

B O L I V I A

LOAN TO THE REPUBLIC OF BOLIVIA

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LOAN FOR WATER SUPPLY AND SEWERAGE IN THREE CITIES
(Cochabamba, Potosí and Santa Cruz)

BOLIVIA

SUMMARY 1/

1. Borrower: The Republic of Bolivia.
2. Executive Agencies: The Corporación de Aguas y Alcantarillado (CORPAGUAS), established by Supreme Decree 07942 of March 1967, would channel the loan resources and assume responsibility for general supervision during execution and administration of the water supply and sewerage systems to be constructed in the cities of Cochabamba, Potosí and Santa Cruz. Execution of each project would be the direct responsibility of the agency currently administering these systems in each city.
3. Amount and Type of Currency: A total equivalent to US\$11 million, of which up to US\$9.7 million would be disbursed in dollars or the equivalent in other currencies to cover direct and indirect costs in foreign currency and up to the equivalent of US\$1.3 million in Bolivian pesos to cover local currency costs.
4. Source of Funds: The Fund for Special Operations.
5. Terms, Interest, Charges and Disbursement; Currency of Payment: The loan would be amortized in a period of 25 years, by means of 42 semi-annual installments, the first of which would be payable 4-1/2 years after signature of the contract. The disbursement term for the loan would be four years. Interest would be charged at the rate of 2-1/4% per annum; the service charge would be 3/4 of 1% per annum and the commitment fee 1/2 of 1% per annum. Payments of principal and interest would be made semiannually in Bolivian pesos or proportionately in the respective currencies disbursed. Payments of the commitment fee and service charge would be made semiannually, the service charge proportionately in the currencies disbursed and the commitment fee proportionately in dollars and the other currencies specifically provided in the loan contract. The commitment fee would commence to accrue 60 days after the date of contract signature.
6. Guarantee: The general responsibility of the debtor.
7. Program Description: The loan resources would be used to finance improvement and expansion of the water supply systems in the cities of Cochabamba, Potosí and Santa Cruz, through the tapping of new sources or better utilization of existing sources, to which end wells would be

1/ Rate of exchange: US\$1 = \$b12.

drilled or catchment sources expanded and the installations necessary for adduction, treatment pumping and distribution would be executed. In addition, financial assistance would be provided for the sewerage system of Santa Cruz, consisting of the installation of collectors, pumping stations and a treatment plant. CORPAGUAS, representing the government, would enter into special agreements with the agencies responsible for administration of the water supply and sewerage systems in each of the three cities assigning responsibility for execution of the projects to those agencies and transferring to them the funds allocated to each of these projects as subloans.

8. Financial Plan: The program cost is estimated at the equivalent of US\$17,640,000, distributed as follows:

(In US\$ thousands)

<u>Water Supply</u>	<u>Local contribution</u>	<u>%</u>	<u>IDB</u>	<u>%</u>	<u>Total</u>	<u>%</u>
Cochabamba	1,000	20.8	3,800	79.2	4,800	100.0
Potosí	440	23.9	1,400	76.1	1,840	100.0
Santa Cruz	1,400	41.2	2,000	58.8	3,400	100.0
<u>Sewerage</u>						
Santa Cruz	3,800	50.0	3,800	50.0	7,600	100.0
Total	6,640		11,000		17,640	
	37.6%		62.4%		100.0%	

The financial plan would be as follows:

(Equivalent in US\$ thousands)

	<u>Currency of origin</u>		<u>Currency of use</u>		<u>Total</u>	<u>%</u>
	<u>US\$</u>	<u>\$b</u>	<u>US\$</u>	<u>\$b</u>		
IDB	9,700	1,300	8,300	2,700	11,000	62.4
Cochabamba		1,000		1,000	1,000	5.7
Potosí		440		440	440	2.5
Santa Cruz		5,200		5,200	5,200	29.4
Total	9,700 ^{1/}	7,940	8,300	9,340 ^{1/}	17,640	100.0%
Percentage	55.0	45.0	47.0	53.0	100.0	

^{1/} Includes US\$1.4 million estimated as the indirect foreign currency cost of outlays in national currency.

9. Justification: In 1964, it was estimated that only 45% of the population in the departmental capitals and other towns with more than 10,000 inhabitants received water supply service; in many cases, this water was of questionable purity. The cities of Cochabamba, Potosí and Santa Cruz are of great importance to the Bolivian economy and they account for approximately 20% of the country's urban population. Although Cochabamba is located in an agricultural region, the city is becoming industrialized because of the establishment of a number of factories and other significant plant projects scheduled for the near future. Potosí is rich in ore, particularly tin, and Santa Cruz, in addition to valuable mines, contains the major deposits of hydrocarbons and expects to undertake extensive livestock development. Santa Cruz is one of the fastest growing cities in Bolivia. In Cochabamba, there are only 10,000 connections and it is estimated that 25% of the pipes in the distribution system are perforated, which, besides causing heavy losses, permits seepage that pollutes the water. A large part of the population purchases water from itinerant peddlers.

