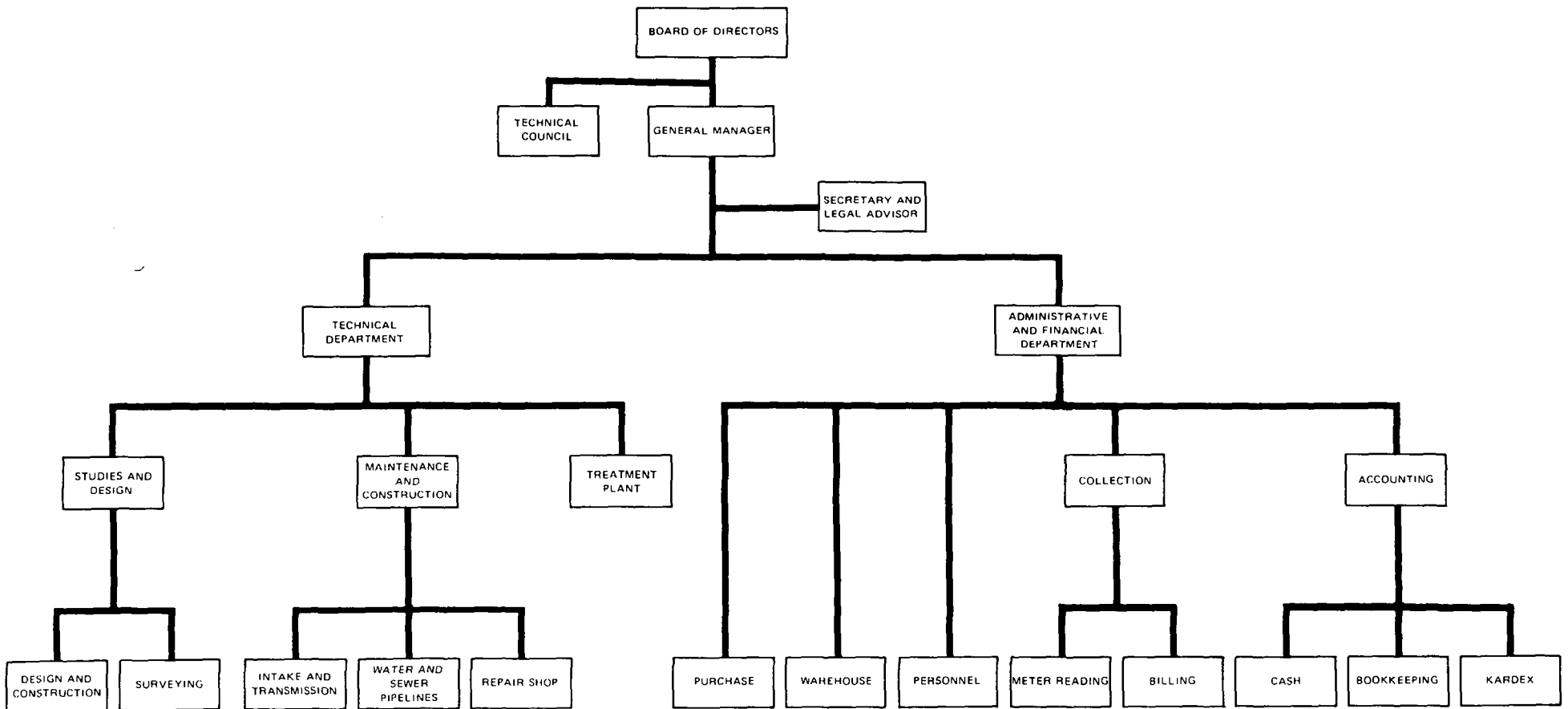
BOLIVIA
URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT
ORGANIZATION CHART
CORPORACION DE AGUA POTABLE Y ALCANTARILLADO
CORPAGUAS



BOLIVIA
 URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT
 ORGANIZATION CHART
 ADMINISTRACION AUTONOMA DE OBRAS SANITARIAS DE POTOSI
 AAPOS



