

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK
FOR OFFICIAL USE ONLY

PR-640-A
17 September 1974
Original: Spanish

PROJECT REPORT

BOLIVIA

SECOND STAGE OF THE WATER SUPPLY PROGRAM
FOR COCHABAMBA

This document was prepared by the Project Committee established May 9, 1974 consisting of Messrs. J. Bartolomé (PRA), E. Bonhomme (PRA), F. Klein (LEG), P. Sorensen (OPS: Chairman) and J. Villatoro (PRA).

B O L I V I A

SECOND STAGE OF THE WATER SUPPLY PROGRAM FOR COCHABAMBA

Table of Contents

	<u>Page</u>
I. THE PROJECT IN THE FRAMEWORK OF THE SANITATION SECTOR .	1
A. The Application	1
B. Priority	1
C. Missions	1
D. The Sanitation Sector in Bolivia	2
E. State of the Sector in Cochabamba	4
F. Development Proposed for the Sector	8
II. THE PROJECT AND ITS EXECUTION	9
A. Description of the Project	9
B. Cost of Project	10
C. Financing the Project	15
D. Status of Studies and Designs	18
E. Conditions of Water Resources	19
F. Technical Justification of the Project	21
G. Execution of the Project	22
H. Social and Economic Evaluation of the Project	31
III. THE BORROWER AND THE EXECUTING AGENCY	36
A. The Borrower	36
B. The Executing Agency	36
C. Financial Management	37
D. Financial Analysis	41
E. Rates and Financial Projections	47
F. Financial Feasibility of the Proposed Operation ..	59
G. Evaluation of Loan 159/SF-BO (Cochabamba Subproject)	62

APPENDIXES

- D. Criterios Básicos de Diseño utilizados en el Proyecto
- E. Detalle de Escalamiento de Costos
- F. Mapa Esquemático del Sistema de Agua Potable de Cochabamba

- G. Proyecto de Reglamento para Conexiones Intradomiciliarias
- H. SEMAPA Organizational Chart
- I. Proyecto de Términos de Referencia para la Supervisión del Proyecto
- J. Proyección de Ingresos y Egresos en Efectivo
- K. Situación Financiera Proyectada (Balance Proforma)
- L. Pronóstico de Resultados (Estado de Pérdidas y Ganancias)
- M. Proyección de Gastos de Operación, Administración y Depreciación y de Conexiones Domiciliarias
- N. Presupuesto y Ejecución Presupuestaria del Gobierno Central

BOLIVIA. EXPANSION OF THE COCHABAMBA WATER SUPPLY
SYSTEM (SECOND STAGE)
LOAN TO THE REPUBLIC OF BOLIVIA

ANALYSIS OF THE PROJECT

I. THE PROJECT IN THE FRAMEWORK OF THE SANITATION SECTOR

A. The Application

- 1.01 By letter of April 18, 1974 the Republic of Bolivia requested a loan from the Bank to assist in financing the second stage 1/ of a program for expansion of the potable water supply system of the city of Cochabamba, the total cost of which was estimated at US\$14,900,000 equivalent. The application was accompanied by technical studies done by a Bolivian engineering firm.

B. Priority

- 1.02 In March of 1974 a program planning mission visited Bolivia in order to examine the tentative schedule of the IDB's operations for the period 1974 to 1976. At that time the Bolivian authorities informed the mission that the government had granted top priority to the second stage of the potable water supply program of Cochabamba, as part of the set of investment projects it was planning to submit to the Bank for consideration. This allocation of priority was confirmed by the Finance Minister of Bolivia in a letter dated April 18, 1974, as mentioned in paragraph 1.01.

C. Missions

- 1.03 In May 1974 the Bank sent an Operations Mission to Bolivia for the purpose of doing the technical, financial, legal and socio-economic analysis of the second stage of the program and engage in preliminary negotiations with the Bolivian authorities as to the terms and conditions of a loan from the IDB to assist in financing the project (second stage of the program). Furthermore, in light of the performance of the previous loan, the mission was directed not to negotiate the new operation unless, as a result of the analysis, a viable project could be put together, with complete studies, and one which could be started immediately.

1/ The first stage of the program consisted of the works financed with the resources of Loan 159/SF-B0. (See Chapter IV. Evaluation of Loan 159/SF-B0)

- 1.04 The analysis done by the mission led to a reduction in the scope of the project presented initially by the Bolivian authorities. A smaller project was then planned at an estimated cost of US\$12,300,000 equivalent, with 70% of the final designs completed. The mission worked with officials of the municipal government and of the Servicio de Agua Potable, Alcantarillado y Desagües Pluviales de Cochabamba (SEMAPA), which is the agency responsible for water supply and sewage-disposal facilities, in doing the analysis and updating the information on technical, financial, legal and socio-economic aspects of the project, in addition to making visits to the proposed work site. Likewise, meetings were held with the consultants who were responsible for making the final designs.
- 1.05 The result of the analysis done during the mission's visit is shown in this report.

D. The Sanitation Sector in Bolivia

- 1.06 Among the countries surveyed in Latin America and the Caribbean by the Pan American Health Organization (PAHO) in 1972, Bolivia recorded one of the lowest proportions of population with access to drinking water supply and sewage-disposal facilities. The PAHO determined that in 1972, 22% of the Bolivian population had potable water supply service and 10% had sewage-disposal services as, compared with the average for the hemisphere of 56% and 24% respectively. This deficit is even greater in the case of 68% of the Bolivian population who live in rural communities of less than 2,000 persons. The PAHO estimated in this case that 4% of the population had access to piped drinking water and 3% to sewage-disposal facilities. As for Bolivia's urban population, 56% had piped drinking water and 23% had sewage-disposal facilities, as compared to 79% and 40% of the urban population, respectively, in the other countries. Of this 56% of population having piped drinking water, 45% was supplied directly by means of residential service connections and the remaining 11% had "ready access" (at 250 meters from public faucets) to the drinking water supply system. In the other countries of the hemisphere an average of 63% of the population has residential service connections and 16% has ready access to the drinking water supply system.
- 1.07 In 1970 the general death rate in Bolivia was 14 deaths per thousand persons, compared to an average for Latin America and the Caribbean of 9 deaths per thousand persons; infant mortality was 155 deaths per thousand, compared to an average for Latin America and the Caribbean of 81 deaths per thousand. In the same year, life expectancy at birth in Bolivia was 46 years as compared to an average for Latin America and the Caribbean of 61 years. ^{1/} According to

^{1/} See "Situación, principales problemas y perspectivas del desarrollo económico y social de Bolivia", CIAP 1670 of March 20, 1974.

estimates made by the Ministry of Public Health and Social Planning, intestinal diseases and other disorders of the digestive system, commonly associated with consumption of impure water, caused 12% of deaths recorded throughout the country, 10% of visits by ambulatory patients, and 17% of all hospitalized patients.

- 1.08 Expenditure for public health, as part of total expenditures by the Government of Bolivia, is one of the lowest in Latin America. The proportion has varied from 2.8% in 1963 to 7.4% in 1973. Apart from the Ministry of Public Health and Social Planning and the National Social Security Fund there are a dozen public sector organizations operating in Bolivia which provide medical services to various groups: Corporación Minera de Bolivia (COMIBOL), Yacimientos Petrolíferos Fiscales Bolivianos (YPFB), Fondo de Choferes, Ferrocarriles Nacionales, Corporación Boliviana de Fomento (CBF), Servicio Nacional de Caminos (SNC), etc. It is estimated that about 231,000 persons are beneficiaries of the services provided by these organizations and the cost of the services furnished is estimated at the equivalent of US\$18.00 per capita per year. The National Social Security Fund, the organization responsible for administering the Social Security System of Bolivia, spends the equivalent of about US\$8.30 per capita per year and serves about 475,000 beneficiaries; the Ministry of Public Health and Social Planning spends the equivalent of US\$1.60 per capita per year. In determining the per capita expenditure of the Ministry of Public Health and Social Planning it was estimated that the services of the Ministry were being provided to at least 50% of the Bolivian population, that is to an estimated 2,200,000 persons. Moreover, there are inequalities in the allocation of expenditure between the urban population and the rural population, as well as between the expenses allocated to preventive medicine and to curative medicine. It is appropriate to note that 80% of the resources of the Ministry of Public Health and Social Planning and 100% of those of the Social Security Fund are absorbed by urban centers, though only 34% of the Bolivian population lives in these. The Ministry of Public Health and Social Planning and the Social Security Fund allocate only 15% and 5% of their resources, respectively, to preventive medicine.

- 1.09 The following table itemizes public investment in Bolivia during 1960-1964 and 1965-1971, by sectors of economic activity: 1/

1/ These figures do not include investments of the defense budget.

(In percentages) 1/

	Average 1960-1964	Average 1965-1971
<u>Directly Productive Sectors</u>	<u>60.0</u>	<u>33.2</u>
Agriculture and Stockraising	1.5	1.6
Mining	20.5	10.1
Petroleum	35.5	18.0
Industry (Manufacturing)	3.5	3.5
<u>Economic Infrastructure</u>	<u>32.3</u>	<u>43.6</u>
Electricity	2.3	10.1
Transportation	28.8	30.8
Communications	-	0.9
Land Settlement and Irrigation	1.2	1.7
<u>Social Infrastructure</u>	<u>7.7</u>	<u>23.2</u>
Health	1.4	0.9
Education	1.4	2.2
Public Services	2.9	14.5
Public Administration Infrastructure	-	1.0
Housing	<u>2.0</u>	<u>4.6</u>
Total	<u>100.0</u>	<u>100.0</u>

- 1.10 It follows from the above table that the health sector's share of public investment from 1960 to 1971 was a small one. In absolute terms the share varied from the equivalent of US\$95,000 in 1966 to the equivalent of US\$650,000 in 1968. However, in relative terms, it fell from 1.4% of the total public investment during 1960-1964 to 0.9% during 1965-1971, even though investments in social infrastructure as a whole grew from 7.7% to 23.2% between these periods.

E. State of the Sector in Cochabamba

1. Water supply

- 1.11 Cochabamba, the second city of Bolivia, at the end of 1973 had a population estimated at 173,000 persons living in 30,426 homes. The

1/ Source of data: Secretaría del Consejo Nacional de Economía y Planificación (CONEPLAN).

metropolitan area of Cochabamba measured 3,175 hectares. Despite an investment program which started in 1967 with partial financing from the IDB (see Chapter IV), the drinking water supply of the city is wholly unsatisfactory and is in a state of rapid deterioration in the short run. Residential service connections in the period 1968-1973 increased at the rate of 2.8% in a year as compared with an annual population growth estimated at 3.5% for Cochabamba. At this time, the median yearly consumption of water in Cochabamba is 100 liters per capita for 79,780 persons, and only 20 liters daily per capita for the remaining 93,220 persons; thus the general average is 56 liters per capita a day. It should be added that owing to system losses, the real median daily consumption is estimated at 41 liters per capita. ^{1/}

- 1.12 There are an estimated 11,200 households listed as connected subscribers, it being determined that 37% of the piped water supply is carried through residential service connections, 50% through connections on the outside of the house, and 9% through connections outside the property. Among households which are not subscribers, 20% have their own wells, and these households have a higher comparative level of income. The majority of homes, however, depend on tank trucks owned by the municipal government or private enterprises. In the case of tank trucks owned by the municipality, service is provided free of charge and, in principle, 200 liters per home are supplied at the request of the interested party. However, the municipal government has only 6 trucks to cover the whole city and these must work full time to do so, including Saturdays and Sundays. Owing to the deficiency of the municipal service, private enterprises have become established whose trucks charge between \$b4.50 and \$b.5.00 per 200-liter drum of water, a price equivalent to US\$1.25 per cubic meter. ^{2/}
- 1.13 The deficits in the supply of drinking water reflect mainly the wear and tear on the supply facilities of Cochabamba, the distribution system whereof dates from 1927, and the absence of a systematic program of preventive maintenance or progressive expansion so as to suit the supply to a constantly increasing demand. The system needs to be renovated in order to remedy the deficiencies in the impoundment, transmission, treatment, storage and distribution of water.

^{1/} Per capita consumption of water in other countries: Caracas, Venezuela (population 2 million) 190; Chittagong, Pakistan (population 350,000) 33; Kingston, Jamaica (population 600,000) 180; Managua, Nicaragua (population 340,000) 205; Palmira, Colombia (population 140,000) 205, and Portland, Oregon (population 580,000) 533. Source of Data: BIRF, Papel de Trabajo del Sector de Agua Potable y Alcantarillado.

^{2/} As reported by the Comisión Nacional de Sueldos de Bolivia, the wage of Bolivian workers varied from the equivalent of US\$33 to the equivalent of US\$83 per month. Source of Data: CIAP, Document 670 of March 20, 1974.

2. Sewerage service

- 1.14 At the end of 1973 the sanitary sewerage system of Cochabamba had 7,378 residential service connections, that is, 24% of a total of 30,426 possible service connections. The total system measured 91,450 meters and depended on two main sewers, one measuring 30 inches in diameter, discharging into the Rocha River, and providing service to the older part of the city and adjacent neighbourhoods; and the other measuring 18 inches in diameter, discharging into the Tamborada River, and providing service to the southern part of Cochabamba. As a whole the sewage-disposal system takes in wastewater from 20% of the built-up area of the city and benefits 34,000 persons. The sewage is discharged into the rivers without treatment. Because the sewage system was built between 1927 and 1938, it is now for the most part deficient. Deterioration is particularly pronounced in the southern part of Cochabamba, which is classified as a residential area in the intermediate category, with second class commercial and crafts facilities. System expansion in recent years has been limited to extending the water supply service to the new streets built. Since 1970, 334 new residential service connections have been added on the average each year.
- 1.15 It is appropriate to note that the existing deficiencies in the sewage-disposal system of Cochabamba have not yet reached the critical stage owing to the relatively small amount of wastewater to be disposed of, which is itself a consequence of the shortage of water. It is estimated that an increase in the volume of drinking water for general use, without a commensurate improvement in wastewater disposal facilities, would presumably intensify the now existing problems of sewage-disposal. In order to improve the sewerage system of Cochabamba, SEMAPA is now examining various alternatives for carrying out studies for expansion of the sewerage system, one of these being to request technical cooperation from the Bank. (See paragraph 1.18)

3. Environmental sanitation and general health conditions

- 1.16 The relationship between environmental sanitation and general health conditions is established in the following table which shows the principal causes of death in Cochabamba:

	<u>1968</u>		<u>1969</u>		<u>1970</u>		<u>1971</u>	
	<u>Cases</u>	<u>%</u>	<u>Cases</u>	<u>%</u>	<u>Cases</u>	<u>%</u>	<u>Cases</u>	<u>%</u>
Diseases of the digestive tract	191	9.1	209	8.6	234	10.7	183	7.9
Diseases of childhood	198	9.4	261	10.7	163	7.5	227	9.9
Tuberculosis	129	6.1	165	6.8	155	7.1	137	5.9
Respiratory diseases	330	15.7	419	17.3	389	17.8	453	19.6
Other, identified	822	39.1	914	37.6	863	39.6	867	37.6
Other, unidentified	432	21.6	464	19.0	377	17.3	439	19.1
Total	<u>2,102</u>	<u>100.0</u>	<u>2,432</u>	<u>100.0</u>	<u>2,181</u>	<u>100.0</u>	<u>2,306</u>	<u>100.0</u>

The above table shows that disorders of the digestive tract as well as diseases of childhood, which are usually attributable for the most part to contamination of water, account for about 19% of reported deaths.

- 1.17 Finally, the high incidence of waterborne diseases is confirmed by the information on calls attended by the Municipal Health Center of Cochabamba. For the most part these are the waterborne diseases described below:

	<u>Number</u>	<u>Percentage</u>	<u>Morbidity per 100,000 persons</u>
Typhoid fever	79	1.9	22.0
Paratyphoid fever and salmonella infections	217	5.2	61.0
Dysentery (bacillary and amebic)	131	3.1	37.0
Enteritis and other diarrheal diseases	1,732	41.9	485.0
Other bacterial diseases	88	2.1	25.0
Acute poliomyelitis	17	0.4	5.0
Infectious hepatitis	3	0.1	0.8
Other viral diseases	143	3.5	40.0
Other diseases of the digestive tract	1,430	34.6	401.0
Parasitic diseases	298	7.2	83.0
Total	<u>4,138</u>	<u>100.0</u>	

F. Development Proposed for the Sector

- 1.18 The maximum goals of Bolivia's planning in the environmental sanitation sphere indicate that in 1980 Bolivia expects to supply potable water service to 80% of the urban population and 50% of the rural population, and provide sewage-disposal service to 70% of the urban population and 50% of the rural population. 1/ The minimum objectives are set at about 50% of those mentioned, except in the case of potable water supply services for the urban population, which at present are estimated at 56%, as mentioned in paragraph 1.06. It is estimated that in order to meet the minimum objectives it would be necessary to invest - for the unserved population - an average of US\$60 per capita for the urban services and of US\$20 per capita for the rural services, a total investment of US\$80 million. For the urban segment of the program which would extend beyond 1980, the Ministry of Urban Development and Housing proposes to carry out eleven projects at a total cost estimated at US\$82 million equivalent, of which amount 11%, that is US\$9 million equivalent, would be financed with local funds and the balance through external financial assistance. Included among the projects scheduled is a sanitary sewerage project for the city of Cochabamba which would be carried out during 1980-1985 at an estimated cost of US\$7,400,000 equivalent.

1/ Source of Data: CIAP, Document 670 of March 20, 1974.

II. THE PROJECT AND ITS EXECUTION

A. Description of the Project

- 2.01 The proposed project would consist of carrying out the second stage of the program for the expansion and improvement of the water supply system of the city of Cochabamba. 1/ The project would provide for raising the available flow of water from 240 liters per second (l.p.s.) to 640 liters per second (l.p.s.) and meet the city's estimated demand up to 1985. (See paragraph 2.23)

The project calls for the following works:

- (a) construction of a new dam in the Escalerani watershed to store 6 million cubic meters of water, including canals for conveying water from the drainage areas of Tunari, Victoria and Montelaguna, and the relining of a section of the Escalerani-La Cumbre canal
 - (b) construction of a new regulating dam on La Cumbre site to store 310,000 cubic meters of water;
 - (c) drilling four wells in Coña Coña and equipping ten wells, six of which are now being drilled;
 - (d) extending the distribution system about 290 kilometers, including two pumping stations, pumping main lines and four storage and regulating reservoirs;
 - (e) procurement and installation of 18,800 service connections;
 - (f) supply and installation of 12,000 meters and installation of 17,000 meters. 2/
- 2.02 Treatment of the new surface water streamflow to be added to the system during project execution would be accomplished by using the Cala Cala treatment plant, financed partly with resources of loan 159/SF-BO. This plant has a discharge capacity of 300 l.p.s. 3/ (See Chapter III. Evaluation of Loan 159/SF-BO)

1/ Appendix F shows a location map of the Cochabamba public water supply system.