The Potosí system serves only approximately 50% of the city's population, which does not even receive a sufficient supply because of the lack of adequate sources.

Only 30% of Santa Cruz's population receives water service from installations dating only from 1961. The rest of the population is compelled to obtain water from inadequate sources.

This city had no sewerage system until 1964, when the installations still under construction were initiated. The sewage is discharged into septic tanks which are polluting the underground water and endangering public health.

For the foregoing reasons, it is believed that the investments in the water supply and sewerage systems proposed are of vital importance, since they would reduce the high rates of infant mortality and infectious and intestinal diseases caused by the shortage or poor quality of the water supply in the cities to be benefited by the new systems.

10. Recommendation: On the basis of the Project Committee's conclusion that the program is justified from the technical, economic and financial standpoints, the Operations Department submits the respective loan document to the President of the Bank for consideration and subsequent presentation of the corresponding proposed resolution to the Board of Executive Directors for approval.

PROGRAM ANALYSIS

LOAN TO THE REPUBLIC OF BOLIVIA

I. INTRODUCTION

A. Background

- 1.01 On November 20, 1962, the Governments of Bolivia, the United States and the German Federal Republic and the IDB signed a memorandum of understanding agreeing to establish a nonreimbursable preinvestment fund to be used to prepare feasibility studies on various socio-economic projects in Bolivia which might eventually be financed with local and/or foreign resources. These studies included those for improvement and/or expansion of the water supply and sewerage systems in the major cities of Bolivia. During 1963-1965, the consulting firm contracted prepared technical and economic feasibility studies for a number of projects, including water supply systems for Potosí, Cochabamba and Santa Cruz and a sewerage system for the last city.

B. Applications

- 1.02 In July 1965, November 1965 and January 1966, respectively, the Minister of Economy made application to the Bank for partial financing of these projects. After a preliminary evaluation of all documentation received by the Bank, it was decided to consider financing of the projects presented as a whole but that additional information was required, particularly with regard to catchment sources and designs and plans for the systems. A Bank mission that visited Bolivia in April 1966 informed the authorities of the various cities of these conditions and noted the desirability of updating the costs of the works to be executed.
- 1.03 In the project for the city of Cochabamba, it was believed necessary to determine more accurately the sources of additional water that could be utilized, since existing sources were insufficient to produce the necessary volume. The consultants had suggested a possible zone for exploration of underground water, but prospecting through the drilling of test wells failed to give the expected results. Later, the municipal government contracted another consulting firm specializing in the field to conduct explorations in other zones. The new test wells gave positive results and it was verified that the volume and quality of the water potential were adequate to supply the city up to 1990.
- 1.04 Once the information for the four projects had been compiled, it was submitted by the Minister of Economy on April 18, 1967, for a reformulation of the original application.

II. BORROWER AND EXECUTIVE AGENCIES

A. Borrower

2.01 The Republic of Bolivia.

B. Supervisory Agency

- 2.02 The Government of Bolivia, through the Ministry of Economy, has arranged for participation in the program under consideration by the Corporación de Aguas Potables y Alcantarillado (CORPAGUAS), which will assume responsibility for general supervision of project execution. To this end, the government has indicated that each city should enter into an agreement with CORPAGUAS specifying the conditions on which the loan resources will be transferred, with a view to establishing a procedure permitting direct relations between those agencies and the Bank in order to avoid delays in processing disbursements or any other step relating to execution of the works.
- 2.03 CORPAGUAS was established by Supreme Decree 7942 of March 8, 1967, as a decentralized agency under the Ministry of Public Health, with its own juridical personality and assets and the powers specified in the aforesaid law. CORPAGUAS headquarters are located in La Paz, but it has jurisdiction throughout Bolivia.
- 2.04 Among the principal objectives of CORPAGUAS, the law provides that it will be responsible for exercising regulatory control of the operations of local water supply and sewerage agencies and determining general policy on water supply, storm drain and sewerage systems and treatment and final disposal of sewage. It is authorized to act as trustee, with the approval of the central government, of the credits, granted by foreign institutions or agencies in operation. Its other objectives, together with the organization and financial aspects of the agency, are set forth in loan document PR-235 of July 31, 1967.
- 2.05 It is expected that the costs relating to the additional responsibilities to be assigned to CORPAGUAS in connection with this program could be covered by its ordinary budget without the need for additional contributions by the central government.
- 2.06 The legal report, Annex III, indicates that CORPAGUAS has the legal power to participate in the program. It also states that the government is fully authorized to contract the loan and sign the respective contract but that, prior to signature, it should be authorized by Congress and should subsequently submit the contract for congressional approval or ratification.