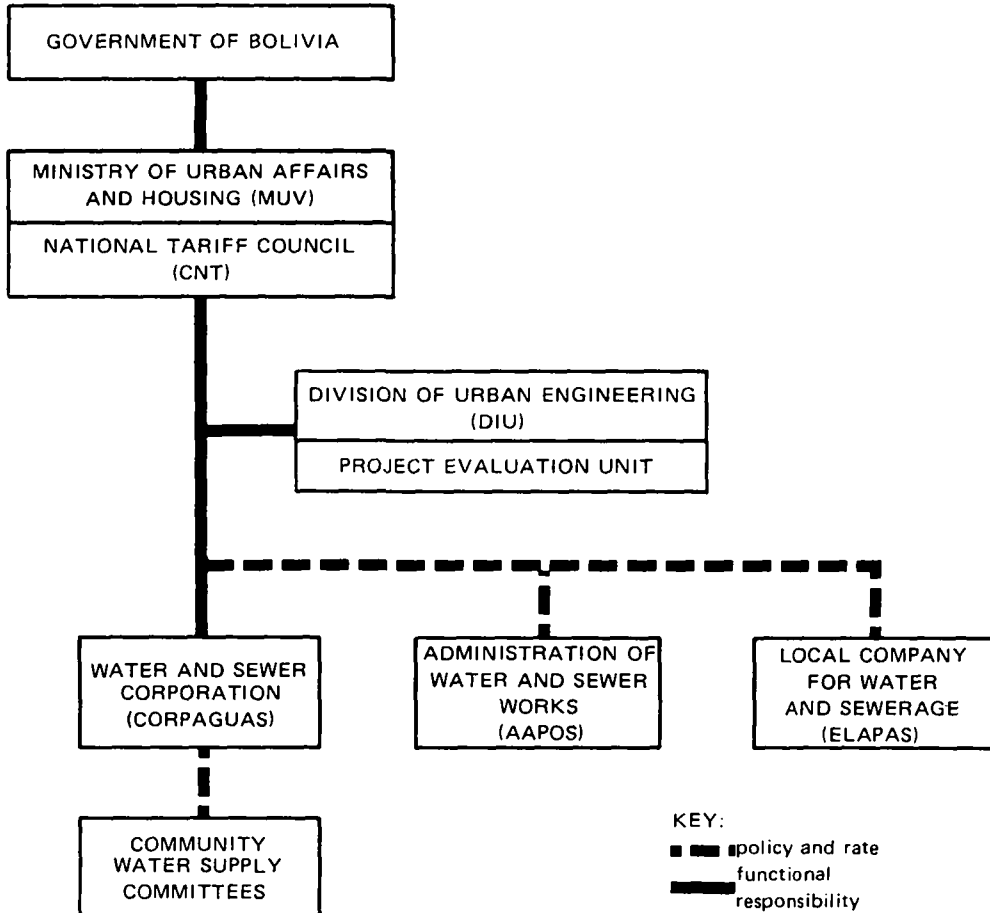
BOLIVIA
URBAN AND RURAL COMMUNITIES WATER SUPPLY AND SEWERAGE PROJECT
ORGANIZATION CHART
EMPRESA LOCAL DE AGUA POTABLE Y ALCANTARILLADO DE SUCRE
ELAPAS