2/ SEMAPA now has 5,000 meters in storage. The ratio of connections to the number of meters to be installed is regarded as reasonable because the cost of installing meters in areas inhabited by families of limited means is not warranted in terms of the benefits that would be derived.

3/ The Cala Cala treatment plant is now under construction and its completion is scheduled for September 1974. The capacity of the plant is 300 l.p.s. of water to be drawn from surface sources. The groundwater resources do not require treatment.

- 2.03 It is appropriate to point out in regard to the present distribution system that most of its is deteriorated. For this reason, plans call for replacing about 74 kilometers of the existing system as part of the 290 kilometers of distribution facilities called for by the project.
- 2.04 In order to facilitate the installation of indoor residential connections for lower income users, a fund for financing indoor residential connections would be established in the amount of US\$210,000 equivalent, to be managed by SEMAPA. This fund would be used to make loans on liberal financial terms and conditions to water users of limited economic resources. (See paragraph 2.51)
- 2.05 The project would also comprise: (a) the hiring of a firm of consulting of engineers to undertake supervision of the project construction; and (b) execution of a program of promotion and sanitary education among the people concerning the benefits to be derived from the supply of potable water. It is recommended furthermore that in parallel fashion technical cooperation in the amount of US\$20,000 should be granted on a nonreimbursable basis to improve SEMAPA's management-accounting system (see paragraphs 2.52-2.53).

B. Cost of Project

- 2.06 The total estimated cost of the project amounts to US\$12,300,000 equivalent, allocated as follows:

(In thousands of US\$ or equivalent)

nt category	Costs in foreign exchange			Local costs	Total
	Direct	Indirect	Total		
<u>neering and administration</u>	<u>234</u>	<u>-</u>	<u>234</u>	<u>773</u>	<u>1,007</u>
Engineering	-	-	-	50	50
Supervision	227	-	227	200	427
Administration	-	-	-	480	480
Promotion and education	7	-	7	43	50
<u>ct costs</u>	<u>3,090</u>	<u>630</u>	<u>3,720</u>	<u>3,580</u>	<u>7,300</u>
Surface water sources	35	255	290	895	1,185
Canals	60	30	90	500	590
Groundwater sources	275	45	320	170	490
Pumping stations	340	10	350	180	530
Pumping main lines	515	-	515	75	590
Piping	1,490	220	1,710	850	2,560
Storage tanks	185	10	195	240	435
Residential service connections	70	60	130	460	590
Meters	120	-	120	-	120
Fund for Financing Intra-Residential Connections	-	-	-	210	210
<u>nce charges</u>	<u>320</u>	<u>-</u>	<u>320</u>	<u>95</u>	<u>415</u>
Interest and commitment fee	220	-	220	95	315
IDB inspection and supervision	100	-	100	-	100
<u>ciated expenses</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>90</u>	<u>90</u>
Rights and expropriations	-	-	-	90	90
<u>nses not specifically allocated</u>	<u>691</u>	<u>210</u>	<u>901</u>	<u>2,587</u>	<u>3,488</u>
Contingencies	191	80	271	547	818
Cost escalation	500	130	630	2,040	2,670
Total	<u>4,335</u>	<u>840</u>	<u>5,175</u>	<u>7,125</u>	<u>12,300</u>
Percentage	(35.2)	(6.9)	(42.1)	(57.9)	(100.0)

1. Engineering and administration (US\$1,700,000)

- 2.07 This category includes the cost of a study for a new dam at Escalerani and adjacent drainage areas. The study was contracted in May 1974 with the firm Prudencio, Claros y Asociados, Ingenieros Ltda. in accordance with IDB procedures, at a cost of US\$50,000 equivalent and is being financed with national resources. 1/ Project supervision would be carried out by a consulting firm specialized in the kind of work called for by the project, at an estimated cost of US\$400,000 equivalent. This item of supervision also includes an allocation for procurement of five vehicles for supervision of project construction work-measures located at some distance from one another and from the city, as well as office equipment, the total amount being US\$27,000. The costs of administration include: (a) the hiring by SEMAPA of 16 additional employees necessary to the development of the project throughout the period from 1975 to 1978, at an estimated cost of US\$138,000 equivalent (see Chapter III); (b) payment of US\$309,000 equivalent for storage and internal handling at Bolivian customs, which amount is 10% of the US\$3,090,000 corresponding to the imported goods; 2/ and (c) expenses of vehicle maintenance, stationery and miscellaneous supplies totaling about US\$33,000 equivalent.
- 2.08 An item of US\$50,000 equivalent has been provided under this category to provide for an active promotional and educational campaign in the city of Cochabamba so that its inhabitants may learn the benefits to be derived from the supply of potable water, the purpose being to accomplish the greatest number possible of residential service connections, facilitating also the establishment and acceptance of rate schedule charges for services (see paragraph 2.50). This item includes US\$7,000 for the procurement of one vehicle equipped with audiovisual facilities; and US\$43,000 equivalent for the necessary personnel, teaching materials, radio-broadcasting campaigns, etc.

2. Direct costs (US\$7,300,000)

- 2.09 The construction cost estimates were based on the final project designs, prepared by consultants for most of the constituent parts of the project (70% of total) and on the preliminary project design for the new dam at Escalerani and the canals for conveying water from the adjacent drainage areas (see paragraph 2.23 et seq).

1/ It is recommended in this report that these expenses should be recognized as part of the local contribution to the proposed project (see paragraph 3.21).

2/ Of course, these expenses are neither taxes nor customs duties.

The prices of asbestos-cement pipe placed in Cochabamba were taken from recent invitations for bids and are regarded as adequate. The cost allocations in this category are for procurement of asbestos-cement pipe, accessories and valves in the amount of US\$2,045,000; pumping equipment and controls in the amount of US\$205,000; electrical materials and transformers in the amount of US\$70,000; reinforcing steel for tanks and other structures (US\$290,000); meters and housings, totalizers and chlorinating equipment for US\$260,000; polyvinyl choride (PVC) piping and brass accessories for residential service connections in the amount of US\$130,000; pipe for casing and filters for four wells in the amount of US\$50,000; steel and cast iron pipe, steel beams, cranes, etc. in the amount of US\$40,000. Moreover, the direct costs will comprise local materials and labor estimated at US\$3,370,000 as well as an item of US\$210,000 equivalent to assist in establishing the Fund for Financing Intra-Residential Connections for persons of limited economic means (see paragraph 2.51).

The direct costs of construction include also the amount of US\$630,000, estimated for indirect costs in foreign exchange (see paragraph 3.15).

3. Financing charges (US\$415,000)

- 2.10 This category comprises financing charges such as interest during project construction, commitment fee, and the special fee for IDB inspection and supervision. Interest during construction, as well as the special fee for IDB inspection and supervision would be financed with IDB resources; the commitment fee would be financed with national resources.

4. Associated expenses (US\$90,000)

- 2.11 This category comprises US\$90,000 equivalent for procurement of land, expropriation and easements (see paragraph 3.46).

5. Items not specifically allocable (US\$3,488,000)

- 2.12 Estimates of cost include an item for contingencies set at approximately 9% of amounts allocated to Engineering and Administration, and direct costs, which amount to US\$818,000 equivalent, to cover any possible work unprovided in the project costs budget and any increases in the volume of construction that might result. Since the final engineering designs are advanced, it is estimated that the 9% estimated is adequate to cover these contingencies.
- 2.13 Furthermore, a factor of 10% per annum was allowed for probable yearly increases in the price of goods of external origin required for the project, based on experience obtained in recent invitations for bids on this type of work and on the trend observed in international

prices in the recent past. For goods and services of local origin, a factor of increase of 20% a year was used taking into consideration the increases in the minimum wage and in the cost of construction materials, enacted into law in the last three years, particularly the cost of cement, as well as the fact that parity of the Bolivian peso has remained stable since October 1972. Accordingly, the amount of US\$2,670,000 equivalent was allowed for cost escalation. In these circumstances it is regarded as reasonable that owing to the combined effect of the contingencies items and the cost increase during the construction period, the amount allowed was 28% of the project cost. Appendix E discusses the calculation of cost escalation.

6. Estimates of costs in foreign exchange and national currency

- 2.14 Costs in foreign exchange and national currency were determined according to an itemized analysis of the goods and services required for the project.
- 2.15 Direct costs in foreign exchange represent imported materials and equipment, including meters (US\$3,090,000); part of the fees in foreign exchange of consulting engineers who will supervise the work construction (US\$200,000); procurement of vehicles for project supervision and office equipment required by the staff to be engaged by SEMAPA during project execution (US\$27,000); purchase of a vehicle equipped with audiovisual facilities for the promotional and educational program which SEMAPA proposes to undertake (US\$7,000) (see paragraph 2.50).

The internal and external direct costs also include: interest and the commitment fee on the IDB loan during project execution (US\$220,000); the IDB inspection and supervision fee (US\$100,000); and part of the unspecified expenses (US\$691,000). Indirect costs in foreign exchange (US\$840,000) represent chiefly depreciation of construction equipment of external origin to be used by contractors, as well as spare parts, in addition to imported raw materials included in products manufactured in Bolivia. The cost in foreign exchange (42.1%) is thought to be reasonable considering the size and the characteristics of the project.

- 2.16 The costs in national currency comprise the expenses of engineering, administration, promotion and education and the part in local currency of the supervision expenses (US\$773,000). Furthermore, these include the value of local materials and labor (US\$3,370,000); the amount of the Fund for Financing Intra-Residential Connections (US\$210,000); the interest and commitment fee on part of the prospective loan granted in national currency (US\$95,000); land, easements and expropriations

(US\$90,000); and the unspecified local expenses (US\$2,587,000). The cost in national currency (57.9%) is regarded as reasonable considering the high content of civil works in the project.

C. Financing the Project

2.17 The following financing plan is proposed for this operation:

(In thousands of US\$ dollars or equivalent)

Category	IDB Loan			Sub-total	Local Contribution 1/	Total
	Direct Cost	Indirect Cost	Local Cost			
Engineering and Administration	234	-	-	234	773	1,007
Engineering	-	-	-	-	50	50
Supervision	227	-	-	227	200	427
Administration	-	-	-	-	480	480
Promotion and education	7	-	-	7	43	50
<u>Costs</u>	<u>3,090</u>	<u>630</u>	<u>2,900</u>	<u>6,620</u>	<u>680</u>	<u>7,300</u>
Surface water resources	35	255	895	1,185	-	1,185
Canals	60	30	500	590	-	590
Groundwater resources	275	45	170	490	-	490
Pumping stations	340	10	160	510	20	530
Pumping main lines	515	-	75	590	-	590
Piping	1,490	220	700	2,410	150	2,560
Storage tanks	185	10	240	435	-	435
Residential service connections	70	60	160	290	300	590
Meters	120	-	-	120	-	120
Fund for Financing Intra-Residential Connections	-	-	-	-	210	210
<u>Interest Charges</u>	<u>270</u>	<u>-</u>	<u>75</u>	<u>345</u>	<u>70</u>	<u>415</u>
Interest and commitment fee	170	-	75	245	70	315
IDB inspection and supervision	100	-	-	100	-	100
<u>Related Expenses</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>90</u>	<u>90</u>
Easements and expropriations	-	-	-	-	90	90
<u>Costs not specifically allocated</u>	<u>691</u>	<u>210</u>	<u>1,900</u>	<u>2,801</u>	<u>687</u>	<u>3,488</u>
Contingencies	191	80	307	578	240	818
Cost escalation	500	130	1,593	2,223	447	2,670
Total	<u>4,285</u>	<u>840</u>	<u>4,875</u>	<u>10,000</u>	<u>2,300</u>	<u>12,300</u>
Percentage	<u>(34.8)</u>	<u>(6.9)</u>	<u>(39.6)</u>	<u>(81.3)</u>	<u>(18.7)</u>	<u>(100)</u>

The local contribution will be used to finance only expenses in local currency, except US\$50,000 in 1970 to cover the commitment fee on the IDB loan.

1. Source and use of currencies

- 2.18 The source and use of currencies for financing the project would be as follows:

(In thousands of US\$ or the equivalent)

	<u>Origin of Funds</u>		<u>Expenses to be made</u>		<u>Total</u>	<u>%</u>
	<u>External</u>	<u>Local</u>	<u>Foreign exchange</u>	<u>Local currency</u>		
IDB loan	6,000 <u>1/</u>	4,000	5,125 <u>2/</u>	4,875	10,000	81.3
Local counter-part contribution	<u>50</u>	<u>2,250</u>	<u>50</u> <u>3/</u>	<u>2,250</u>	<u>2,300</u>	<u>18.7</u>
Total	<u>6,050</u>	<u>6,250</u>	<u>5,175</u>	<u>7,125</u>	<u>12,300</u>	<u>100.0</u>
Percentage	(49.2)	(50.8)	(42.1)	(57.9)	(100.0)	

2. Use of the Bank's resources

- 2.19 The proposed loan from the Bank would amount to US\$10,000,000 equivalent, accounting for 31.3% of the total cost of the project. As much as 86.2% of the foreign exchange resources provided by the Bank would be used to finance all expenses in foreign exchange, except the commitment fee. On the other hand, the rest of the resources in foreign exchange (14.6%) and the resources in national currency would be used to finance part of the cost in local currency of the construction contracts to be awarded by means of international competitive bidding in member countries of the Bank, interest on the part of the loan which the Bank would make in national currency, procurement of minor local goods, and part of the contingencies and the item for cost increases. Furthermore, considering Bolivia's classification as a relatively less developed borrower nation of the IDB, it was thought reasonable to propose that the loan should be used in financing up to 81.3% of the total project cost, and to allocate a moderate proportion, namely 14.6%, of the foreign exchange resources of the loan, that is US\$875,000, for financing the local expenses.

1/ It is proposed that 14.6% of the loan proceeds in foreign exchange (US\$875,000) be used to finance local expenses.

2/ Includes US\$840,000 in foreign exchange chiefly for depreciation of construction equipment and imported raw materials included in the products of national manufacture.

3/ Represents the part of the commitment fee payable in foreign exchange.

3. Local contribution

- 2.20 The local contribution to finance the project would be US\$2,300,000 equivalent and would account for 18.7% of its total cost, which is regarded as reasonable considering the social nature of the project. These resources of the local contribution would be used to finance part of the direct construction costs in national currency, the cost of the national currency of the contract of the consulting engineers who will supervise execution of the project works, the local costs of administration having to do with project execution, the local associated costs, the local costs of the promotional and educational program, and part of the amount estimated for contingencies and cost increases in national currency. Only the foreign exchange part of the commitment fee would be financed with foreign exchange resources of the local counterpart contribution (see paragraph 3.18).

4. Recognition of expenses previously incurred

- 2.21 It is proposed that as part of the local contribution the amount of US\$50,000 equivalent in expenses should be recognized as expenses to be made by SEMAPA as of the date of presentation of the loan application (April 18, 1974), for making final designs of the Escalerani dam and of the canals and small diversion dams in the adjacent drainage areas of Tunari, Victoria and Montelaguna. Employing procedures acceptable to the Bank (see paragraph 2.24) these final designs were contracted in May 1974 with a Bolivian firm of consulting engineers.

D. Status of Studies and Designs

- 2.22 Using funds from Loan 159/SF-BO, in April 1973 SEMAPA engaged the services of the consulting firm Prudencio, Claros y Asociados for the final design of the program for expansion and improvement of the potable water supply system of Cochabamba, calling for two more stages of construction additional to that of Loan 159/SF-BO: a) the second stage of the program, consisting of the project considered herein, to meet the demand for potable water during 1975-1989; and b) the third stage, over the longer run, which would provide for meeting demand from 1985 to 2005. In December 1973 the consultants submitted the final designs of the basic parts of the Cochabamba potable water supply system (second stage), pointing out that the system had been designed assuming that as of 1985 it would be necessary to incorporate new aquifers.
- 2.23 Therefore, it is appropriate to point out that the basic parts of the system, the reservoirs and the main distribution systems, made up of piping greater than 8 inches in diameter, were so designed that with the continuous expansion of the sources of supply that would be required, these components would meet the potable water needs to the year 2005. As for the residential distribution system, made up of a pipe network three to four

inches in diameter, plans call for a design capacity to meet the needs up to 1985 (see paragraph 2.35). Moreover, considering the topography of Cochabamba, future withdrawals from new surface water sources would always be made along the high part of the city where the Cala Cala treatment plant is located, for which reason the design of the basic parts of the system would not be affected.

- 2.24 In May 1974 SEMAPA again engaged the firm Prudencio, Claros y Asociados to prepare the final designs for a new dam at Escalerani, with a storage capacity of 6,000,000 cubic meters. This design includes canals and small diversion dams on the nearby drainage areas from Tunari, Victoria and Montelaguna. Completion of the design was expected in October 1974 (see paragraph 3.21).
- 2.25 To do the groundwater surveys, in 1970 SEMAPA engaged the services of Boyle Engineering, Inc. This firm determined that a discharge of 120 liters per second could be obtained within the perimeter of Cochabamba City by drilling 10 wells in that part of the city named Muyurina. These wells are now in operation and discharging at that rate. Boyle Engineering, Inc. in April 1973 completed the survey for a second well field in the Coña-Coña area located about 70 kilometers to the west of the city, the discharge estimated for that area being 200 liters per second. For that reason the firm recommended that this resource should be developed by means of drilling 10 wells to 125 meters average depth, with wellheads separated at approximately 500-meter intervals (for further details on these water resources see paragraphs 2.28 to 2.33).
- 2.26 So far, 70% of the final designs are available; the remaining 30% represent: a) the contract entered into with Prudencio, Claros y Asociados for the design of the new dam at Escalerani, 21 meters high, and having a storage capacity of 6,000,000 cubic meters. This work would be completed in the month of October 1974; and b) the possibility that the designs for the Coña Coña system will have to be adjusted in the event that on completion of the drilling of the first six wells, a discharge different from the one estimated by the consultants is obtained; this would entail also an adjustment of the designs for the pumping station, the main water-line and part of the distribution system supplied from these sources. The task of adjusting the now completed designs, before the invitation for bids is made, would last about two months and would be done by the same firm of engineering consultants engaged to supervise project execution (see paragraph 3.31).
- 2.27 The basic design criteria used by the consultants for the project were determined in the light of Bolivia's experience and in keeping with generally accepted international standards. These criteria are deemed adequate. Appendix D shows the design parameters utilized for the project.