C. Executives Agencies

Description

- 2.07 The water supply and sewerage systems will be constructed by the agencies already operating in each of the three cities. In Cochabamba,

the Department of Water Supply and Sewerage, a municipal agency, will be the responsible unit. It has a staff of 75 semiprofessionals and operators but would require a construction and inspection section. In Potosí, construction would be handled by the Department of Water Supply of the Departmental Board of Public Works, which is headed by the Department Prefect as president and the City Mayor as vice president. This agency has repaired and improved the existing system at its own expenses, in accordance with the proposed project. In the city of Santa Cruz, the Public Works Committee of the department would undertake the construction work.

- 2.08 The Santa Cruz Public Works Committee is responsible for urban works in the department. It is an autonomous agency whose president, a civil engineer, is elected by the Executive Branch from a panel of three candidates proposed by the Ministry of Public Works and Communications. One representative of the departmental prefecture and one of the municipal government are also members of the committee, which has a full-time staff of 217 employees, including 28 professionals.
- 2.09 The departmental boards were established by special laws for the purpose of administering the funds allocated for construction and maintenance of public service works.
- 2.10 According to the Technical-Financial Report, Annex I, these agencies have sufficient capacity to execute the projects. It is considered necessary, however, to contract specialized consultants for preparation of the final designs, plans and specifications. With reference to Cochabamba, the Technical-Financial Report notes that the technical staff of the local agency would have to be strengthened in order to supervise the works during the construction period.
- 2.11 To ensure efficient future operation of the expanded water supply and sewerage systems in each city, it is recommended that the present agencies be reorganized to enable them to administer their resources independently of other municipal funds and preclude the assignment of other responsibilities to them. An attempt should also be made to maintain staff size and expenditures within the limits strictly necessary for the accomplishment of their purposes. It is estimated that the agencies that will administer and operate the systems constructed will be reorganized within the 18 months following signature of the loan contract, on the assumption that part of the systems would be operating during that period.
- 2.12 The cities of Santa Cruz and Potosí also receive revenues from mining royalties and, in the case of Santa Cruz, from petroleum royalties as well. In accordance with the law assigning these royalties to the departments where they originate (see the Technical-Financial Report, Annex I), 50% of the funds collected under this heading must be allocated for specific projects of water supply, sewerage, paving and urban infrastructure.

- 2.13 The national accounting system, which does not provide for statements showing the financial position, operates on a budget basis. For 1966 and 1967, budgets for the cities of Cochabamba and Potosí and the Santa Cruz Public Works Committee were as follows:

	(In US\$ thousands)	
	<u>1966</u>	<u>1967</u>
Cochabamba	1,861	1,637
Potosí	542	346
Santa Cruz	2,380	3,065

- 2.14 In these budgets for 1966, the equivalent of US\$215,000 in Cochabamba, US\$140,000 in Potosí and US\$1,871,000 in Santa Cruz was allotted to public service works, chiefly water supply and sewerage.

Debts

- 2.15 The debt status of the three local agencies to October 1967 is as follows:

a. Cochabamba

The sole long-term obligation of the municipality consists of two credits extended by the Bolivian Development Corporation (CBF) for studies on improving the water supply system. On one of these loans, amounting to US\$60,000, the sum of US\$17,573.83 had been amortized with the remainder of US\$42,462.16 scheduled for repayment over four years at interest of 8% per annum on balances outstanding. The other loan, in the amount of US\$100,000, would be amortized, according to the conditions agreed on, during 1969 and 1970 at interest of 6% per annum on balances outstanding. The short-term obligations are covered by normal budget collections.

b. Potosí

The only debt of the Board of Public Works was 87,500 Bolivian pesos, equivalent to US\$7,292, representing the balance of a loan of \$b300,000 granted by the Central Bank in April 1966 to outfit a hotel in Potosí. The repayment term was two years and the interest rate 2% on outstanding balances.

The Central Bank has reported that amortization installments on this loan have been paid punctually each month.

c. Santa Cruz

The Public Works Committee had only the following debts:

- i. Central Bank credit of US\$500,000 payable in three years at 4% annual interest.
- ii. USAID credit of \$120,000, equivalent to US\$10,000, maturing January 1, 1968, at 4% annual interest.
- iii. US\$300,000 withholding in favor of the Bartos Construction Company to guarantee fulfillment of a construction contract. This guarantee expires December 31, 1967.