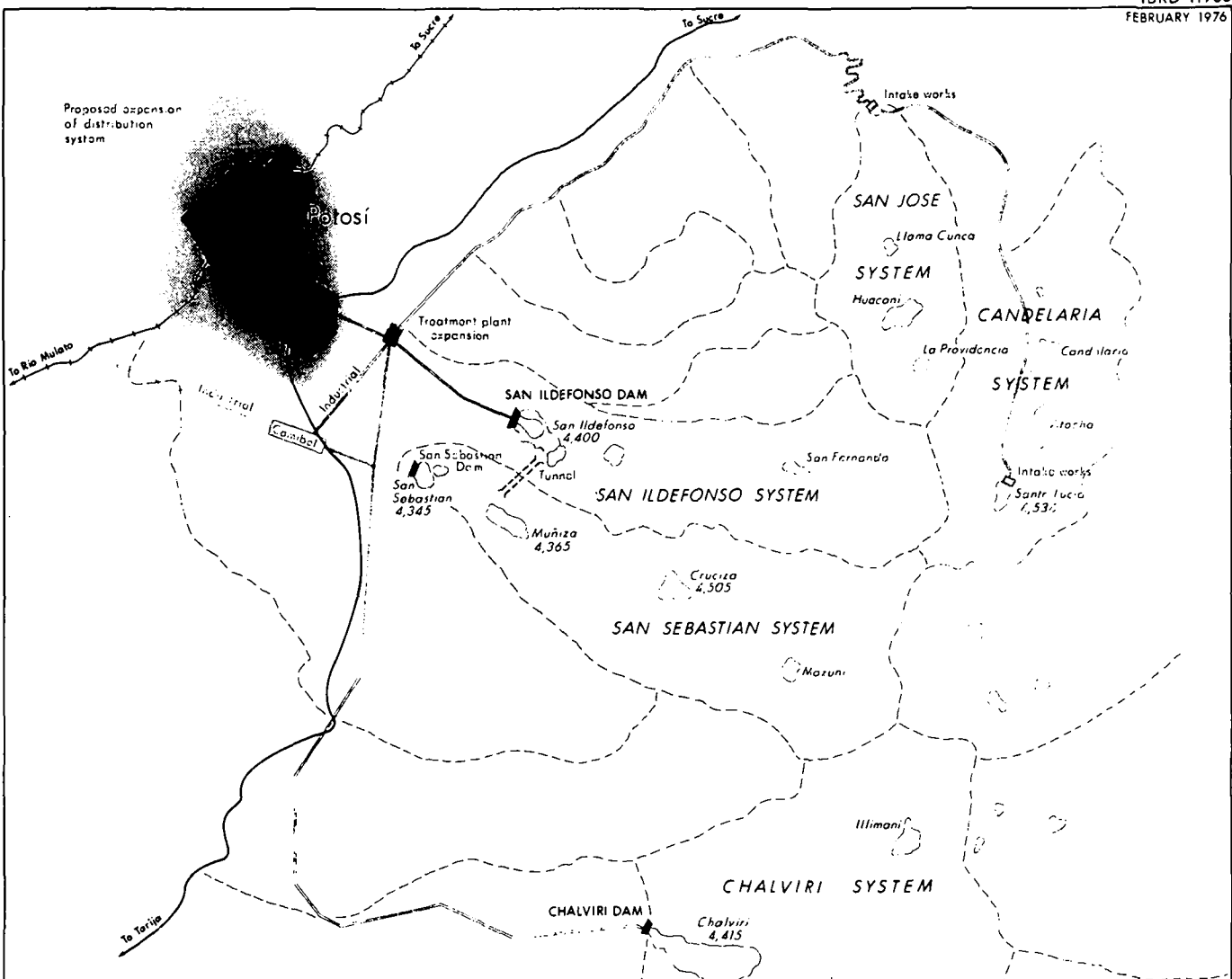


BOLIVIA
URBAN AND RURAL WATER SUPPLY AND SEWERAGE PROJECT
IMPLEMENTATION SCHEDULE

	Responsible Agency	1976												1977												1978											
		6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12					
Division of Urban Engineering																																					
Revise Tariff Order No. 133	MUV																																				
Provide National Tariff Council and Project Evaluation Unit with power to enforce tariff covenants	MUV																																				
Prepare terms of reference for consultants. Select and hire consultants for organization and training	DIU																																				
Complete evaluation case study	DIU																																				
Implement consultants recommendation	MUV/DIU																																				
CORPAGUAS																																					
Water System																																					
Present plans for transfer of operation and maintenance responsibilities to Departmental Development Committee of Potosi	CORP/CODEPO																																				
Present plans for transfer of construction to Departmental Development Committees	CORP/DDO																																				
Carry out transfer plans	CORP/DDO																																				
Purchase materials and supplies for systems	CORP																																				
Prepare draft agreements for Community Water Supply Committee and Departmental Development Committees	CORP																																				
Sign agreements with Community and Departmental Committees	CORP																																				
Construction of systems	CORP																																				
Standardize materials and designs	CORP																																				
Technical Assistance:																																					
Prepare terms of reference	CORP																																				
Select and hire consultants	CORP																																				
Prepare construction and operating manuals	CORP																																				
Implement recommendations and train staff	COHP																																				
ELAPAS																																					
Water Supply																																					
Implement new tariff	ELAPAS/CNT																																				