E. Condition of Water Resources

- 2.28 The sources of supply used by the consultants for the final design of the system are as follows:

(In liters per second)

Sources now in production

Surface water sources

Escalerani system	100
-------------------	-----

Groundwater sources

Chungará infiltration gallery and Arocagua wells	20
--	----

10 wells in Muyurina area	<u>120</u>
---------------------------	------------

Subtotal	240
----------	-----

Sources to be added by the proposed project

Surface water sources

Increment of the Escalerani system (water impounding included)	200
--	-----

Groundwater sources

10 wells in Coña Coña area	<u>200</u>
----------------------------	------------

Subtotal	<u>400</u>
----------	------------

Total	<u><u>640</u></u>
-------	-------------------

- 2.29 It follows from the above table that 440 liters per second of water are now available for the project from wells in the Muyurina area (120 l.p.s.), the Chungará infiltration gallery and the Arocagua wells (20 l.p.s.), and the Escalerani system, with a 95% probability of exceeding the target (300 l.p.s., that is, the 100 l.p.s. now available plus the 200 l.p.s. from the increase in impoundment capacity).
- 2.30 As regards the 10 wells in the Coña Coña area to be added by the proposed project, the consultants, Boyle Engineering Inc., in their hydrogeologic survey of April 1973 point out that the results of the pumping test of the producing well drilled show that there are favorable groundwater conditions for wells capable of discharging 20 l.p.s., spaced 500 meters apart. Boyle Engineering Inc. further points out that the information obtained from the pumping test combined with that developed in previous investigations shows that the groundwater sources in the general area of Coña Coña are capable of producing a volume of flow of about 200 l.p.s. Furthermore, the consultants have pointed out that the presence of thicker sediments toward the west indicates that additional sources of groundwater could be developed by drilling other wells in areas adjacent to the Coña Coña area. Boyle Engineering Inc. in 1968 delivered to SEMAPA surveys that show the possibilities for a well-field in the Quillacollo area to the west of the city, indicating a high probability of larger aquifers to the west of Cochabamba as the distance from the city increases.

- 2.31 In order to reinforce the hydrogeologic survey done by Boyle Engineering Inc., SEMAPA engaged the Bolivian Geological Service (GEOBOL) to drill and test six of the ten wells necessary for the project; it is estimated that these would be completed in October 1974. As of the date of this report, August 1974, two of the six wells scheduled have been drilled. Without pumps, these wells are discharging water at 5 to 6 liters per second, which indicates that once these are developed and equipped with filters and pumps they might produce the 20 liters calculated for each one. As stated in paragraph 3.24, plans call for the firm to be engaged in project supervision as an initial activity to verify the discharges obtained and to adjust the designs of the pumping station, main pipeline and part of the distribution system in the areas to be served from these sources to the volumes of flow finally obtained, should this be necessary.
- 2.32 Considering the importance which the flows that are finally obtained will have upon the development of the project, it is recommended that the loan contract should include among the conditions precedent to the first disbursement, that SEMAPA should show the volume of flow obtained from the first six wells in the Coña Coña area is at least 120 l.p.s.
- 2.33 More water could be impounded in the medium future term by constructing new dams in the Saitucocha, Chusequiri and Lagunmayu lagoons as well as the respective canals to carry water to the Escalerani-La Cumbre system itself. Over the longer run, SEMAPA could utilize water from nearby drainage areas on the other side of the dividing crest by means of tunnels or pressure pipes from existing or improved lagoons. Furthermore, the Empresa Nacional de Electricidad (ENDE), Corporación de Desarrollo de Cochabamba (CORDECO) and SEMAPA have recently contracted a feasibility study for development of the Misicuni river, since part of its stream flow could be utilized to subsequently raise the volume of flow to Cochabamba.
- F. Technical Justification of the Project
- 2.34 The project was prepared according to modern sanitary engineering practices and the necessary studies, plans, designs and specifications are available, representing 70% of the direct cost of the project, thus enabling its technical feasibility to be established. The remaining studies and designs are now being prepared by the firm Prudencio, Claros y Asociados, who plan to complete them in October 1974.
- 2.35 The proposed design is well suited to the geographic characteristics of the city of Cochabamba and represents the most suitable alternative from the technical standpoint. The project would provide for executing the second stage of the program for improvement and expansion of the potable water supply system of the city of Cochabamba, increasing the present volume of flow from 240 l.p.s. to 400 l.p.s. which would meet Cochabamba's water demand, as regards the capacity of the water resources, up to 1985. The distribution system and its reservoirs, by means of constant extensions, could serve the projected population to the year 2005.

- 2.36 The estimate of project cost was based on the latest available data obtained by the consulting firm and reviewed by the technical staff of SEMAPA. The estimate includes a cost escalation factor of 10% of the direct cost of imported goods and services, and 20% of the direct costs of local goods and services. Plans call for executing the project in four years, allowing reasonable periods for construction, for which reason it is felt that the schedule of investments is feasible and satisfactory. 1/ SEMAPA now has bid schedules for purchasing imported goods in the amount of about US\$3,000,000 which it expects to process once the prospective loan contract is signed. In order to obtain lower costs in works construction, SEMAPA proposes to provide the goods acquired to the contractors (see paragraphs 3.41 and 3.42). In addition to such foreign firms as might be interested in executing the project, it is important to note that there are enough national construction companies capable of undertaking the work involved.
- 2.37 As stated in paragraph 2.23, the project is designed in such a way as to allow for subsequent expansion which would include new water supply sources (third stage of the program) to meet water demand to the year 2005. (See paragraph 2.35)
- G. Execution of the Project
1. Proposed method of execution
- 2.38 SEMAPA would undertake to execute the proposed project, and for purposes of supervision it would establish before the first disbursement of the loan a coordination unit to engage exclusively in project execution. 2/ Furthermore, as a complement to the work to be done by the coordinating unit, SEMAPA would contract, also before the first disbursement, the services of a firm of specialized consulting engineers who would supervise the construction work. 3/
- 2.39 The project work would be carried out by contractors selected by means of public international invitations for bids. Contractors would be prequalified by SEMAPA, taking into account their technical and financial capacity, staff and equipment available to them as well as their previous experience with this kind of project. In procuring equipment and other goods related to the project and in awarding construction contracts, the system of public invitation for bids would be used whenever the value of such goods or services was greater than US\$25,000 equivalent.

1/ See paragraph 3.45.

2/ See paragraph 2.47.

3/ See paragraph 2.48.

- 2.40 Current Bolivian legislation concerning invitations for bids 1/ requires foreign companies to associate with citizens of Bolivia for the awarding of construction contracts in the public sector, and to register with the National Register of Construction Firms and Consultants and with the Bolivian Chamber of Construction. 2/ Though the purpose of this requirement is to enable national companies to enhance their experience and technical expertise it is incompatible with the Bank's rules since the said association is mandatory and not voluntary.
- 2.41 Therefore, it was decided as a result of timely negotiations with the Bolivian authorities to use procedures consistent with the IDB's requirements in the case of projects partly financed by the Bank, such as those of Loans 342/SF-BO, 351/SF-BO and 399/SF-BO. These procedures were set forth in annexes to the respective loan contracts. Owing to the fact that in order for all loan contracts to enter into force they must be ratified by the Bolivian legislature, and this depends on the issuance of an executive decree, the loan contract and the annexes thereto in fact must become the object of a special law for the project in question; and the stipulations on specific procedures for inviting bids on the project must replace the general law governing invitations for bids. As this is what would be done in the case of the proposed loan, the loan contract would contain as an annex the procedure agreed upon with SEMAPA, which is to be substantially similar to those used in Loans 342/SF-BO, 351/SF-BO and 399/SF-BO. Appendix O describes the draft regulations governing invitations for bids as agreed upon with SEMAPA; these are to be used in executing the proposed project.
- 2.42 It was deemed advisable for SEMAPA itself to undertake the procurement of materials and equipment for executing the project because: (a) better prices would be obtained by purchasing all similar goods needed for the project at the same time; and (b) prices in the present fluctuating market would be assured by acquiring in 1975 all the materials and equipment necessary, thereby reducing the incidence of escalation.
- 2.43 The procurement of necessary materials and equipment and the contracting of civil works included in the project would be done by means of seven invitations for bids in the estimated amount of US\$3,122,000, and four invitations for bids on work in the amount of US\$4,000,000 equivalent (not including contingencies and cost escalation), in keeping with the following schedule:

1/ Decree Law 10.120 of February 2, 1972 which regulates the method whereby contractors are selected for the execution of projects in the public sector.

2/ This applies also to the consulting firms.

(In thousands of US\$ or equivalent)

	<u>Call for Bids</u>	<u>Amount</u>
1. <u>Materials and Equipment</u>		
1.1 Asbestos-cement pipe, including accessories and valves	July/75	2,045
1.2 PVC pipe for residential service connections, including brass accessories	July/75	130
1.3 Structural steel	July/75	290
1.4 Pumping equipment, including motors, chlorinators, meters, piping and others	July/75	455
1.5 Residential service meters	October/75	120
1.6 Pipe for well casing and well filters	January/75	50
1.7 Vehicles	January/75	32
Subtotal		3,122
2. <u>Construction</u>		
2.1 Distribution system, including reservoirs and residential service connections	October/75	1,840
2.2 Drilling of four remaining wells at Coña Coña	January/75	100
2.3 Pumping stations at Coña Coña and Cala Cala, well field, pressure pipes	October/75	380
2.4 Escalerani system, including the Escalerani dam, the La Cumbre dam and canals	April/75	1,680
Subtotal		4,000
TOTAL		<u>7,122</u>

2. Sureties

- 2.44 According to the laws of the Republic of Bolivia, contractors who submit proposals are required to post bonds for 1% of the cost of construction. A bidder who is awarded a contract would also be required to post a bond ensuring the proper performance of the work and a bond assuring performance of the contract. The surety requirements applied in Bolivia to projects for which international bids are invited are more exacting than those of other member countries of the Bank but are considered to be acceptable.

3. Proposed schedule of procurements and construction

- 2.45 It is estimated that project construction will require four years from the date the loan contract is entered into. Since all final designs of the project would be available in October 1974, and invitations for bids would be made during the first quarter of 1975, it is expected that the work could be started between the second and third quarters of 1975. Following is a time schedule for project execution.

[illegible]

Accordingly, the time schedule of investments by source of funds would be as follows:

(In thousands of US\$ or equivalent)

Year	IDB Loan		Local contribution		Total	
	Amount	%	Amount	%	Amount	%
1	2,587	25.9	478 ^{1/}	20.8	3,065	24.9
2	3,600	36.0	753	32.7	4,353	35.4
3	2,280	22.8	571	24.8	2,851	23.2
4	1,533	15.3	498	21.7	2,031	16.5
Total	10,000	100.0	2,300	100.0	12,300	100.0

4. Aspects of law concerning expropriation and easements

2.46 In addition to the aspects indicated elsewhere in this report as regards invitations for bids and the legal capacity of SEMAPA, the following ones should be added:

- a) As regards expropriation, the law provides that in order for expropriation action to be carried out it is necessary that real property shall have been declared to be of public usefulness by decree of the Executive Branch. Once this declaration is made the Bolivian procedure for expropriation allows work to advance independently of any suits that might be brought in connection with the setting of prices. Consequently, in order for the project works to be carried out it would be necessary, before the prospective loan contract is signed, for the land where the works are to be located to be declared of public usefulness by decree of the Executive Branch. (See proposed resolution)
- b) As regards easements, the law provides that these must be directly negotiated by SEMAPA with the owners of land on which it is proposed that facilities are to be installed. Should the parties fail to agree, the government is empowered to proceed to expropriate. The project calls for establishing easements on privately owned land on which water conduits would be installed. For this reason it is proposed that the contract to be entered into shall establish that before the start-up of work on each one of the pertinent facilities, SEMAPA shall give evidence to the Bank, to the satisfaction thereof, that it has acquired the respective easement.

^{1/} Including the expenses made by SEMAPA in contracting designs for the Escalerani dam, canals and diversion dams in adjacent drainage areas. (See paragraph 3.21)

5. Coordinating unit of the IDB-SEMAPA project

- 2.47 In order to assure the development of the project SEMAPA proposes to establish, before the first disbursement of the loan, 1/ a special organization unit to engage exclusively in the management and control of the execution of works called for by the project and in the management of local and foreign funds allocated to the project. This system was designed in order to supplement SEMAPA's capabilities as executing agency. The previous loan did not provide for the establishment of such a unit. This unit would depend on the General Manager and would be constituted by a chief engineer for the project who must be experienced in the accomplishment of this kind of work; an assistant engineer and one secretary. Furthermore, the unit would be supported by a team of officials posted to the accounting and purchasing and supply sections of the Financial Administration and General Services divisions, respectively, thereby enabling the institution to utilize all its personnel. Recently SEMAPA appointed the chief engineer for the project and part of the staff. (Chapter III examines the capacity of SEMAPA to execute the proposed project and the measures which are proposed to assure that said capacity for execution will be satisfactory to the Bank.)

6. Supervision and technical control

- 2.48 To supplement the work of the IDB-SEMAPA Project Coordinating Unit, plans call for hiring, before the first disbursement of the respective loan, a firm of consulting engineers in keeping with the procedures which the Bank shall set forth in the loan contract. (See resolution and Recommendations.) The main supervisory functions of the Consultants would be as follows: a) to adjust the designs of the Coña Coña system, as necessary, on the basis of the volume of flow finally obtained once the six wells contracted with GEOBOL are drilled and tested; b) to advise SEMAPA on procedures for prequalification, inviting bids and making awards; c) to supervise construction activities undertaken by the contracting firms; d) to assist SEMAPA on administrative affairs of the project, especially those having to do with the proposed loan, such as technical reports and quarterly progress reports. Appendix I contains the draft terms of reference of the work to be performed by the consultants.

7. IDB inspection and supervision

- 2.49 The Bank's responsibility for inspection and supervision in connection with this project would be undertaken by the Sanitation Sector Specialist of the Office of the IDB Representative in Bolivia.

1/ See proposed resolution.

8. Promotion and education program

- 2.50 In order for SEMAPA to carry out an active promotional campaign designed to achieve a greater number of connections, inform the public of the benefits yielded by an adequate supply of potable water, and also facilitate the establishment and acceptance of the service rates, the project cost estimate provides an item of US\$50,000 equivalent. In executing this program the various communications media in Cochabamba would be used: radio, newspapers, magazines, etc., as well as a vehicle equipped with audiovisual devices capable of bringing information to the public in various parts of the city, thus disseminating the advantages of the orderly use of potable water. For these purposes, it is recommended that the prospective loan contract should include an obligation for SEMAPA to submit to the Bank within 24 months of the date of the loan contract, to the satisfaction of the IDB, a program for conducting promotional and educational activities among the people who are to benefit from the project. Once the promotional program was approved by the Bank, it would be set in operation during the last two years of project execution, so that once all investments had been made, that part of the city's population to benefit from the project would have been reached by the program.

9. Intra-residential service connections

- 2.51 The project includes an item of US\$210,000 equivalent allocated to establish a "Fund for Intra-Residential Connections" through which SEMAPA, using resources of the local contribution, would finance intra-residential service connections for users of limited means. The loans, to be administered by the Financial Administration Division of SEMAPA, would be earmarked for making improvements to existing sanitary facilities or for construction of new sanitary facilities, including as a maximum in the case of new sanitary facilities, a shower, toilet and a washbowl. Terms and conditions for payment to SEMAPA would be as follows: A term of 5 years and in justified cases as long as 8 years; and interest at 6% a year on balances outstanding. The Construction and Financial Administration Divisions would be respectively in charge of studying the technical feasibility of the installations and of managing and supervising the loans. Within 12 months of the date of the prospective loan contract, SEMAPA would establish the Fund and submit for approval of the IDB the regulations thereof. It is noteworthy that SEMAPA has already submitted to the Bank a draft of said regulations which are shown in Appendix G hereto.

10. Technical cooperation

- 2.52 It is proposed as a supplement to the project that nonreimbursable technical cooperation of US\$20,000 equivalent 1/ should be granted in order

1/ The local contribution would be US\$20,000.

to contract consultants in management accounting to advise the SEMAPA on the implementation of systems designed with the previous technical cooperation partly financed with resources of Loan 159/SF-BO (see Chapter III-G - Evaluation of Loan 159/SF-BO). The technical cooperation would provide for designing a cost accounting system for SEMAPA and a statistical reporting system, in addition to shaping the systems already designed to the new requirements and provide for their implementation and for follow-up of results. This technical cooperation is expected to produce a favorable impact in that it would provide not only for the normal development of the project but also enable SEMAPA to have at its disposal adequate general accounting systems, cost accounting systems and program budgeting and internal control systems that would ensure satisfactory management of its resources. (See Appendix C to the loan document)

- 2.53 The SEMAPA proposes to engage the Pan American Health Organization (PAHO) to provide the technical cooperation, since experts of this organization provided the previous technical cooperation. The IDB's analysis of the systems, rules and procedures developed by the PAHO has indicated that these would be adequate for the management of SEMAPA. Following is a table showing the reported advance, at the time of writing this report (August 1974), of the various aspects of the technical cooperation provided by the PAHO. For purposes of contracting the PAHO, SEMAPA in July 1974 presented to PAHO a letter of intent. (See paragraph 3.21.)

Accomplishment of Technical Cooperation

(In percentages)

<u>Activity</u>	<u>Accomplishment</u>
Organization Structure	88.0%
Human Resources	95.0%
Public Relations	57.5%
Financial Administration	68.0%
Materials and Internal Services	45.0%
Invoicing	61.0%
Collection	15.0%
Accounting, Budgeting and Internal Auditing	40.0%
Operation and Maintenance	40.0%
Rates	55.0%

11. Other technical aspects of the project

a) Availability of construction materials and labor

- 2.54 The project calls for the procurement of imported goods of an estimated value of US\$3,122,000 of which the greater part is expected to come from Argentina, Brazil, Colombia and the United States. It is

noteworthy that these countries readily provided most of the imported goods used in the first stage of the project financed partly with the resources of Loan 159/SF-B0. In purchasing local materials, no difficulties in supply are expected. The principal local materials to be employed in the project would be cement, sand, gravel, rock and lumber.

- 2.55 The project would be labor-intensive. The personnel required by the contracting firms would be mostly unskilled workers who can be contracted locally in Cochabamba. However, specialized personnel would be required and these may be found in Cochabamba as well as in other cities of Bolivia.

b) Contamination of water resources

- 2.56 Since the surface water resources to be used in this project are found in the high mountain ranges, far from urban centers, industry and mining activities, no great risks of contamination are anticipated. As for groundwater resources, it is recommended that only chlorination should be employed owing to the small likelihood of contamination.

c) Fluoridation of water

- 2.57 In the study on fluoridation of the Cochabamba potable water system done by the Pan American Health Organization (PAHO) the natural content of fluorine in surface water was estimated at 0.13 parts per million (ppm) and at 0.20 parts per million in groundwater. The PAHO determined that these quantities were less than adequate and recommended that the fluorine content should be increased to 0.79 parts per million. For the purpose, SEMAPA proposes to add fluorine salts regularly as soon as the improvement works to the potable water system discussed herein are put into operation.

H. Social and Economic Evaluation of the Project

- 2.58 The following main elements were used in doing the socio-economic evaluation of the second stage of the potable water program of Cochabamba: a) analysis of the demand for potable water; b) analysis of the supply of potable water; c) problems of distribution and marketing of potable water; and d) analysis of the investment and operating costs of the system.

a) Analysis of the potable water

- 2.59 The potable water demand was estimated in terms of the population to be served during the serviceable life of the project and in terms of daily per capita water consumption resulting from execution of the project. The number of users on the potable water system within 10, 20 and 30 years after completion of the project was estimated on the basis of the present population and the estimated population growth during the serviceable life of the project.

2.60 The last three population censuses taken in Cochabamba showed the population at 75,000 in 1950, 124,000 in 1960, and 137,000 in 1967. The 1974 population was estimated at 173,000 persons. These population growth rates in Cochabamba have recorded significant variations during the last 25 years. They have varied from an annual average of 5.2% in 1950-1960 to an annual average of 1.4% in 1961-1967 and to an annual average 3.5% in 1968-1973. Natural growth since the census of 1967 was estimated at 3.9% a year as a result of a 5.4% birth rate and a 1.5% death rate. In studies sponsored by the Municipality of Cochabamba, done for the purpose of preparing a master plan for celebrating in September 1974 the 400th anniversary of Cochabamba's founding, 1/ it is estimated - with probably undue optimism - that expansion will continue at a rate of not less than 3.5% up to the end of the century owing in great measure to the recently paved highway which bears eastward to Santa Cruz, underscoring the importance of the city as a transportation hub between the Atlantic and the Pacific. In arriving at a conservative estimate of the number of potable water system users during the next 15 years, it was thought prudent to assume a growth rate of 2.9% (see Appendix M), except that such an estimate would not take into account the possible impact of several longer-run development possibilities, such as: a) the possible transformation of Cochabamba into a central communications hub in Bolivia, with north-south and east-west axes, through its link with the Beni River transportation system, to provide service to the vast and virtually unexplored tropical lowlands; 2/ and b) the possibility that Cochabamba would become in the medium or long run, a center for Bolivia's light metalworking industry, making use of the available hydroelectric resources in the region. This latter possibility is based on the establishment, in April 1974 in one of the suburbs of Cochabamba, of a farm tractor factory with a capacity of 264 units per year, and on the fact that planning work is well advanced for establishing outside the city a petroleum refinery with a productive capacity of 434 barrels a day.

1/ Source: La urbanización de la Ciudad de Cochabamba by Jorge Urquidí Zambrana, Editorial Universitaria, Cochabamba, 1967; and La Realidad Social de Cochabamba by Humberto Guzmán Arze, Editorial "Los Amigos del Libro", Cochabamba 1972.

2/ The IDB is cooperating in the improvement of the section of the Cochabamba-Quillacollo highway in the south (Loan 351/SF-BO of December 1972). In May 1974 the Bank approved Loan 399/SF-BO in the amount of US\$35,000,000 to assist in the financing of a highway 105 kilometers long, between Quillacollo and Cofital, which forms part of the international highway system. Moreover, on August 8, 1974, the Bank authorized technical cooperation for making studies of the section named Río Chimoré-Río Yapacaní, of the new alternative highway to the existing one which would be constructed between Cochabamba and Santa Cruz.

b) Analysis of the supply of potable water

- 2.61 The project under consideration calls for increasing the potable water supply of Cochabamba from a present mean volume of flow of 240 liters per second (lps), which represents a gross annual output of 7,568,400 cubic meters of water, at a design flow of 640 lps, which represents a gross annual output of 20,183,000 cubic meters of water. (See Appendix M)
- 2.62 On the bases of an average potential consumption of 186 liters of water per capita daily (lpcd), which would increase to 200 lpcd in 1985 as compared to actual consumption of 56 lpcd, the new capacity resulting from the project would equal the estimated demand in 1985. 1/ As of 1985 Cochabamba would require a third stage investment to expand the water supply system. Following is a table showing the equilibrium between the demand and supply of potable water in Cochabamba over the next ten years:

<u>Year</u>	<u>Population (In thou- sands)</u>	<u>Potential Consumption of Water (lpcd)</u>	<u>Average Annual Demand (In mil. cubic meters)</u>	<u>Gross Production (In mil. cubic meters)</u>	<u>Deficit of Water Re- <u>2/</u> sources (In mil. cubic meters)</u>	<u>Deficit of Water Re- <u>3/</u> sources (In mil. cubic meters)</u>
1975	178.0	186	11.7	7.5	4.2	4.2
1976	183.1	187	12.1	7.5	4.6	4.6
1977	188.4	188	12.5	10.0	5.0	2.5
1978	193.4	190	12.9	13.0	5.4	-
1979	199.5	191	13.9	15.7	6.4	-
1980	205.2	193	14.4	16.4	6.9	-
1981	211.2	194	14.9	17.0	7.4	-
1982	217.3	195	15.4	17.7	7.9	-
1983	223.6	196	16.0	18.4	8.5	-
1984	230.0	198	16.6	19.0	9.1	-
1985	236.7	200	17.3	20.2	9.8	-

- 2.63 The improvement in the water supply service of Cochabamba that would result from the project under consideration and also in part from investments in the previous stage would be qualitative as well as quantitative. Under present conditions the volume of surface water obtained from the Escalerani dam is distributed to the population in a virtually crude state, and there is no effective protection against contamination or even against turbidity, especially during periods of

1/ The maximum demand is 1.2 times average demand.

2/ Deficit of water resources without the project.

3/ Deficit of water resources with the project.

flooding, because the Cala Cala treatment plant is still under construction. ^{1/} The increased volume of project-generated water (300 lps as compared to 100 lps, and 47% of the gross volume of output as compared to 42%) would all be processed by a new and efficient treatment plant and distributed in the form of pure water of high quality, comparable in every respect to groundwater.

c) Analysis of the distribution and marketing of potable water

- 2.64 In order to realize the benefits of the gross output of water and to market such output, the project would provide for financing 18,800 service connections and 12,000 water meters. Of the 18,800 service connections proposed, 10,000 (53%) would be new connections additional to the existing ones, while the 8,800 remaining connections would replace some of the 12,000 existing connections which have deteriorated. To the 12,000 meters to be installed would be added the 5,000 meters which were financed with resources of the previous loan and are now in storage. Therefore, 17,000 meters would be installed during project execution, that is, at the conclusion of the work the city of Cochabamba would have 22,000 residential service connections for potable water and 77% of these would be equipped for metered service. This percentage of connections with meters is regarded as reasonable inasmuch as the cost of installing water meters in areas of little water consumption would be unwarranted in terms of the benefits to be obtained.

d) Analysis of the costs of investments and operation of the project

- 2.65 The structure of the investment cost of the project now under consideration is as follows: distribution 32%, water production 27%, designs and engineering 8%, other costs 5%, contingencies and cost escalation 28%.
- 2.66 The project is considered to have a high cost, because of its characteristics. The economic cost of investment per capita, which does not include financing charges of US\$415,000, amounts to the equivalent of US\$69 per capita for the present population, and to the equivalent of US\$53 per capita for the estimated design population. At the end of the construction period (1978) the gross production costs would be equivalent to US\$0.62 per cubic meter and amount to the equivalent of US\$632 per residential service connection. It is noteworthy, however, that the recommended technical solution for the project is the one that costs least to meet the problems of supplying water to Cochabamba through 1985. The high cost of the project is determined by the following factors: a) the distance and natural obstacles which separate the city of Cochabamba from abundant waterway resources; b) the urban settlement pattern of low-income families, on the sides of the mountains, which

^{1/} The Cala Cala treatment plant is being financed with resources of the Loan 159/SF-B0, and its completion is scheduled for September of 1974.

requires the placing of new tanks at higher elevations; and c) Cochabamba's height above sea level is 2,250 meters, thus affecting the operating efficiency of the pumping equipment and entailing greater fuel consumption.

- 2.67 Between 1975 and 1985 the cost of operating the Cochabamba water supply system would increase from US\$502,000 equivalent to US\$1,424,000 equivalent a year, an annual rate of 11%, whereas the output of billable water would increase from 14.2 million cubic meters to 14.4 million cubic meters, at the annual rate of 13%. (See Appendix M.) For this reason, the mean cost per cubic meter of billed water would be reduced from the equivalent of US\$0.12 at the beginning of the decade to the equivalent to US\$0.10 at the end of the decade, which is regarded as a fairly high level in terms of international norms, yet it is justified in the case of a system which depends on deep wells and pumping for 57% of its gross output. There are various possibilities for reducing this average cost by means of a program of limiting transmission and other system losses, which in the computation referred to above were estimated at 45% of gross production in 1975, 40% in 1976, and 30% in 1978. It is noteworthy in connection with these losses that 74% of the distribution system which dates from 1927 would be replaced owing to its deteriorated state. Furthermore, plans call for relining the Escalerani-La Cumbre canal in three sections. Consequently losses will be reduced substantially (33%) once these facilities are installed.
- 2.68 Summing up what was stated in the foregoing paragraphs, while the project has a relatively high cost, both in terms of the initial investment as well as its operation, and it presents complex technical features, it nevertheless constitutes, among the possible alternatives, the minimum investment necessary to assure the essential supply of water to the city of Cochabamba for the next ten years, and its socio-economic feasibility is thereby justified. It is appropriate to note that the high cost, together with other factors, supports the recommendation regarding rate schedules made in this report. (See Chapter III)

III. THE BORROWER AND THE EXECUTING AGENCY

A. The Borrower

- 3.01 The borrower would be the Republic of Bolivia.

B. The Executing Agency

- 3.02 The executing agency would be the Servicio de Agua Potable, Alcantarillado y Desagües Pluviales de Cochabamba (SEMAPA), 1/ (Drinking Water, Sewerage and Storm Sewer Service of Cochabamba), which has its origin in another enterprise, the Servicio Municipal de Agua Potable (Municipal Drinking Water Service) that was created in 1967 as a municipal enterprise. Based on that enterprise the present SEMAPA was created by means of Ministerial Resolution 114 of May 25, 1973 as a public utility, which is administratively, financially and managerially independent, of indefinite duration, with its own assets and legal status under public law. 2/ SEMAPA is under the Ministerio de Urbanismo y Vivienda (Ministry of Urban Planning and Housing) and its geographic jurisdiction extends throughout the Province of Cercado in the Department of Cochabamba. SEMAPA headquarters are located in the city of Cochabamba.

- 3.03 SEMAPA is in charge of managing and providing directly and exclusively drinking water services, sewerage and storm water sewers for the Province of Cercado in the Department of Cochabamba.

1. SEMAPA's organization and staff

- 3.04 The general management of SEMAPA is entrusted to the Board of Directors composed of five persons. The Mayor of the Municipality of Cochabamba is the Chairman of the Board. The other four members are: one representative of the Ministry of Urban Planning and Housing, who acts as Vice Chairman; one representative of the Ministry of Public Health and Social Planning; one representative appointed jointly by the departmental chambers of industry and commerce; and one representative of the Federation of Local Boards (Federación de Juntas Vecinales). The General Manager of SEMAPA acts as secretary of the Board and is a nonvoting member. The legal representation of SEMAPA can be exercised either individually by the Chairman of the Board of Directors of SEMAPA or by the General Manager, or jointly by both.

1/ Address: Servicio de Agua Potable, Alcantarillado y Desagües Pluviales de Cochabamba (SEMAPA), Plaza Colón 5697, Casilla 1647, Cochabamba, Bolivia.

2/ The organization chart for SEMAPA is given in Appendix H.

3.05 The General Manager, appointed by the Ministry of Urban Planning and Housing for an indeterminate period of time, is in charge of the management, operation and maintenance of the drinking water, sewerage and storm drainage systems through a centralized managerial structure organized based on functional criteria. The technical departments under the General Manager and their functions are as follows:

- a. Engineering Department. This department is in charge of conducting the technical studies and investigations and preparing specific sanitation projects. It also engages in works construction by force account and supervision of work let under contract. The department carries out a limited number of studies because of its small technical staff. Nevertheless, it contracts the services of specialized firms that prepare most of the studies.
- b. Operation and Maintenance Department. Its basic functions are maintenance of production and provision of local drinking water, sewerage and storm drainage services. It must also control the quality of the water supplied to users and repair and maintain equipment and meters.

3.06 SEMAPA carries out its functions by means of the following staff:

<u>Professionals</u>	<u>Middle-level technicians</u>	<u>Administrative employees</u>	<u>Laborers</u>	<u>Total</u>
19	10	19	61	109 ^{1/}

C. Financial Management

3.07 The Administrative Department of SEMAPA is in charge of all the administrative and accounting functions. These functions are carried out through the Financial Management, General Services and Billing and Collecting Divisions.

- a. Financial Management Division. This division is in charge of classifying and recording economic and financial information, planning, budget execution and control and administration and custody of funds. To carry out these tasks it has Accounting, Budget and Treasury Sections.
- b. General Services Division. This division is responsible for personnel management, procurement, control and distribution of supplies and general services. It handles these tasks through the Personnel, Procurement and Supplies and General Services Sections.

^{1/} Including staff recently contracted (see paragraphs 3.14 and 3.15).

- c. Billing and Collecting Division. This division handles metering of customer consumption, billing and collecting, through the Meter Reading, Billing and Collecting Section.

- 3.08 The Administrative Department has been operating on a limited basis because it lacks adequate staff to suitably carry out its tasks. For this reason some of the functions of the Department, such as billing and collecting, have been done by the Municipality. It should be recalled that the present SEMAPA was organized only in May 1973 as an independent institution (see paragraph 3.02).
- 3.09 For the reasons indicated in the preceding paragraph, the administrative, accounting and internal control services used by the Administrative Department present several weaknesses. The present managers of SEMAPA are attempting to correct these deficiencies. Furthermore, SEMAPA has no accounting systems, nor does it have any systems for controlling inventories, purchases, personnel management or budget performance except for the investments under the previous project financed in part with resources from Loan 159/SF-BO, which are kept on separate accounts.
- 3.10 Despite the weaknesses indicated in the preceding paragraph, it is felt that they could be corrected relatively quickly for the following reasons: (a) SEMAPA has systems designed by the Pan American Health Organization (PAHO) under the technical cooperation financed in part with resources from Loan 159/SF-BO (see paragraph 3.53), which is in the process of being implemented; (b) SEMAPA intends to once again contract PAHO to complete the setting up of the systems, to adjust them and provide for control over the results, for which purpose SEMAPA has already addressed a letter of intent, and (c) SEMAPA has contracted the necessary accounting services for issuing bills and is negotiating an extension of these services to include control over collections, debtor status and statistics, which will make it possible to meet a large part of SEMAPA's information needs.

1. Internal auditing

- 3.11 SEMAPA has an internal auditing manual prepared by the Pan American Health Organization (PAHO) under the technical cooperation financed in part with resources from Loan 159/SF-BO. SEMAPA has already contracted an internal auditor for purposes of implementing the internal auditing manual. With the contracting of the internal auditor and the implementation of the auditing manual SEMAPA is able to accomplish these functions satisfactorily.

2. External auditing

- 3.12 The Office of the Comptroller General of the Republic (Contraloría General de la República) is in charge of SEMAPA's external auditing.

However, since the assets and liabilities of the drinking water supply and sewerage services were only lately transferred by the Municipality to SEMAPA, it is recommended that a provision be included in the eventual loan contract providing that within nine months of the signature of the contract SEMAPA is to submit to the satisfaction of the Bank evidence that a firm of independent public auditors, acceptable to the IDB, has conducted an initial auditing of SEMAPA's activities (see Recommendations). It is furthermore recommended that provision be made in the loan contract that financial statements and additional financial information concerning SEMAPA and the project are also to be audited by a firm of independent auditors acceptable to the Bank, and that such information is to be submitted to the Bank within 120 days from the end of each fiscal year during the life of the contract. It should be pointed out here that although in some cases the Bank has allowed an alternative clause for Bolivia, it has done so when the executing agencies, by their very nature, are not required to keep a complicated system of property accounting, as in the case of highway loans. In these operations only income and expenditure statements are obtained and this considerably reduces the complexity of the auditing work. In this case, since SEMAPA is an independent enterprise with program budget and property accounting systems it is believed necessary that independent auditors should conduct the auditing of the financial statements.

3. Technical and administrative capacity of SEMAPA

- 3.13 SEMAPA's technical and administrative capacity is limited. For this reason during the talks held with the Bolivian authorities at the time of the Operations Mission's visit in May 1974, it was agreed with SEMAPA that a program would be put into effect for selecting and contracting additional staff (21 persons) needed to effectively provide the services required of SEMAPA. The following positions were agreed upon:

Advisory Services and Control

Internal Auditor

General Secretariat

1 Typist

1 Telephone Operator

Studies and Projects Division

1 Draftsman Estimator

1 Topographer

Financial Management Division

Chief, Financial Management Division

Chief, Accounting Section

Chief, Treasury Section

Billing and Collecting Division

Chief, Billing Section

Chief, Collection Section

1 Meter Reading Assistant

1 Collection Assistant

Construction Division

Chief, Bidding and Auditing
Section

General Services Division

Chief, Personnel Section
Payroll Officer

Water Supply Division

Chief, Production Section

Sewerage Division

Chief, Sewerage Division

Water Treatment

Chief, Water Treatment Section
2 Plant Operators

Distribution Section

Chief, Distribution Section
Mechanic, for workshop
1 Assistant Mechanic

- 3.14 With the exception of the Chief of the Sewerage Division, who would be hired in September 1974, SEMAPA has now contracted all of the persons indicated, plus a driver, a meter reading assistant and a collection assistant, making a total of 24 persons. With the contracting of this staff it is felt that SEMAPA has the capacity required to carry out its functions normally.
- 3.15 In order to provide appropriate staff for the coordinating unit for the execution of the project it will be necessary despite the above to contract the following additional staff: (a) a chief engineer for the project, an engineering assistant and a secretary, who would comprise the core of the coordinating unit; 1/ and (b) an accountant, an assistant accountant, an accounting secretary, a man in charge of purchasing, a purchasing assistant, a warehouseman, a driver and six laborers, all of whom would become part of the regular structure of SEMAPA. As of this time SEMAPA has also contracted the chief engineer for the project, the person in charge of purchasing, the man in charge of the warehouse, and a driver. For the purpose of assuring that the contracting of the rest of the staff mentioned in this paragraph will be carried out on time, it is recommended that prior to the first disbursement from the proposed loan SEMAPA will prove to the satisfaction of the Bank that it has contracted the persons necessary to execute the project (see proposed resolution).
- 3.16 In addition, in order to continue to strengthen the capacity of the agency, in such a way as to assure appropriate execution of the

1/ See Chapter II.

proposed project, it is recommended that the eventual loan contract contain, as a condition precedent to the first disbursement, the obligation that SEMAPA shall submit to the satisfaction of the Bank: (a) evidence that it has contracted the firm of consultants that would supervise project execution, and (b) evidence that it has contracted the administrative accounting technical cooperation with PAHO. It is felt that once these arrangements have been made SEMAPA would have adequate institutional capacity for carrying out the activities proper to the various departments and for executing the proposed project.

D. Financial Analysis 1/

- 3.17 As stated previously, SEMAPA has been in existence only since May 1973. The former Municipal Drinking Water Service and the Municipality of Cochabamba do not have adequate accounting records to carry out effective control over the water supply and sewerage activities. Consequently, the financial analysis presented in this section is based on non-accounting information provided by the Municipality.