Prepare plans and specifications for canals, tunnels and roads	ELAPAS																																				
Construct facilities	ELAPAS																																				
Prepare plans specifications and bidding documents for distribution network, tanks, meters, and treatment plant spare parts	ELAPAS																																				
Purchase materials and equipment	EI APAS																																				
Install equipment and materials	ELAPAS																																				
Sewerage																																					
Establish ear-marked tax for sewer system	ELAPAS																																				
Prepare plans specifications and bidding documents for sewer system	ELAPAS																																				
Purchase and install pipe plant	ELAPAS																																				
Fabricate pipe	ELAPAS																																				
Construct facilities	ELAPAS																																				
Technical Assistance																																					
Prepare terms of reference for consultants	ELAPAS																																				
Select and hire consultants	EI APAS																																				
Implement recommendations and train staff	ELAPAS																																				
AAPOS																																					
Water Supply																																					
Implement new tariff	AAPOS/CNT																																				
Execute meter installation program	AAPOS																																				
Prepare plans and specifications for canals, additional meters, distribution network, storage tanks, and access roads	AAPOS																																				
Purchase materials and equipment	AAPOS																																				
Install equipment and construct facilities	AAPOS																																				
Technical Assistance																																					
Prepare terms of reference for consultants	AAPOS																																				
Select and hire consultants	AAPOS																																				
Implement recommendations and train staff	AAPOS																																				

BOLIVIA
URBAN AND RURAL WATER SUPPLY AND SEWERAGE PROJECT
RELATIONSHIP OF MINISTRY OF URBAN AFFAIRS
AND HOUSING AND THE EXECUTING AGENCIES