1. Summary of cash, receipts and expenditures

- 3.18 The next table is a summary of the revenue and expenditures of the former Municipal Drinking Water Service and, starting with May 1973, of SEMAPA for the last three years: 2/

1/ The rate of exchange used was 12 Bolivian pesos for US\$1 in 1971 and 1972 and 20 Bolivian pesos per US\$1 in 1973.

2/ Only drinking water is included since expenditures for sewerage could not be determined because the Municipality had no records.

(In thousands of US\$ or equivalent)

	<u>1971</u>	<u>1972</u>	<u>1973</u>
Balance at the beginning of the year	-	51	84 <u>1/</u>
Plus			
<u>Revenues</u>			
Drinking water	28	48	21
Municipality	199	76	46
PADES <u>2/</u>	-	-	45
IDB Loan 159/SF-BO	<u>243</u>	<u>193</u>	<u>334</u>
Total	<u>470</u>	<u>317</u>	<u>446</u>
Total available	437	368	530
<u>Expenditures</u>			
System operation <u>3/</u>	62	52	49
IDB project	324	174	436
Repayment to the Municipality <u>4/</u>	<u>33</u>	<u>-</u>	<u>-</u>
Total	<u>419</u>	<u>226</u>	<u>485</u>
Balance at end of year	51	124 <u>1/</u>	45

1/ The change in the balance is due to the variation that occurred in the relationship between the Bolivian peso and the dollar, from 12 Bolivian pesos to 20 Bolivian pesos per US\$1.00.

2/ Programa de Arranque para el Desarrollo Económico Social financed by the United States Agency for International Development (USAID).

3/ Operating costs do not include accounting and financial management costs incurred by the Municipality.

4/ Expenditures incurred by the former Drinking Water Service in 1970, paid by the Municipality of Cochabamba that were repaid.

- 3.19 It can be seen from the preceding table that revenues originating from the drinking water supply system in 1973 accounted for only 4.7% of all revenues, compared with 15.1% in 1972. It was not possible to determine the reason for the difference in revenues due to the fact that the Municipality does not have any records on billing and collections by periods. It should also be pointed out that the revenues for 1973, when converted to United States dollars, are affected by the devaluation of the Bolivian peso in October 1972. As the result of these low revenues from services, the Municipality resorted to other revenues to finance the operation of the service, as well as the local contribution to the project financed in part with resources from loan 159/SF-BO. Since the Municipality, in its turn, has experienced cash flows problems in covering the local contribution to the project, in 1973 it was forced to resort to financing from the Central Government through funds from the "Programa de Arranque para el Desarrollo Económico Social" program (PADES). The present and past cash difficulties at the Municipality level were basically the reason for the delay in the creation of SEMAPA and also for the sluggishness in the execution of the former project (see G, Evaluation of loan 159/SF-BO).

2. Current and projected financial situation

- 3.20 Based on information provided by SEMAPA on the source and application of funds, the statement of condition of SEMAPA was estimated as of March 31, 1974. Furthermore, due to the lack of financial statements for preparing a conventional historical financial analysis, based on this estimated statement of condition and the financial projections drawn up for SEMAPA, proforma statements of condition were prepared up to 1979 (Appendix K) for the purpose of providing comparative criteria for evaluating the impact of project execution.
- 3.21 The next table gives the proforma statement of condition of SEMAPA estimated for March 31, 1974:

(In thousands of US\$ or equivalent)

<u>Fixed Assets</u>		<u>%</u>	<u>Liabilities and Net Worth</u>	<u>%</u>
Net assets, prop- erties	4,281	72.7	-	-
Construction work in process	<u>1,387</u>	<u>23.6</u>	—	—
Total Fixed Assets	5,668	96.3		
			<u>Current Liabilities 2/</u>	108 4.3
<u>Current Assets</u>				
Cash and bank holdings	33	0.6		
Contribution receiv- able from the Mu- cipality 1/	44	0.7		
Inventories	<u>97</u>	<u>1.6</u>		
Total Current Assets	174	2.9		
Other Assets	<u>46</u>	<u>0.8</u>	<u>Net Worth</u>	5,632 95.7
Total Assets	<u>5,888</u>	<u>100.0</u>	Total Liabilities and Net Worth	<u>5,888</u> <u>100.0</u>

3.22 Some comments are given ahead on the various categories of the estimated statement of condition:

- (a) Fixed assets: The fixed assets "properties" refers to assets of the Municipality of Cochabamba transferred to SEMAPA at book value less appropriate depreciation. Depreciation is not considered in this statement because the transfer of assets from the Municipality to SEMAPA was made net of depreciation. It should be pointed out in this regard that these assets were transferred pursuant to Ministerial Resolution 17130 of December 13, 1973. To give legal validity to this transfer it would be necessary for a Supreme Decree to be issued authorizing the transfer and confirming the ownership rights (equity) of SEMAPA to the fixed assets. This

1/ Accrued up to March 1974.

2/ This includes payments made by the Municipality on behalf of SEMAPA.

Supreme Decree is in the preparatory stage and it is recommended that it should be submitted to the Bank prior to the signature of the possible loan contract (see proposed resolution). The category "construction work in progress" involves basically the amounts invested in the execution of the previous project financed in part with resources from Loan 159/SF-B0. The net fixed assets as of March 31, 1974 accounted for 96.3% of total assets, 72.7% of which concerned assets transferred by the Municipality and 23.6% new works. The turnover in net fixed assets during the project execution period is projected in the next table:

	<u>March 1974</u>	<u>December 1975</u>	<u>December 1978</u>
Fixed assets	4,281	6,014	13,783
(-) Less depreciation	-	(211)	(647)
Net fixed assets	<u>4,281</u>	<u>5,803</u>	<u>13,136</u>
Construction work in progress	<u>1,387</u>	<u>3,065</u>	<u>4,531</u>
Total Fixed Assets	<u><u>5,668</u></u>	<u><u>8,868</u></u>	<u><u>17,667</u></u>

The above table shows that the increase in net fixed assets at the end of the project (December 1978) would be more than three times the present amount.

- (b) Contribution receivable from the Municipality - This category covers the contribution promised by the Municipality to cover SEMAPA operating costs as of March 31, 1974. It should be pointed out here that the category "Accounts and Notes Receivable" has been placed in the projections of statements of condition only starting from December 31, 1974 in view of the fact that no records of accounts payable were available in the Municipality as of March 31, 1974.
- (c) Inventories - The inventories of material on hand amounted to US\$97,000 as of March 31, 1974, representing 1.6% of total assets.
- (d) Liabilities - SEMAPA has no significant liabilities such as might affect its financial management. Furthermore, the expansion project considered in this document would be financed through the Central Government, the value of these investments in SEMAPA being capitalized (see paragraph 3.33).
- (e) Net worth - SEMAPA's net worth as of March 31, 1974 amounted to the equivalent of US\$5,632,000 and was composed of contributions from the Municipality of Cochabamba and the Central Government. Over the period 1974 to 1978 net worth should increase to the equivalent of US\$18,950,000. This would represent a percentage increment on the order of 236%, reflecting the investments in the second stage of the Cochabamba drinking water supply program.

3. Working capital and liquidity ratio

3.23 The next table presents the liquidity ratios and the working capital situation of SEMAPA for the period 1974-1978 (see Appendix K):

(In thousands of US\$ or equivalent)

	<u>Liquid Assets</u>	<u>Current Assets</u>	<u>Current Liabilities</u>	<u>Working Capital</u>	<u>Ratios</u>	
					<u>Current</u>	<u>Liquidity</u>
Actual March 1974	77	174	256	(82)	0.68	0.30
Estimated December						
1974	151	178	14	164	12.7	10.7
1975	339	610	79	531	5.6	4.2
1976	399	753	59	694	12.7	6.7
1977	409	766	39	727	19.6	10.4
1978	429	703	33	670	21.3	13.0

3.24 As of March 31, 1974 the liquidity position of SEMAPA was unfavorable. It is believed, however, that it should improve substantially by September, largely as the result of the contributions SEMAPA is to receive from the Central Government during 1974, amounting to the equivalent of US\$712,000. 1/ Rather high liquidity and current ratios are expected for the coming years. This is largely caused by the system of provision of contributions, as recommended in this document, by the Central Government for project execution and for operations and working capital formation of SEMAPA. Another positive factor would be a strengthening in the collection system as conventional methods of enforcing collection and the mechanisms for bringing this about, as planned by SEMAPA are established, 2/ and as the meters are installed. It should be repeated that SEMAPA has already contracted the computer facilities for issuing bills for water supply services. Computer use is to be expanded to include collections and status of debtors. The working capital at the beginning of the period was negative, but starting with December 1974 it is expected to be positive. From the equivalent of US\$164,000 as of December 31, 1974, working capital should increase to the equivalent of US\$670,000 as of December 31, 1978.

4. Projection of source and application of funds

3.25 Given below is the estimated statement of source and application of funds for the period that began March 31, 1974 and will end December 31, 1978, prepared based on the proforma financial statements presented as Appendix K.

1/ See paragraph 3.46.

2/ See paragraph 3.28.

(In thousands of US\$ or equivalent)

<u>Source</u>		<u>%</u>
Contributions from the Municipality	175	1.1
Contributions from the Central Government		
Proposed IDB loan	10,000	69.8
IDB Loan 159/SF-B0	187	1.3
PADES	262	1.9
Own funds	<u>3,715</u>	<u>25.9</u>
Total	<u>14,339</u>	<u>100.0</u>
<u>Application</u>		
Fixed assets	12,646	88.2
Other assets	567	3.9
Operating loss	1,021	
Less: Depreciation	<u>(647)</u>	<u>0.6</u>
	13,587	94.7
Increase in working capital	<u>752</u>	<u>5.3</u>
Total	<u>14,339</u>	<u>100</u>

- 3.26 The proforma statement of source and application of funds reveals that the total resources available for the period 1974-1978 would reach the equivalent of US\$14,339,000, 27% of which would come from the Central Government's and the Municipality's own funds and the remaining 71.1% from Loan 159/SF-B0 and the proposed loan. The funds would be applied to: fixed assets, 88.2%; working capital, 5.3%; operating losses, 0.6%; other assets, 3.9%.

E. Rates and Financial Projections

1. Legal regulations

- 3.27 Concerning rates, Ministerial Resolution 114 that created SEMAPA as a public service institution with legal status under public law establishes that SEMAPA, through its Board of Directors, shall study and propose to the Ministry of Urban Planning and Housing the rates it proposes to charge for its services. In order for the rate schedule proposed by SEMAPA to become effective it must first be approved by the Ministry of Urban Planning and Housing and then by the Executive Branch.
- 3.28 In order to collect rate charges by recourse to law, the law provides that it is up to the Municipality of Cochabamba and not SEMAPA to initiate legal action to compel payment of charges due. Nevertheless, payments due can be paid directly at the collection offices of SEMAPA. In order for SEMAPA to be able to institute legal action to collect amounts due it would be necessary to change its by-laws. For this purpose it is

recommended that the eventual loan contract should set forth the obligation that within nine months from the signature of the loan contract SEMAPA shall submit evidence to the satisfaction of the Bank that it has conventional procedures for enforcing collection and the necessary legal mechanisms use these procedures. It is also recommended that the loan contract should include a provision that within 36 months from the signing of the loan contract the borrower shall submit to the Bank proof that SEMAPA has set up a legal collection office, for which purpose it would be necessary to change its by-laws (see Recommendations), and that it has collected at least 80% of its billing over the last twelve months (see Recommendations).

2. Current rates

- 3.29 At the present time it is the Municipality of Cochabamba and not SEMAPA that has been collecting charges for the drinking water and sewerage services according to the assessed valuation of property. Up to December 1972 the monthly rates for drinking water were equivalent to 0.30% of the assessed valuation of property and the monthly rates for sewerage were equivalent to 0.20%. In 1972 the assessed valuation of property was increased, and the monthly water charge reduced to 0.050% and to 0.075% for sewerage. At the present time there are 11,200 service connections for water and 7,378 for sewerage. The following table shows the collections for drinking water and sewerage of the Municipality for the period 1968-1973:

(Equivalent in thousands of US\$) 1/

	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
Total Collections	25.7	28.4	39.2	44.6	76.7	57.4
<u>I. Water</u>						
Total Collections	16.8	18.1	25.3	27.6	46.9	21.4
Service Revenues (%) <u>2/</u>	93.5	94.7	94.4	96.8	98.0	96.3
Connection Revenue (%) <u>2/</u>	6.5	5.3	5.6	3.2	2.0	3.7
<u>II. Sewerage</u>						
Total Collections	8.9	10.3	13.9	17.0	29.8	36.0
Service Revenue (%) <u>2/</u>	88.7	88.1	88.4	90.9	93.9	95.8
Connection Revenue (%) <u>2/</u>	9.3	10.3	10.8	8.2	3.4	4.2
Sewer Cleaning Revenue (%) <u>2/</u>	1.9	1.5	0.8	0.9	2.7	-

1/ Exchange rates: \$b12.00 for each US\$1.00 up to and including 1972 and \$b20.00 for each US\$1.00 in 1973.

2/ Percentage share of the total for each category of revenue.

- 3.30 The preceding table shows that revenue from drinking water and sewerage for 1973 was more than twice that obtained in 1968. Furthermore, collections have been increasing steadily if considered in equivalent Bolivian pesos. Nevertheless, revenue received by the Municipality for the items mentioned has been and continues to be low and insufficient to cover operating costs.

3. Proposed rates

- 3.31 In July 1974 SEMAPA presented a proposed rate schedule to the Bank that included fixed rates in terms of various housing categories, providing for yearly increases up to the end of 1976 that would remain unchanged in 1977 and 1978. Starting with January 1979, after the system to be financed through the possible loan is operational, (see proposed resolution), a rate schedule would be applied based on metered consumption. It should be pointed out that at the present time the service being provided by SEMAPA is inadequate and not metered. The rates proposed by SEMAPA for drinking water are considered reasonable since they could be effectively collected and increased as service improves. The rates would be divided into three categories each one of which would depend upon the financial capacity of the users. Within the residential or house sector, according to the real property valuation made in 1972, two categories were established for the commercial and industrial sectors and one category for the official and public sector. The lower-income consumer in the residential category would be charged a fixed monthly rate equivalent to US\$1.25 in 1974, US\$1.50 in 1975, and US\$2.00 in 1976-1978. For sewerage service SEMAPA would charge 30% of the water rate.
- 3.32 Using these rates SEMAPA has estimated that during the execution of the project 50% of the amounts billed would be collected in 1974, 60% in 1975, 70% in 1976, 80% in 1977, 85% in 1978 and 90% in 1979 (see paragraph 3.33). The annual percentage increment in billing over the previous year is estimated at 33% for 1975, 28% for 1976, 24% for 1977 and 45% for 1978. In order to achieve these collection levels SEMAPA would conduct a health promotion and education campaign through various communication media (see Chapter II).
- 3.33 It should also be pointed out that on April 13, 1974 the Government of Bolivia issued Ministerial Resolution 113 providing that the rates to be applied by utilities that would be operating and administering drinking water and sewerage systems in the cities of Cochabamba, Santa Cruz, and La Paz should cover the following items: (a) operating and maintenance costs; (b) payment of principal and interest on loans; and (c) improvements and expansions. Nonetheless, in order to determine what tariff level would be recommended for this operation, to be applied as soon as the proposed project is completed, the following criteria were taken into account: (a) the borrower for the operation being

examined would be the Republic of Bolivia and therefore that Government would be responsible for payment of principal and interest on the proposed loan; (b) the proposed project is the second stage of a three-stage program and therefore until such time as the program has been completed full service would not be achieved to cover the needs of the population up to the year 2005; (c) the Government of Bolivia is ready to make a considerable financial effort not only to provide the necessary local counterpart funds but also to finance part of the SEMAPA operating costs until such time as SEMAPA can generate sufficient revenue to operate without government subsidy; (d) as mentioned in Chapter II, the proposed project involves a relatively high cost both as concerns investment and operations, so that depreciation charges and operating costs are relatively high; and (e) after the project facilities have been completed it is estimated that by the end of 1978 there would be 22,000 residential service connections, 17,000 of which would be equipped with meters for consumers who use more than 20 cubic meters.

For the reasons indicated, it was determined together with the Bolivian authorities that in the case of SEMAPA - basically for the reason of capitalizing the new entity - it would not be required to repay the government the amounts paid for principal and service on the possible loan, nor on Loan 159/SF-BO and the allotments made to it by the government for operating costs and local contribution. Consequently it is recommended that the proposed loan contract set forth the obligation that the Republic of Bolivia will transfer to SEMAPA the resources from the possible loan as well as the resources for the local contribution to the project and part of the operating costs of SEMAPA, as a contribution to SEMAPA's assets. Therefore SEMAPA would not be obliged to repay the government these amounts nor the amounts of principal and service on Loan 159/SF-BO (see resolution).

- 3.34 In keeping with the preceding paragraph and also considering the financial capacity of people who live in Cochabamba and the financial condition of SEMAPA as well, it would be recommended that at the end of the project the rates should produce sufficient revenue to cover at least operating costs, including those costs relative to operation, administration, maintenance and depreciation (see proposed resolution). In recommending this rate level it was considered that it, together with the rate level specified for the project execution period (1974-1978), would cause that the average monthly rate, weighted according to the composition of users, payable by the people of Cochabamba would develop as follows, this being considered adequate: 1/

1/ It should be pointed out that the monthly income of a head of a low income household in Cochabamba is currently equivalent to US\$52.

(Equivalent in US\$)

1974	1.54
1975	1.91
1976	2.44
1979 <u>1/</u>	3.05
1980	4.03

3.35 As examined in detail in the financial projection (see paragraph 3.36, subsequent paragraphs, and Appendix L), with the implementation of the proposed rates, SEMAPA would incur losses during the period 1974-1978 (project execution period) that would total the equivalent of US\$1,021,000. In 1979, however, once the metered rates and collection procedures were in effect, SEMAPA would realize a small profit equivalent to US\$25,000, which would increase to the equivalent of US\$190,000 in 1980. SEMAPA would continue to obtain greater profits in the following years.

4. Financial projections

(1) Bases for the financial projections

3.36 The financial projections for SEMAPA for 1974 to 1989 are given in Appendices L and J and are based on the following assumptions:

- a) Income and expenses of operation, maintenance and administration of the water supply and sewerage systems are those estimated by SEMAPA and reviewed by the Bank. Operating revenues were calculated according to the rates mentioned in paragraphs 3.31 and 3.34
- b) The average depreciation used was 2.5% per annum for both types of services.
- c) A write-off of 20% in 1974 and 1975 was considered for uncollectible debts, decreasing to 15% in 1976 and 10% in 1977, and dropping to 5% in the other years.
- d) Actual collections of service billing for 1974, 1975, 1976, 1977, 1978, and 1979 and thereafter were estimated at 50%, 60%, 70%, 80%, 85%, and 90%, respectively. This is considered reasonable, taking into account that SEMAPA would be able to use the computer facilities of the Centro Nacional de Computación-CENACO (National Computer Center) for purposes of issuing bills, controlling collections and customer accounts statements. Bills on accounts due would be paid the year following their issuance, deducting the write-off of uncollectible accounts.

1/ Starting this year the rate would be metered, an average of US\$0.10 per cubic meter being obtained which, for the low-income consumer, would represent US\$2.00 per month for 20 cubic meters consumption, which is less than 1% of his income.

- e) As is customary for sewerage services, sewerage revenues were estimated as a percentage of the billing for water supply, and would increase as new facilities were added to the system.
- f) The monthly water supply rates used are those given in paragraph 3.34.
- g) The following percentages of contingencies in the administrative expenses were considered in the cash flow:

1974	10%
1975	5%
1976	5%
1977 and after	3%

- h) The water supply and sewerage program was taken as a whole in the SEMAPA projections, that is, in three water supply stages and one sewerage stage. The project has also been considered separately and as part of the SEMAPA projections as well.

(2) SEMAPA profit and loss statement (forecast of results)

- 3.37 Based on the forecast figures for operating results in the years 1974 to 1989 given in Appendix L, a forecast of conditions in 1974-1983 is given in the following table.

(In thousands of US\$ or equivalent)

<u>Year</u>	<u>Revenue</u>	<u>Expenses</u>	<u>Profit (Loss)</u>
1974	128	321	(193)
1975	333	611	(278)
1976	444	714	(270)
1977	570	725	(155)
1978	704	829	(125)
1979	1023	998	25
1980	1377	1187	190
1981	1477	1243	234
1982	1665	1388	277
1983	1908	1566	342

- 3.38 The losses during project execution (1974-1978) would be due to inadequate rates charged for water and sewerage service, since the amounts collected from the rates charged would not even meet the operating costs of the enterprise. Nevertheless, operating losses would cease as of 1979 because of the implementation of the second stage of the system and the new rates with metering, resulting in an operating profit for the year equivalent to US\$25,000. This figure would increase until it reached US\$342,000 equivalent in 1983.

(3) Summary of SEMAPA cash receipts and expenditures

- 3.39 Based on the projected cash revenue figures for SEMAPA during the years 1974 to 1989 shown in Appendix J, a summary of these projections for the period 1974-1978, 1979-1984, and 1985-1989 are given ahead. The first group (1974-1978), would cover the execution period of the present water supply project. The second (1979-1984) would cover the execution period of the third stage of the water supply program and the first stage of a sewerage program, and the third (1985-1989), the development of the projects.

(In thousands of US\$ or equivalent)

	Periods			Total
	1974-1978	1979-1984	1985-1989	
<u>Initial Balance</u>	47	180	190	47
<u>Cash Receipts</u>				
Operating Income	2,300	10,081	13,020	25,401
Contributions Committed <u>1/</u>	731	-	-	731
IDB Loans <u>2/</u>	10,187	-	-	10,187
Loans for Future Expansions <u>3/</u>	-	9,911	-	9,911
Total (including initial balances)	13,265	20,172	13,210	46,277
<u>Cash Expenditures</u>				
Operating Expenses	2,744	5,184	6,253	14,181
IDB Project <u>4/</u>	12,646	-	-	12,646
Future Expansions	-	12,391	-	12,391
Other Investments	1,067	897	1,867	3,831
Cash Requirements <u>5/</u>	180	190	210	580
Total	16,537	18,662	8,330	43,629
Surplus (Deficit)	(3,372)	(1,510)	4,880	3,018

1/ Contributions committed by the Central Government, PADES, and the Municipality of Cochabamba.

2/ Includes Loan 159/SF-BO and proposed loan.

3/ Includes the third water supply stage and the first sewerage stage.

4/ Includes the project financed in part using resources from Loan 159/SF-BO.

5/ Cash requirements (final cash balance).

- 3.40 The estimated deficit for the first period (1974-1978), equivalent to US\$3,372,000, would be eliminated in the second period (1979-1984) and become a surplus of US\$1,510,000 equivalent in that period, and another surplus of US\$4,880,000 in the third period (1985-1989). This situation will cause a constant decrease in the contributions made by the Government of Bolivia to SEMAPA, which would gradually drop from the equivalent of US\$662,000 in 1974 and US\$655,000 in 1975 to US\$384,000 in 1977 and US\$132,000 in 1978. Thus, starting with 1978, SEMAPA would no longer require any contributions from the government for its operations (see paragraph 3.46).

4. Projections for the proposed project

(i) Forecast of operating results for the project

- 3.41 The forecast of operating results for the project given in the next table shows that starting with 1976, when the installations of the residential service connections and distribution network will begin, the project will begin to generate revenue. By 1976 the project would generate additional revenue from utilization of the water supply system in the equivalent of US\$102,000 and by 1978, when the proposed project is finished, in the equivalent of US\$448,000. It should be pointed out that the deficit shown for the project execution period results from the fact that the rates were established on a graduated scale and did not include metering until 1979 (when the project facilities will be completed).

FORECAST OF RESULTS OF THE PROJECT FOR 1974 TO 1989

(In thousands of US\$ or equivalent)

	<u>1974</u>	<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>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>TOTAL</u>
<u>ome</u>																	
service	0	0	102	290	448	805	1,022	1,027	1,070	1,222	1,252	1,315	1,380	1,596	1,676	1,759	14,964
	<u>0</u>	<u>0</u>	<u>23</u>	<u>42</u>	<u>71</u>	<u>56</u>	<u>42</u>	<u>22</u>	<u>23</u>	<u>22</u>	<u>21</u>	<u>25</u>	<u>28</u>	<u>31</u>	<u>34</u>	<u>38</u>	<u>478</u>
	<u>0</u>	<u>0</u>	<u>125</u>	<u>332</u>	<u>519</u>	<u>861</u>	<u>1,064</u>	<u>1,049</u>	<u>1,093</u>	<u>1,244</u>	<u>1,273</u>	<u>1,340</u>	<u>1,408</u>	<u>1,627</u>	<u>1,710</u>	<u>1,797</u>	<u>15,442</u>
<u>enses</u>																	
Adminis-	51	177	291	368	452	540	548	555	572	656	698	742	790	846	900	960	9,146
ts	<u>0</u>	<u>0</u>	<u>34</u>	<u>73</u>	<u>145</u>	<u>296</u>	<u>423</u>	<u>424</u>	<u>429</u>	<u>436</u>	<u>440</u>	<u>444</u>	<u>448</u>	<u>461</u>	<u>467</u>	<u>473</u>	<u>4,993</u>
and Write-	<u>51</u>	<u>177</u>	<u>325</u>	<u>441</u>	<u>597</u>	<u>836</u>	<u>971</u>	<u>979</u>	<u>1,001</u>	<u>1,092</u>	<u>1,138</u>	<u>1,186</u>	<u>1,238</u>	<u>1,307</u>	<u>1,367</u>	<u>1,433</u>	<u>14,139</u>
Profit (Loss)	<u>-51</u>	<u>-177</u>	<u>-200</u>	<u>-109</u>	<u>-78</u>	<u>25</u>	<u>93</u>	<u>70</u>	<u>92</u>	<u>152</u>	<u>135</u>	<u>154</u>	<u>170</u>	<u>320</u>	<u>343</u>	<u>364</u>	<u>1,303</u>

- 3.42 In 1979, after the project has been completed, revenues should reach their normal level, since all of the new facilities planned would be included in the system and would be operating fully. By then all of the operating costs, including administration, operation, maintenance and depreciation of the project, would be covered and an operating profit equivalent to US\$25,000 would be earned.

(ii) Projected cash income and expenses of the project

- 3.43 As can be seen in the following income and expenses table for the project the Central Government of Bolivia in the first two years of the project would have to provide, in addition to the local counterpart funds, the proportional amounts needed to handle the increasing operating costs of SEMAPA arising from the project, which would amount to the equivalent of US\$253,000 in 1975 and US\$118,000 in 1976. It should be noted, however, that in 1977 and 1978, with the project under construction, it would now be generating sufficient funds to cover project-associated administrative costs and also cover part of the costs of the normal operating activities of SEMAPA.
- 3.44 By 1979, the project being completed, cash proceeds of the project would amount to the equivalent of US\$391,000, making it possible to cover satisfactorily the project's operating, administrative, and maintenance costs.

PROJECTED CASH INCOME AND EXPENSES OF THE PROJECT FOR 1974 TO 1989

(In thousands of US\$ or equivalent)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL
at beginning year	0	63	130	135	130	130	130	135	135	135	135	135	135	140	140	140	
ome																	
for services	0	0	125	332	519	861	1,064	1,049	1,093	1,244	1,273	1,340	1,408	1,627	1,710	1,797	15,442
on recoveries	0	0	90	168	285	222	169	89	92	86	82	99	110	122	135	151	1,900
tal	0	0	215	500	804	1,083	1,233	1,138	1,185	1,330	1,355	1,439	1,518	1,749	1,845	1,948	17,342
ills	0	0	-22	-50	-80	-108	-123	-114	-119	-133	-136	-144	-152	-175	-184	-195	-1,735
of unpaid bills	0	0	0	0	12	37	54	65	72	63	65	72	73	78	83	95	769
tal Cash Income	0	0	193	450	736	1,012	1,164	1,089	1,138	1,260	1,284	1,367	1,439	1,652	1,744	1,848	16,376
d contributions 1/	174	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	174
	0	2,587	3,600	2,280	1,533	0	0	0	0	0	0	0	0	0	0	0	10,000
Income	174	2,650	3,923	2,865	2,399	1,142	1,294	1,224	1,273	1,395	1,419	1,502	1,574	1,792	1,884	1,988	28,498
enditures																	
g expenses	55	177	291	368	452	540	548	527	572	656	698	742	790	846	900	960	9,122
g contingencies	6	9	15	11	14	16	16	16	17	20	21	22	24	25	27	29	288
ect	50	3,015	4,353	2,851	2,031	0	0	0	0	0	0	0	0	0	0	0	12,300
vestments	0	0	0	0	0	65	39	40	40	30	53	55	57	59	90	92	620
ons	0	0	0	0	50	0	0	0	0	88	98	110	121	134	149	168	918
tal Expenditures	111	3,201	4,659	3,230	2,547	621	603	583	629	794	870	929	992	1,064	1,166	1,249	23,248
ueriments	63	130	135	130	130	130	135	135	135	135	135	135	140	140	140	140	2,088
Expenditures	174	3,331	4,794	3,360	2,677	751	738	718	764	929	1,005	1,064	1,132	1,204	1,306	1,389	25,336
(Deficit)	0	-681	-871	-495	-278	391	556	506	509	466	414	438	442	588	578	599	3,162
ation committed																	
e government:																	
vestment	0	428	753	571	498	0	0	0	0	0	0	0	0	0	0	0	2,250
ration	0	253	118														371

1/ Includes the equivalent of US\$50,000 of costs that would be incurred in the final design of the Escalerani dam and adjacent areas that would be recognized as a local contribution to the project and other allotments associated with the project.

F. Financial Feasibility of the Proposed Operation

1. Resources required

- 3.45 The major problem affecting development of the previous project was the fact that the local contribution was not made on time. This, in turn, precluded completing of the groundwater resource studies and the final designs of the basic parts of the system until December 1973, that is, six years from the date of the loan contract (see Section B, Evaluation of Loan 159/SF-BO). As the result of that experience, in order to make sure that the local contributions will be made on time as required for the project, and to cover the estimated operating deficits of SEMAPA during the project execution period, the following procedure was agreed upon with the Bolivian authorities:
- (a) the resources needed by SEMAPA for 1975 and later years will be appropriated in the national budget at the proper time to cover the contribution needed for the project and to cover the estimated operating deficits in those fiscal years. This procedure is considered adequate; and it is felt that it would provide suitable assurance that the necessary counterpart funds will be available;
 - (b) the amounts needed for a particular quarter to cover the local counterpart contribution to the project and the estimated deficits for SEMAPA during project execution will be conveyed to SEMAPA through two special accounts in the National Treasury, in advance of each quarter, this system to start in the third quarter of 1974; and
 - (c) confirmation of the project's order of priority as regards the use of National Treasury revenues.
- 3.46 The local contribution needed for the project and for proper operation of SEMAPA is as follows:

(In thousands of US\$ or equivalent)

<u>Year</u>	<u>Project Cost</u>	<u>IDB Loan</u>	<u>Contributions from the Central Government</u>		
			<u>Project</u>	<u>SEMAPA Operation</u>	<u>Total</u>
1974 ^{1/}	50	-	50	662	712
1975	3,015	2,587	428	655	1,083
1976	4,353	3,600	753	384	1,137
1977	2,851	2,280	571	132	703
1978	2,031	1,533	498	-	498
TOTAL	12,300	10,000	2,300	1,833	4,133

^{1/} Contracting of the designs for the Escalerani dam and the additional staff required (see Chapter II).

- 3.47 This table shows why it is necessary for the Central Government to provide SEMAPA with the amount needed for the local contribution, amounting to the equivalent of US\$2,300,000, and the amount needed to cover operating costs during the years 1974 to 1978, which are estimated at the equivalent of US\$1,833,000, that is a total of US\$4,133,000 equivalent. Since it is important that the government's contributions should be made on time, it is recommended that the loan contract contain a provision requiring the borrower to submit evidence to the Bank each year that the necessary arrangements have been made to ensure that the local contribution for the project and for the SEMAPA's operating costs in the year in question, will be made on schedule and that these amounts will be credited in advance of each quarter in special accounts at the Central Bank to be utilized by SEMAPA for the purposes indicated in each account (see proposed resolution).
- 3.48 To comply with these requirements, in August 1974 the Government of Bolivia opened two special accounts in the Central Bank to be used to provide counterpart funds for the proposed project and meet SEMAPA's operating costs, in the following manner: (a) Account 1-24, named "Departamento de Conducción y Control Proyectos SEMAPA - Inversión", into which the equivalent of US\$278,250 was deposited to provide the initial local counterpart funds for the project; and (b) Account 3H-312 named "Aporte SEMAPA Alcaldía Cochabamba y Tesoro - Funcionamiento", into which US\$136,465 was deposited. Thus, the contributions now made by the government total the equivalent of US\$414,715, i.e. 58.2% of the contribution required for 1974.
2. Financial capacity of the borrower
- 3.49 As mentioned, the local contribution to the project and the funds needed for SEMAPA operating expenses during project execution would be provided by the Central Government as well as the debt service on the proposed loan. Appendix N gives a table of budgets and budget execution of the Central Government. This table reveals the following facts:
- (a) Budget performance has improved steadily in the last three years. Budget receipts improved from 69.3% in 1971 to 75.6% in 1972, and 85.3% in 1973.
 - (b) Expenditures exceeded budgeted amounts in 1971 by 0.7%, 17.1% in 1972, and 16.9% in 1973. Capital expenditures also exceeded the budgeted amounts by 18.1% in 1971, 97.7% in 1972 and 165.4% in 1973.
 - (c) In the three years examined, the budget deficits were 45.3% in 1971, 62.9% in 1972 and 37.1% in 1973. The reduction in the budget deficit in 1973 was the result of an increased flow of revenue to the budget.

- (d) A projected deficit equivalent to US\$65,000,000 in the 1974 budget is shown. 1/ This represents 30% of revenue and is slightly less than the percentage for 1973. The deficit is expected to be financed through external contributions and by the Central Bank.
- (e) The Ministry of Urban Planning and Housing, to which SEMAPA is now attached, has only a 1.2% share of the total Central Government budget. The capital budget of the Ministry of Urban Planning and Housing though small, is greater and has improved in the last three years, rising from 1.6% in 1971 to 7.9% in 1974 with respect to the amount budgeted for capital expenditures by the Central Government.
- 3.50 Actual revenue increased in 1973 by 69% over 1972 and it is felt that the revenue estimated for 1974 will increase 74% over actual revenue in 1973. This increase in 1973 over 1972 is basically the result of new export taxes and significant increases in taxes on small- and medium-scale mining, in particular taxes on the production and marketing of petroleum.
- 3.51 The prospects for achieving greater receipts in 1974 are much better than in previous years, owing to the higher world prices for minerals and, in particular, for petroleum.
- 3.52 The next table reveals the effect on the Central Government budget of the contributions for the project and for SEMAPA operations:

(In millions of US\$ or equivalent)

	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
1. Central Government Revenue	124	236	288	317	349	384
2. Total Expenditures, Ministry of Urban Planning and Housing	1.4	3.1	3.4	3.7	4.1	4.5
3. Percentage (2/1)	1.1	1.3	1.2	1.2	1.2	1.2
4. Total SEMAFA Contributions		0.7	1.2	1.2	0.8	0.6
5. Percentage (4/1)		0.3	0.4	0.4	0.2	0.2

1/ The rate of exchange used was \$b20.00 = US\$1.00.

- 3.53 The above table shows an increase in revenue of only 10%, a rather conservative figure when compared with the rates of growth in the last three years. The same table also shows the impact of the contributions to SEMAPA over the life of the project as being small and representing a maximum of 0.4% of total government revenue. In view of the importance that the Government of Bolivia attaches to this project, the numerous communications indicating priority that the Bolivian Government has sent to the Bank, as well as the commitments that the Bolivian Government is willing to assume relative to the proposed loan contract, it is believed that even though an effort would have to be made to finance the necessary local counterpart funds, this effort is within the range of normal possibilities of the Bolivian Government.

G. Evaluation of Loan 159/SF-B0 (Cochabamba Subproject)

1. Purpose of the loan

- 3.54 On December 7, 1967 the Bank approved Loan 159/SF-B0 in the equivalent of US\$11,000,000 to the Republic of Bolivia to help finance a project to improve and expand water supply and sewerage services for the city of Santa Cruz and water supply systems for the cities of Cochabamba and Potosí. The cost of the Cochabamba subproject was estimated at US\$4,900,000 equivalent.
- 3.55 The Cochabamba subproject was composed of the following items: (1) the drilling of approximately four wells in the area of Quillacollo; (2) the installation of pumps and mechanical-electric equipment and electric power lines; (3) pipelines leading from the wells to a lift-pumping station; (4) construction of a pumping station equipped with pumps, loading tank, electrical and mechanical equipment, chlorination equipment, controls, electric substation and accessories, and a building with capacity for the final stage; (5) a pipeline from the pumping station to the new reservoir at La Coronilla; (6) improvement of the Escalerani dam and raising the elevation about two meters; (7) relining of canals, including slide-retarding structures to convey water from Escalerani to the water intake of Tolapujru; (8) a new intake at Tolapujru, a pipeline to the Cala Cala treatment plant; (9) a pumping station next to the Cala Cala plant with a pipeline to a new storage tank for the elevated area of Cala Cala; (10) a new lift-pumping station next to the San Pedro storage tank, with pump, mechanical-electronic equipment, chlorination equipment, and auxiliary equipment; (11) a new storage tank in Cala Cala with a capacity of 2,000 cubic meters; (12) a new storage tank at La Coronilla with a capacity of 800 cubic meters; (13) in the distribution network, replacement of piping in poor condition and installation of new piping measuring about 70 kilometers and having a diameter of 4 to 24 inches, made of asbestos-cement, steel or cast iron; and (14) a revolving fund for 6,000 residential service connections with meters.