BOLIVIA

**Urban and Rural Communities Water Supply and Sewerage Project
POTOSÍ WATER SUPPLY
Location of Works**

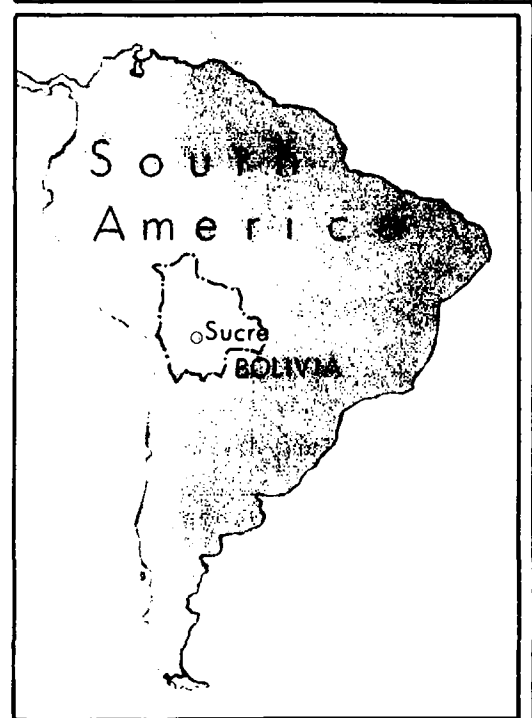
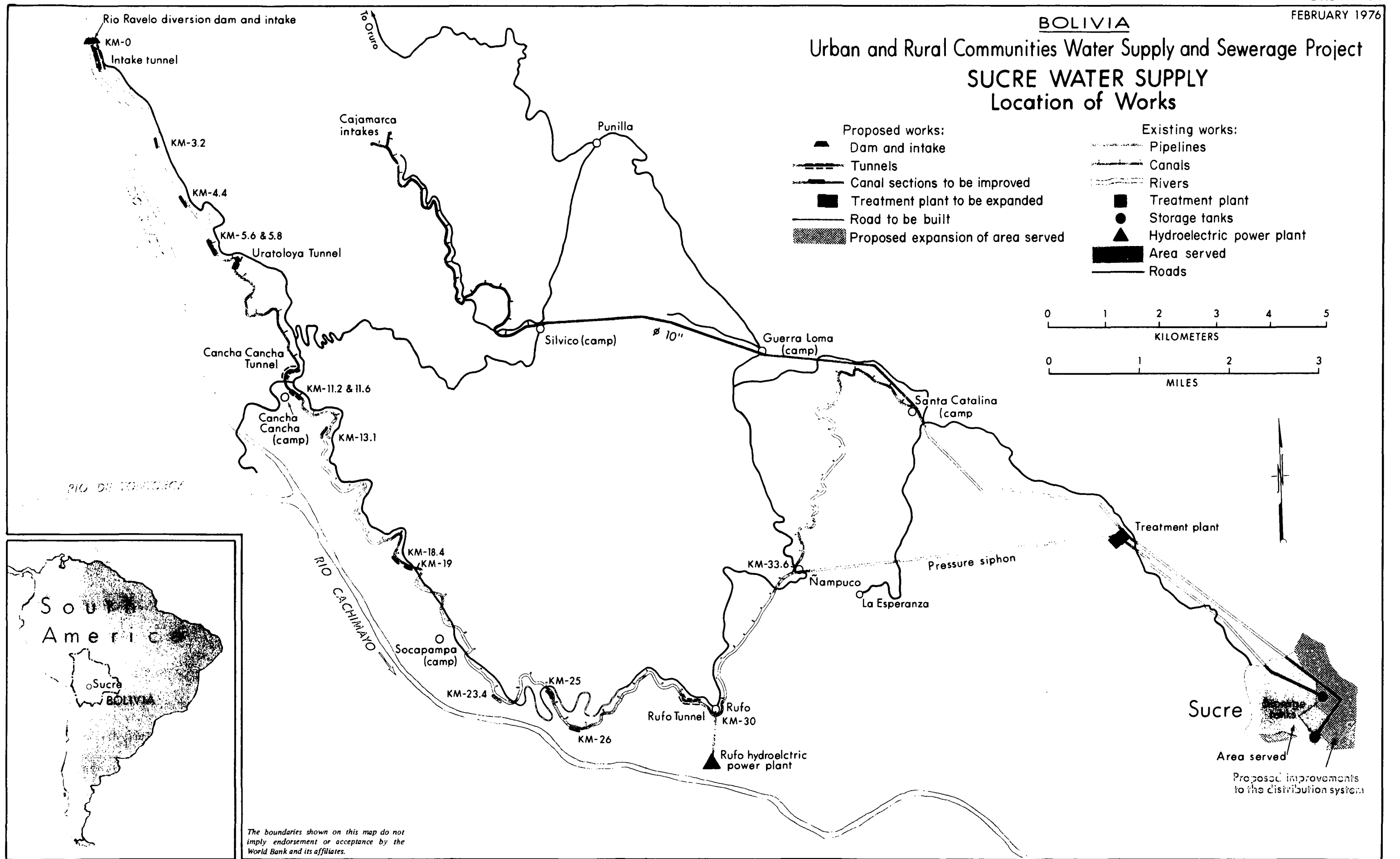
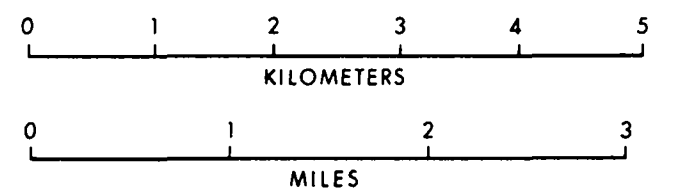
- | | |
|-----------------------------------|--------------------------------|
| Proposed works:
Dam | Existing works:
Dams |
| Intake works | Water supply lines |
| Water supply lines | Treatment plant |
| Tunnel | Area served |
| Treatment plant to be expanded | Roads |
| Proposed expansion of area served | Railroad |
| | Watershed boundaries |
| | Lakes (mean elevation, meters) |



The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.

BOLIVIA
Urban and Rural Communities Water Supply and Sewerage Project
SUCRE WATER SUPPLY
Location of Works

- | | |
|-----------------------------------|---------------------------|
| Proposed works: | Existing works: |
| Dam and intake | Pipelines |
| Tunnels | Canals |
| Canal sections to be improved | Rivers |
| Treatment plant to be expanded | Treatment plant |
| Road to be built | Storage tanks |
| Proposed expansion of area served | Hydroelectric power plant |
| | Area served |
| | Roads |



The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.