- 3.56 The equivalent of US\$15,000 was authorized as part of Loan 159/SF-BO for technical cooperation aimed at: (a) recommending a rate schedule for the city of Cochabamba; and (b) providing advice on the setting up of the agency that would be responsible for administering, operating and maintaining the water supply and sewerage systems of Cochabamba.
- 3.57 The loan resources allocated to the subproject amounted to the equivalent of US\$3,800,000 (77.6%) and were intended to finance foreign currency costs of civil engineering work on the subproject, items of equipment, inspection and supervision, part of the technical cooperation, and part of the estimated contingencies for the subproject. The local contribution to the subproject was estimated at the equivalent of US\$1,100,000 (22.4%), earmarked to finance local materials, labor, working capital, engineering studies and designs, interest and commissions during the construction period and part of the estimated contingencies for the subproject.

2. Contract amendments

- 3.58 The conditions precedent to the first disbursement from the loan for the Cochabamba subproject experienced a delay of 25 months before they were fulfilled, that is February 15, 1970. The reason for this delay was that the Servicio Municipal de Agua Potable y Alcantarillado (Municipal Water Supply and Sewerage Service), an agency created to execute the project that preceded the present SEMAPA, had only been in existence since 1967. Another reason was the slowness in fulfilling the conditions themselves. The deadline for final disbursement from the loan on the Cochabamba subproject part was extended twice. The first extension was authorized February 11, 1972 for two years up to January 15, 1974. The second extension was authorized January 15, 1974 for six months up to July 15, 1974, for the exclusive purpose of handling commitments entered into by means of letters of credit and contracts approved. On January 15, 1974 the uncommitted balance in the equivalent amount of US\$2,761,406 (72.7%) was canceled.

3. Development of the subproject

- 3.59 The subproject developed very slowly mainly because of the considerable delay in the provision of the local counterpart funds and the fact that the amount of such funds was less than originally scheduled. This caused a considerable delay in conducting the studies on the water sources to be used. For this reason it became necessary to change the financing plan originally scheduled for the subproject, to the extent of using part of the IDB funds instead of the local contribution to finance studies of groundwater sources and the designs for the basic parts of the Cochabamba water supply system.
- 3.60 It should be pointed out in this regard that by the end of 1968 the Boyle Engineering Inc., which was contracted to complete the specific

part of the studies, conducted by the German company Deutsche Projekt Union GmbH (DPU), to determine the groundwater sources, delivered the studies on water supply to the Municipal Service. These studies revealed as possible well fields the area of Quillacollo, located 17 kilometers from Cochabamba. After examining this study it was considered necessary to conduct a detailed supplementary study of areas closer to Cochabamba. For the purpose of having these supplementary studies performed SEMAPA broadened the contract with Boyle Engineering Inc. These studies were completed with the drilling of two wells in the area of La Muyurina. Subsequently the studies were resumed because the volume of flow obtained at La Muyurina did not satisfy the future demand for water. Consequently the studies of La Muyurina were carried out to full extent, along with the drilling of additional wells. Afterwards, from the end of 1972 to April 1973 a second field of wells was studied in the area of Coña Coña. Thus, only by April 1973, when the volumes of flow of the well fields of La Muyurina and Coña Coña were known, was it possible to proceed with the final design of the missing parts of the water supply system since the final design could not be made until the location and characteristics of the sources of supply were known.

- 3.61 SEMAPA contracted the services of the Bolivian Engineering firm Prudencio, Claros y Asociados in April 1973 to do the final designs of the basic parts of the water supply system. These final designs were completed in December 1973, resulting in a new cost for the construction work, estimated at the equivalent of US\$10,000,000.
- 3.62 Consequently, the fact that the local contribution was not made on schedule, the delay in the carrying out of the groundwater studies, and hence, in the execution of the final designs for the basic parts of the system, resulted in the situation that only the following work was performed within the Cochabamba subproject (first stage): (i) the new intake in Tolapujru; (ii) the pipeline from Tolapujru to the treatment plant at Cala Cala; (iii) the lining of the Cala Cala tank; (iv) the well field of La Muyurina; and (v) the Cala Cala treatment plant. ^{1/} The completion of this work has resulted in increasing the flow of available water from 120 liters per second to 200 liters per second and has improved the quality of the water because of the addition of groundwater. The water from underground sources comprises 50% of the increase. It is further expected that once the Cala Cala treatment plant is operating it would be possible to obtain water of uniform quality. This would be sufficient to treat the surface flow envisaged in the proposed project.
- 3.63 As concerns the technical cooperation granted, it is felt that this cooperation has achieved rather satisfactory results. It is also felt that with the implementation of the recommendations from PAHO, SEMAPA would be able to operate its services normally. The degree of implementation of the technical cooperation has been low primarily because of

^{1/} The Cala Cala treatment plant is currently in the construction stage and 75% of the work has been finished.

SEMAPA's lack of financial resources. However, as stated in Chapter II, new technical cooperation is contemplated to supplement the new project for implementing the recommendations flowing from the previous technical assistance, for making some adjustments in the systems that were designed, and for providing timely follow-up of results (see Chapter II).

CRITERIOS BASICOS DE DISEÑO

APENDICE D

1. Población
 - a) Población según censo 1967 137.000 habitantes
 - b) Población estimada por la Municipalidad 1974 173.000 "
 - c) Población calculada para la 1a. etapa 1985 230.000 "
geométricoMétodo de proyección / a razón de 2.9% anual
2. Período de diseño
 - 1a. Etapa año 1985
 - Final año 2005
3. Consumo
 - a) Dotación por persona promedio anual 1978 190 litros
 - b) Dotación por persona promedio anual 1985 200 litros
4. Variaciones del Consumo
 - a) Máximo diario 1.20 del promedio anual
 - b) máximo horario 2.00 " " "
- 5) Caudales
 - a) Promedio anual 1985 = 523 l.p.s.
 - b) Máximo diario 1985 = 638 l.p.s.
- 6) Vida Util de los diferentes elementos
 - a) Equipos de bombeo 10 años
 - b) Conducción y redes 40 años
 - c) Tanques 40 años
 - d) Medidores 10 años
 - e) Pozos 25 años

- 7) Diámetro mínimo de tuberías 3" (75 mm.)
- 8) Presiones en la red
 - a) mínima 15.00 m (aprox. 20 lb/pulg²)
 - b) máxima 70.00 m (aprox. 100 lb/pulg²)
- 9) Coeficiente de rugosidad
"C" Hazen y William 140
- 10) Reservorios
 - a) Regulación: para el máximo horario (aproximadamente un 18% del día máximo)
 - b) Incendio:
volumen para atender un incendio de 4 horas de duración con N bocas
de 16 l.p.s. actuando en forma simultánea. El número de bocas
está dado por la fórmula $N=0.4\sqrt{P}$, siendo "P" la población en miles.
- 11) Velocidad máxima en tuberías: 2.00 m/seg.

Cochabamba

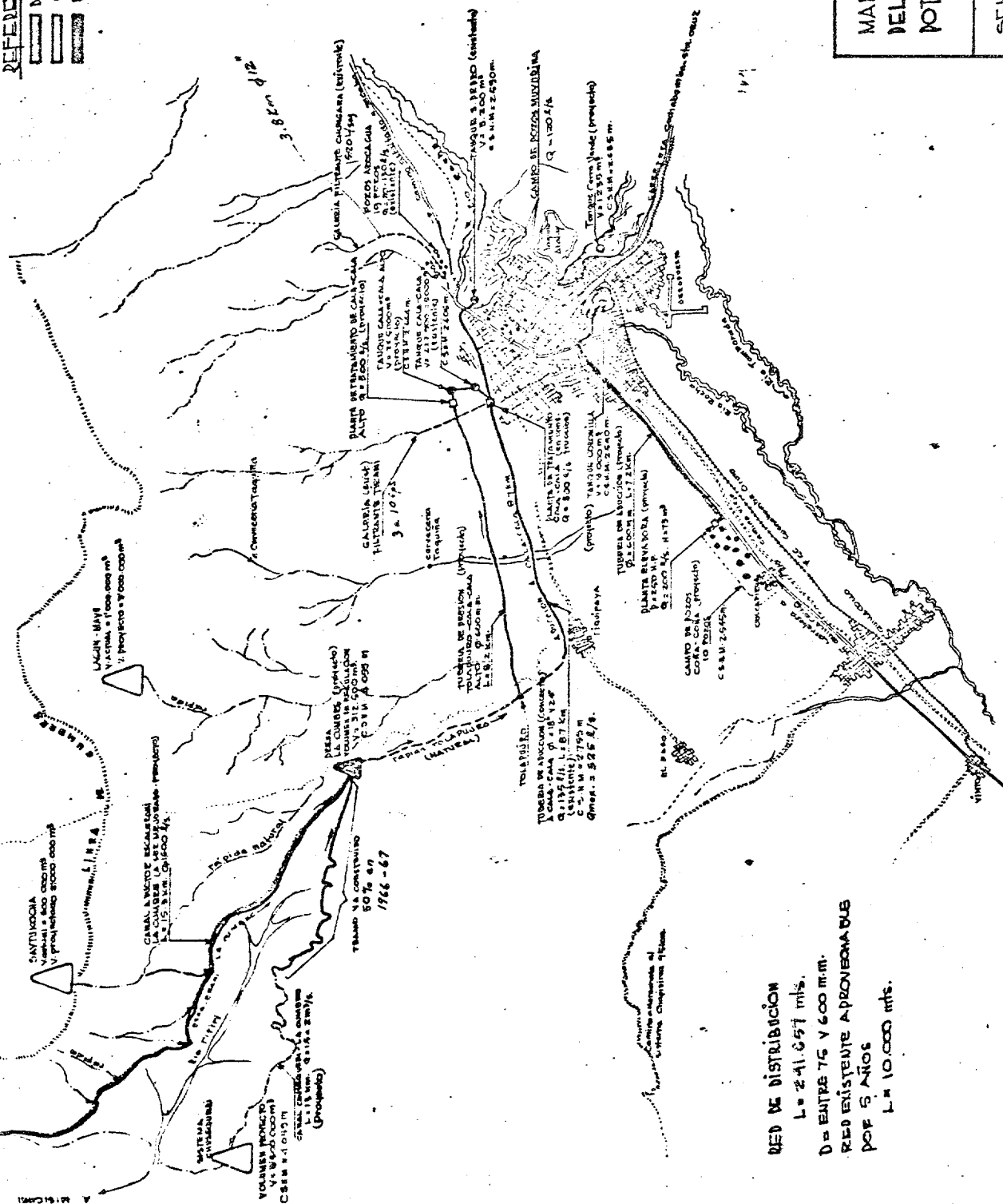
Costos Directos Considerando su Escalamiento

	I 1975		II 1976		III 1977		IV 1978		TOTAL	
	B\$	US\$	B\$	US\$	B\$	US\$	B\$	US\$	B\$	US\$
1. <u>Fuentes Superficiales</u>										
Presupuesto 1974	195	100	460	130	240	60	-	-	895	290
Costo escalado en pesos bolivianos	234	-	662	-	415	-	-	-	1.311	-
Costo escalado en dólares	-	110	-	157	-	80	-	-	-	347
2. <u>Canales</u>										
Presupuesto 1974	80	60	280	20	140	10	-	-	500	90
Costo escalado en pesos bolivianos	96	-	403	-	242	-	-	-	741	-
Costo escalado en dólares	-	66	-	24	-	13	-	-	-	103
3. <u>Fuentes Subterráneas</u>										
Presupuesto 1974	20	320	150	-	-	-	-	-	170	320
Costo escalado en pesos bolivianos	24	-	216	-	-	-	-	-	240	-
Costo escalado en dólares	-	-	216	-	-	-	-	-	-	352
4. <u>Estación de Bombeo Coña-Coña</u>										
Presupuesto 1974	-	260	160	10	-	-	-	-	160	270
Costo escalado en pesos bolivianos	-	-	230	-	-	-	-	-	230	-
Costo escalado en dólares	-	286	-	12	-	-	-	-	-	298
5. <u>Línea Bombeo Coña-Coña-Cornilla</u>										
Presupuesto 1974	-	595	95	-	-	-	-	-	-	595
Costo escalado en pesos bolivianos	-	-	137	-	-	-	-	-	137	-
Costo escalado en dólares	-	654	-	-	-	-	-	-	-	654
6. <u>Tuberías Red</u>										
Presupuesto 1974	10	420	120	840	300	450	420	-	850	1.710
Costo escalado en pesos bolivianos	12	-	173	-	519	-	871	-	1.575	-
Costo escalado en dólares	-	462	-	1.016	-	598	-	-	-	2.076
7. <u>Tanques Almacenamiento</u>										
Presupuesto 1974	50	185	190	10	-	-	-	-	240	195
Costo escalado en pesos bolivianos	60	-	274	-	-	-	-	-	334	-
Costo escalado en dólares	-	203	-	12	-	-	-	-	-	215
8. <u>Conexiones Domiciliarias</u>										
Presupuesto 1974	-	-	75	95	185	15	200	20	460	130
Costo escalado en pesos bolivianos	-	-	108	-	320	-	415	-	843	-
Costo escalado en dólares	-	-	-	115	-	20	-	29	-	164
9. <u>Medidores</u>										
Presupuesto 1974	-	-	-	70	-	-	-	-	-	70
Costo escalado en pesos bolivianos	-	-	-	85	-	-	-	-	-	85
Costo escalado en dólares	-	-	-	-	-	-	-	-	-	-
10. <u>Fondo Financiamiento Instalaciones Domiciliarias</u>										
	-	-	70	-	70	-	70	-	210	-
Escalamiento	1.20	1.10	1.44	1.21	1.73	1.33	2.074	1.464		
Totales										
									Sin escalamiento 7.250 = 3.580+3.670	
									Con escalamiento 9.915 = 5.621+4.294	
									Escalamiento 2.665	2.040 624

REFERENCIAS:

- ☐ DISEÑO EXISTENTE (PROYECTADO)
☐ COOPERACIÓN TÉCNICA
☐ EN ACTUAL DISEÑO

ϕ mm.	LONGITUDE mts.
75 mm.	122032
100 mm.	75-828
150 mm.	35 608
200 mm.	13 810
250 mm.	13 136
300 mm.	15,642
350 mm.	5,692
400 mm.	3,482
450 mm.	1,012
500 mm.	1,552
600 mm.	3,903
LONGITUDE TOTAL: 231,637 mts.	



RED DE DISTRIBUCION
L = 241.657 mts.
D = ENTRE 75 Y 600 m.m.
RED EXISTENTE APROVECHABLE
POR 5 AÑOS
L = 10.000 mts.

MAPA ESQUEMATICO
DEL SISTEMA DE AGUA
POTABLE DE LA CIUDAD DE
COCHABAMBA

SEMPA — COCHABAMBA

SERVICIO DE AGUA POTABLE, ALCANTARILLADO Y
DESAGUES PLUVIALES

PROYECTO DE REGLAMENTO PARA OTORGAR PRESTAMOS A LOS POBLADORES PARA LA CONSTRUCCION DEL SERVICIO DE AGUA POTABLE INTRADOMICILIARIO DE ACUERDO AL PROYECTO QUE EJECUTARA SEMAPA CON FONDOS DEL PRESTAMO BID.

1. Generalidades:

1.1 Definiciones:

Siempre que en este Reglamento y en el Contrato de Préstamo se haga referencia a los términos enumerados a continuación, los mismos se interpretarán de la siguiente manera:

- 1.2 SEMAPA Servicio de Agua Potable; Alcantarillado y Desagues Pluviales
- 1.3 Gobierno: Gobierno de la República de Bolivia
- 1.4 BID: Banco Interamericano de Desarrollo
- 1.5 Divisiones de Administración Financiera y de Construcciones
Unidades de SEMAPA encargados de estudiar la factibilidad técnica de las instalaciones y de la administración y supervisión de los préstamos.
- 1.6 Proyecto: Nuevo proyecto de Agua Potable para el que actualmente se gestiona un préstamo con el Banco Interamericano de Desarrollo.
- 1.7 Obra: La construcción a ejecutarse en la vivienda del beneficiario.
- 1.8 Beneficiario: Persona dueña de la vivienda donde se construirá la obra.
- 1.9 Supervisor Ejecutivo: Jefe de la División de Administración Financiera.
- 1.10 Préstamo: El monto que SEMAPA otorga al beneficiario para la construcción de la obra y que éste deberá reembolsar a SEMAPA junto con los intereses devengados en las amortizaciones convenidas en el plazo estipulado en el contrato.
- 1.11 Contrato: El contrato de préstamo a suscribirse entre el beneficiario y SEMAPA para el financiamiento de la obra y del cual este Reglamento forma parte integrante.

- 1.12 Objetivo de los Préstamos: Los préstamos otorgados por SEMAPA dentro del nuevo proyecto para el acueducto de Cochabamba, tienen como objetivo asistir financieramente a los habitantes de escasos recursos de la población donde se construirá o ampliará el sistema de agua potable, para la instalación de las conexiones intradomiciliarias de agua potable y alcantarillado.

2. Condiciones Generales

- 2.1 Suscriben el contrato las siguientes personas:
- a) Por parte de SEMAPA el Gerente General, o quien haga sus veces;
 - b) El beneficiario, o su representante legal.
- 2.2 Los fondos provenientes del préstamo deberán ser utilizados exclusivamente para la construcción de conexiones intradomiciliarias de agua potable.
- 2.3 Con el monto del préstamo se podrán hacer mejoras a servicios sanitarios existentes o bien la construcción nueva que podrá incluir como máximo: 1 ducha, 1 inodoro y 1 lavamanos.
- 2.4 El monto total del préstamo no podrá exceder para instalación de Agua Potable \$b. 3.000 equivalente a \$us. 150.-

3. Condiciones Específicas

- 3.1 SEMAPA concederá el préstamo para su amortización a un período no menor de 5 años, pudiéndose considerar hasta 8 años en los casos justificados. La tasa de interés sobre el préstamo será del 6% (Seis por ciento) anual sobre saldos.
- 3.2 El financiamiento se otorgará al beneficiario, después de que éste haya cumplido con los requisitos siguientes:
- 3.2.1 Presentar solicitud de préstamo al Servicio de Agua Potable, Alcantarillado y Desagues Pluviales, indicando el destino que dará el mismo.
 - 3.2.2 Haber manifestado por escrito la aceptación del préstamo por el monto presupuestado y en las condiciones convenidas con SEMAPA.
 - 3.2.3 Firmar el contrato, debiendo el beneficiario presentar por lo menos:

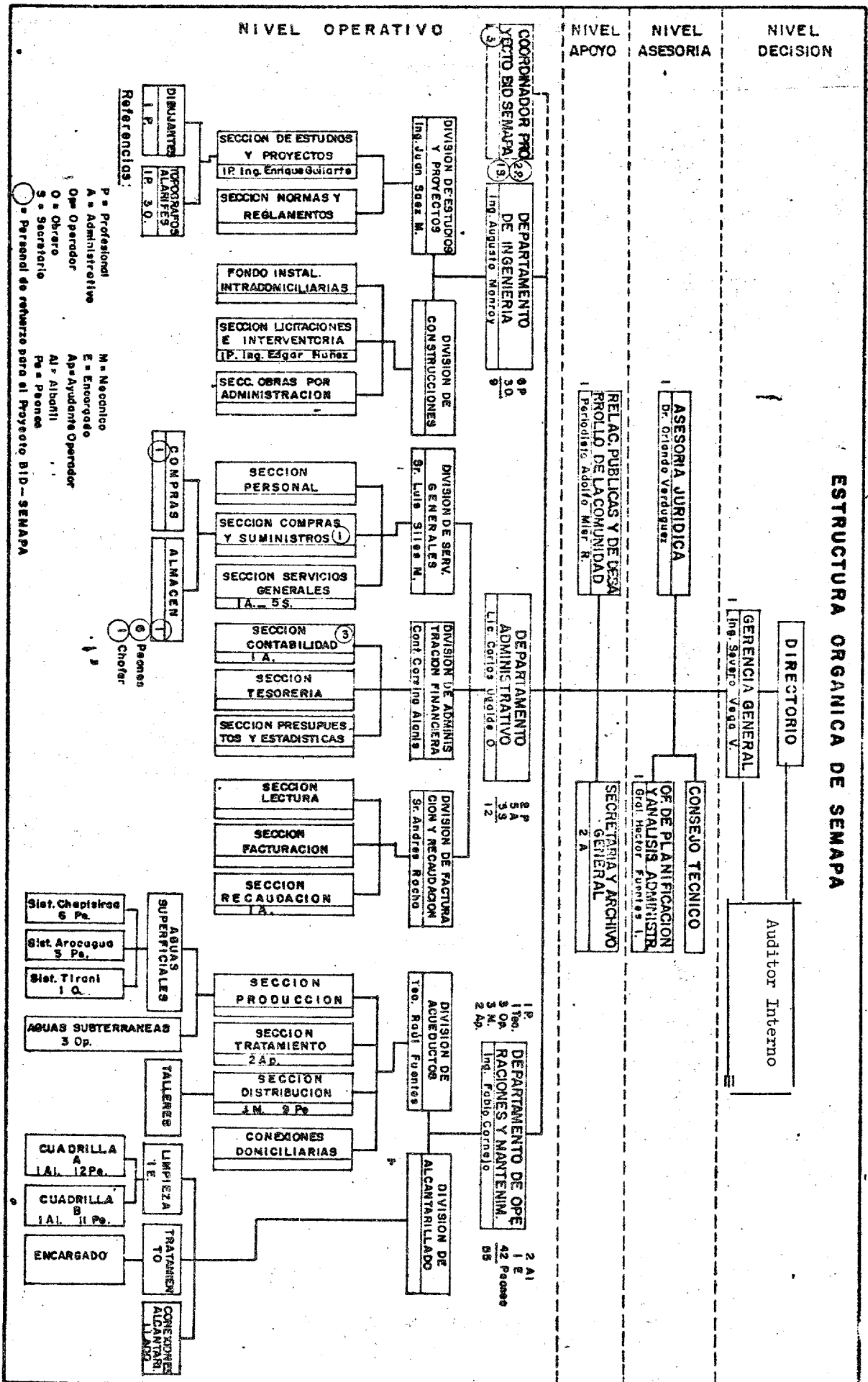
- a) Cédula de Identidad
- b) Constancia de ser propietario de la vivienda donde se construirá la obra;

- 3.4 El plazo para la construcción de la obra no podrá exceder en ningún caso de 60 días calendario, contando a partir de los 10 días siguientes a la fecha de la firma del Contrato.
- 3.5 El pago del préstamo se hará de la siguiente forma:
 - a) Al mes siguiente de concluida la obra, se deberá efectuar la primera amortización del préstamo conforme al plan de amortización convenidas.
 - b) La obra se dará por concluida automáticamente a partir de la fecha indicada en el numeral 3.4
- 3.6 El beneficiario deberá comprometerse a remitir directamente a SEMAPA o a través de la Agencia Bancaria que SEMAPA designe la cuota mensual que se le indique.
- 3.7 El beneficiario deberá tener en propiedad la vivienda en el cual se construirá la obra.
- 3.8 El beneficiario será el administrador de los fondos del préstamo, pero SEMAPA inspeccionará la construcción de la obra.
- 3.9 El beneficiario proporcionará a SEMAPA los informes que éste solicite respecto a la inversión de la suma prestada a la utilización de los bienes adquiridos, a las operaciones que realice y a su situación financiera.

4. Diversos

- 4.1 Este Reglamento forma parte íntegramente del Contrato excepto los artículos expresamente modificados en las cláusulas contractuales.
- 4.2 Del presente Reglamento se reproducirán suficientes ejemplares para distribuir a los posibles beneficiarios, a efecto de que se compenetren de sus derechos y obligaciones.
- 4.3 Este proyecto de Reglamento deberá ser aprobado por el Consejo de Administración de SEMAPA, y podrá ser revisado de acuerdo a las condiciones imperantes en el país.

ESTRUCTURA ORGANICA DE SENAPA



Referencias:

- P = Profesional
- A = Administrativo
- Op = Operador
- O = Obrero
- S = Secretario
- Pe = Peones
- M = Mecanico
- E = Encargado
- Ap = Ayudante Operador
- Al = Albofil
- Pa = Peones

Personal de refuerzo para el Proyecto BID-SEMAPA

- AGUAS SUPERFICIALES**
 - Sist. Chapirao 6 Pe.
 - Sist. Arocaque 3 Pe.
 - Sist. Tironi 1 O.
- AGUAS SUBTERRANEAS**
 - 3 Op.
- TALLERES**
 - CUADRILLA A (1. A. 12 Pe.)
 - CUADRILLA B (1. A. 11 Pe.)
 - ENCARGADO
- LIMPIEZA**
 - 1 E.
- TRATAMIENTO**
 - CONEXIONES ALCANTARILLADO

TERMINOS DE REFERENCIA PARA LA SUPERVISION DEL PROYECTO

1. Objetivos

Supervisión de construcción y entrenamiento técnico del personal de SEMAPA en la Unidad de Coordinación del Proyecto y en el Departamento de Operación para obtener la adecuada construcción y posterior operación y mantenimiento de las obras a construir.

2. Servicios a Prestar

a) Técnicos

- i) Análisis y recomendaciones sobre los caudales aprovechables tanto de las aguas subterráneas como superficiales, estudios geológicos e hidrológicos, diseños y especificaciones de las presas. Revisión actualizada de las capacidades de las estaciones de bombeo de acuerdo a los volúmenes disponibles.
- ii) Asesoramiento en la preparación de documentos para licitaciones públicas del Proyecto, en la precalificación de posibles licitantes y en la adjudicación de ofertas para adquisición de materiales y equipo y para contratación de obras.

b) Supervisión de Construcción

- i) Información sobre solvencia, experiencia, disponibilidad de maquinaria y equipo, suficiencia de personal calificado, fianzas y garantías de licitantes que respondan por la correcta ejecución del trabajo y cumplimiento de contratos en los plazos fijados.
- ii) Supervisión e inspección de todo trabajo ejecutado por los contratistas o por el personal del ejecutor del Proyecto.
- iii) Comprobación de que todos los materiales y equipos empleados han sido debidamente examinados y satisfactoriamente aprobados.

- iv) Autorización de cambios justificados en los documentos técnicos, que fueran necesarios durante el proceso de construcción.
- v) Certificación de obra satisfactoriamente ejecutada por los contratistas, indicando cantidades, precios unitarios y costos globales.
- vi) Inspección final de todas las obras ejecutadas del Proyecto y certificación de correcta terminación de las mismas.
- vii) Preparación de planos finales que incorporen todo cambio justificado que se ha autorizado en la construcción de las obras.

c) Adiestramiento de Personal

- i) Entrenamiento del personal técnico que se encargaría de la operación y mantenimiento de las obras.
- ii) Promoción del mayor grado de eficiencia en el manejo y control de equipos mecánicos, eléctricos, de medición, etc.
- iii) Adiestramiento en el empleo de registros y estadísticas operacionales.

3. Obras del Proyecto

En el Anexo B del Contrato de Préstamo se establecen las obras a ejecutar dentro del Proyecto.

4. Informes

- i) Presentación de informes trimestrales a SEMAPA, certificando el avance y la labor ejecutada por los contratistas de las obras, de acuerdo con los procedimientos que establezca el Banco.
- ii) Presentación de un informe final a SEMAPA, estableciendo conclusiones y recomendaciones. Este informe deberá incluir un resumen del contenido del mismo, no mayor de dos páginas e indicar:
 - a) el costo real del Proyecto; b) las variaciones de costo y programación, si ocurrieran, debidamente justificadas; y, c) recomendaciones para la adecuada administración, operación y mantenimiento de las obras del Proyecto.
- iii) Presentación de otros informes que el Banco razonablemente solicite.

5. Cooperación con el Banco

SEMAPA deberá mantener al Banco al tanto de las actuaciones de los consultores, notificando a la Representación del BID de dichas actuaciones y coordinando sus labores con el Especialista de Proyecto.

6. Período de Duración de Servicios

Los servicios indicados en Sección Servicios a Prestar, pueden cumplirse aproximadamente en 45 meses, exceptuando la presentación del informe final. Los consultores deben ser contratados dentro de 90 días después de haberse firmado el contrato de préstamo. Los consultores deberán iniciar sus labores en Cochabamba, un mes después de firmarse el contrato de prestación de servicios.

El informe final de los consultores deberá ser presentado a más tardar, tres meses después de haberse finalizado las obras del Proyecto.

7. Costos

El costo estimado de los servicios profesionales a ser presentados por los ingenieros consultores es el siguiente:

	<u>US\$/mes</u>	<u>Meses</u>	<u>US\$</u>
Personal de Ingeniería	3.000	45	135.000
Personal Especializado	1.500	16	24.000
Overhead firma Consultora	-	-	202.000
Viáticos	-	45	10.000
Viajes	-	-	4.000
Gastos Generales Locales	-	-	7.000
Imprevistos	-	-	<u>18.000</u>
Total Costos Servicios			<u>400.000</u>

[illegible]

deficit resultan por la inversión de deporte local para la tercera etapa del programa de agua potable y la primera de alcantarillado. A partir de 1983, SEMAPA podría cubrir el déficit necesario para estos proyectos y no le sería necesario recurrir al Gobierno Central.

APENDICE K

SITUACION FINANCIERA PROYECTADA AL 31 DE DICIEMBRE DE CADA EJERCICIO

(Balances Proforma)

(en miles de US\$ o su equivalente)

	<u>1974 1/</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
Fijo						
edades	4.281	6.064	7.079	13.432	16.203	18.314
: Depreciación	<u>(0)</u>	<u>(83)</u>	<u>(211)</u>	<u>(343)</u>	<u>(467)</u>	<u>(647)</u>
L Activo Fijo	4.281	5.981	8.868	13.089	15.816	17.667
Corriente						
y Bancos	33	63	180	190	180	180
as y documentos a cobrar	44	114	252	343	353	341
: Previsión deudas						
incobrables	(0)	(26)	(93)	(134)	(124)	(92)
arios	<u>97</u>	<u>27</u>	<u>271</u>	<u>354</u>	<u>357</u>	<u>274</u>
L Activo Corriente	174	178	610	753	766	703
ctivos	<u>46</u>	<u>212</u>	<u>350</u>	<u>433</u>	<u>521</u>	<u>613</u>
L ACTIVO	<u>5.888</u>	<u>6.371</u>	<u>9.828</u>	<u>14.275</u>	<u>17.103</u>	<u>18.983</u>
y Patrimonio						
o Corriente	256	14	79	59	39	33
nio						
e Municipalidad	4.765	4.940	4.940	4.940	4.940	4.940
e Gobierno	903	1.646	5.316	10.053	13.036	15.067
: Pérdidas	<u>(36)</u>	<u>(229)</u>	<u>(507)</u>	<u>(777)</u>	<u>(912)</u>	<u>(1.057)</u>
L Patrimonio Neto	5.632	6.357	9.749	14.216	17.064	18.950
L PASIVO Y PATRIMONIO	<u>5.888</u>	<u>6.371</u>	<u>9.828</u>	<u>14.275</u>	<u>17.103</u>	<u>18.983</u>

31 de marzo.

PRONOSTICO DE RESULTADOS PARA EL PERIODO 1974 A 1989
(en miles de US\$ o su equivalente)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL
PROC. DE EXPLOTAC.																	
1/																	
AGUA POTABLE	104	275	351	439	527	805	1111	1208	1304	1490	1565	1644	1726	1994	2095	2200	18838
ALCANTARILLADO	21	55	70	88	105	161	222	242	326	373	470	453	518	598	629	660	5031
CONEX. (AMEOS SERV) 2/	3	3	23	43	72	57	44	27	35	45	56	56	50	40	44	49	647
TOTAL PRODUCTOS EXPLOTACION	128	333	444	570	704	1023	1377	1477	1665	1900	2091	2193	2294	2632	2768	2909	24516
GASTOS EXPLOTACION																	
AGUA POTABLE	112	217	303	307	341	382	410	444	487	531	567	605	644	693	739	789	7571
ALCANTARILLADO	47	83	86	90	94	98	103	107	131	149	163	175	183	191	199	208	2112
ADMINISTRACION	79	163	193	204	214	211	223	234	246	263	277	292	310	329	347	368	3975
TOTAL	238	463	582	601	649	691	736	755	866	943	1012	1072	1137	1213	1285	1365	13658
DEPREC. (AMEOS SERV) 3/	83	128	132	124	180	307	451	438	542	623	723	770	825	846	853	868	7898
TOTAL GASTOS DE EXPLOTACION	321	611	714	725	829	998	1187	1243	1388	1566	1735	1842	1962	2059	2143	2233	21556
UTILIDAD (PERDIDA) DE EXPLOTAC.	-193	-278	-270	-155	-125	25	190	234	277	342	356	351	332	573	625	676	2960
UTILIDAD (PERDIDA) ACUMULADA	-193	-471	-741	-896	-1021	-996	-806	-572	-295	47	403	754	1086	1659	2284	2960	

1/ Se consideran sólo los ingresos en el semestre julio a diciembre.

2/ Representa el 25% de las recuperaciones de las conexiones.

3/ Incluye castigo por deudas incobrables (véase párrafo 3.36).

APENDICE M

S DE OPERACION, ADMINISTRACION Y DEPRECIACION Y VALORES DEL METRO CUBICO DE AGUA PRODUCIDA Y FACTURADA
a 1989 EN LA CIUDAD DE COCHABAMBA. PROYECCION NUMERO DE CONEXIONES DOMICILIARIAS.

Población (i=2.9%)	Número Viviend.	Número Total Conex.	Conex. Vivi. %	Costos Operac. Mil US\$	Costos Admin. Mil US\$	Deprec. 2.5% Mil US\$ anual	Gastos Financ. Mil US\$	Total Costos Mil US\$	Agua Produce. Millones m3	Agua factura. m3	Costo medio por m3 (centav. \$US)
173.000	30.426	11.200	37	112	59	74	36	282	6.1	3.4 <u>1/</u>	8.3
178.000	31.277	12.000	38	217	137	112	36	502	7.0	4.2 <u>1/</u>	12.0
183.140	32.153	12.000	37	303	145	116	34	598	7.5	4.5 <u>2/</u>	13.3
188.430	33.054	15.000	45	307	153	110	32	602	10.0	6.0 <u>2/</u>	10.0
193.880	33.980	18.000	53	341	161	175	30	707	13.0	9.1 <u>3/</u>	7.7
199.480	34.930	22.000	63	382	158	299	27	866	15.7	11.0	7.9
205.250	35.910	23.000	64	410	167	441	25	1043	16.4	11.5	9.1
211.180	36.914	25.000	68	444	176	447	22	1089	17.0	11.9	9.2
217.280	37.950	27.000	71	487	178	482	20	1167	17.7	12.4	9.4
223.560	39.000	28.000	72	531	180	545	18	1274	18.4	12.8	10.0
230.000	40.100	29.400	73	567	183	605	16	1371	19.0	13.3	10.3
236.670	41.225	30.870	75	605	193	612	14	1424	20.2	14.4	9.9
243.500	42.380	32.400	76	644	205	618	11	1478	21.4	15.0	9.9
250.550	43.560	34.000	78	693	217	636	9	1555	22.3	15.6	10.0
257.800	44.780	35.740	80	739	229	644	7	1619	23.2	16.2	10.0
265.240	46.000	37.500	81	789	243	653	5	1690	24.2	16.9	10.0

Se consideran pérdidas de 45% en 1974 y 1975

Se consideran pérdidas de 40% en 1976 y 1977

Se consideran pérdidas de 30% a partir de 1978 hasta 1989

PRESUPUESTO Y EJECUCION PRESUPUESTARIA DEL GOBIERNO CENTRAL 1/

(en millones de pesos bolivianos) 2/

	1971			1972			1973 3/			Presupuesto	Ejecución	% Ejecución
	Presupuesto	Ejecución	% Ejecución	Presupuesto	Ejecución	% Ejecución	Presupuesto	Ejecución	% Ejecución			
ntes	1.765,5	1.223,0	69,3	1.950,0	1.475,0	75,6	2.917,0	2.488,0	85,3	5.246,0	4	
	1.765,5	1.186,0	67,2	1.950,0	1.450,0	74,3	2.917,0	2.426,0	83,2	5.246,6	4	
	-	37,0	-	-	25,0	-	-	62,0	-	-		
es	1.765,5	1.778,0	100,7	2.052,7	2.403,0	117,1	2.917,0	3.410,0	116,9	5.034,4	5	
al	1.392,8	1.338,0	96,1	1.689,4	1.685,0	99,7	2.593,0	2.550,0	98,4	4.604,1	4	
	372,7	440,0	118,1	363,3	718,0	197,7	324,0	860,0	265,4	430,3	1	
ICIT)	-	(555)	(45,3)	-	(628)	(62,9)	-	(922)	(37,1)	-	(1	
RBANISMO Y VIVIENDA	15,2	11,9	78,4	18,1	12,6	69,6	30,3	27,4	90,4	61,3		
es	9,4	7,2	76,6	11,1	8,9	80,2	11,2	11,1	99,1	27,4		
al	5,8	4,7	81,0	7,0	3,7	52,9	19,1	16,3	85,3	33,9		
ARTICIPACION DEL												
RBANISMO Y VIVIENDA												
al	0,9	0,7	-	0,9	0,5	-	1,0	0,8	-	1,2		
Capital	1,6	1,1	-	1,9	0,5	-	5,9	1,9	-	7,9		

Ministerio de Finanzas y estimaciones de la División de Estudios de Países (BID).

El cambio era de \$b.12,00 por US\$1,00 hasta el 26 octubre 1972 y de \$b.20,00 por US\$1,00 a partir del 27 octubre 1972.

estimada.

proyectada.

Información no disponible.