Other minor obligations deriving from the normal conduct of operations would be easily covered by current resources.

III. THE PROGRAM

A. Description

- 3.01 In general, the program calls for the execution of specific projects in the cities of Cochabamba, Potosí and Santa Cruz consisting of the repair, improvement and expansion of water supply and sewerage systems, particularly with respect to the expansion of supply sources and extension of distribution networks, collectors and treatment plants.
- 3.02 The specific projects are described in greater detail in the Technical-Financial Report, Annex I, a summary of which is presented below.

A-1. Cochabamba

- 3.03 The city of Cochabamba is one of the most important in Bolivia. In 1965, it had an estimated population of 140,000, which is expected by 1980 to reach 198,000 and by 1990, approximately 250,000.
- 3.04 The water supply system dates from 1926 and is based fundamentally on two types of sources consisting of a series of dams located 25 km. from the city and a series of wells and filtration galleries, both in poor condition. The distribution system is approximately 80 km. long and includes a variety of pipe diameters; much of the piping is corroded and must be replaced to prevent continuing leakage and, above all, further pollution from seepage of sewage.
- 3.05 The present estimated population of 140,000 is served as follows:

	<u>Connections</u>	<u>Number of persons</u>
With water and sewerage	5,455	54,550
With water only	4,526	45,260

- 3.06 As can be seen, an estimated average of 10 persons is served by each connection. The rest of the population obtains water from public taps, itinerant peddlers and other unsatisfactory sources.
- 3.07 The project for improvement of this system has been planned to cover population needs over the next 25 years and, owing to the lack of new sources of surface water within a reasonable distance, will consist chiefly of tapping verified underground water sources, improving the treatment plant and repairing and expanding the present distribution system. With these works it is hoped to cover an average per capita demand increase from 90 to 165 liters a day.
- 3.08 Requirements were estimated on the basis of 70% for domestic consumption, 10% for commercial and industrial consumption and 20% for leakage and public use.

3.09 The works would be executed in a term of four years at a cost of US\$4.8 million.

3.10 a. The principal works for repair and improvement of the existing system would be as follows:

- i. Raising the total height of the Escalerani dam along its full length by two meters and eliminating seepage. These works would add 580,000 m³ of water storage capacity, increasing the total storage capacity of the dam to 1,930,000 m³.
- ii. Repair of the adduction channel from the Escalerani dam to the treatment plant in the city to eliminate leaks.
- iii. Installation of new equipment in the treatment plant and repair of existing facilities.
- iv. Increase of pressure through installation of a new storage tank at a higher level than the existing storage reservoir. This will require installation of a fully equipped pumping station including a chlorination plant.
- v. Pipe repairs in the present distribution system.

b. The new works would be the following:

- i. Drilling of deep supply wells in the Quillacolo area, located approximately 10 km. from the city.
- ii. A pumping station and adduction line to convey the water from Quillacolo to storage reservoirs in the city.
- iii. Extension of the present distribution system.

A-2. Potosí

3.11 The city of Potosí is primarily a mining center. Its present population is estimated at 65,000, which could reach 85,500 by 1980 and 115,000 by 1995.

3.12 Its water supply system is one of the oldest in the country and dates from 1573, when a series of dams was built to harness the watershed of the adjacent mountains. The water from these dams is currently transported along 18 km. of canals to three storage reservoirs leading into the distribution system built in 1939.

3.13 The distribution system is approximately 31 km. in length and it is estimated that only 55% of the total population is served by direct connections, with the rest supplied by 20 taps located in various parts of the city, by itinerant peddlers and other inadequate sources.

- 3.14 Owing to the poor condition of the supply sources, city water is rationed and service is available only from 8:00 a.m. to 4:30 p.m., for varying periods in each district.
- 3.15 The project under consideration refers especially to the improvement of dams, construction of a treatment plant and expansion of the distribution system by approximately 100 km. It is expected to meet population needs for the next 25 years, assuming an increase in per capita consumption from 90 to 125 liters a day.
- 3.16 The works would be executed over a four-year period at a cost of US\$1,840,000.
- a. The principal works to be executed for repair and improvement of the existing system would be as follows:
 - i. Raising two of the three dams supplying the system in order to increase their storage capacity.
 - ii. Repair and waterproofing of dams.
 - iii. Increase in storage capacity of the present reservoir.
 - iv. Repair of the existing distribution system.
 - b. The new works would consist of extending the distribution system to sectors not now supplied and constructing a treatment plant.

A-3. Santa Cruz

- 3.17 The Department of Santa Cruz accounts for 29% of the national territory and, in terms of its physical soil and subsoil conditions, can be considered one of the areas of greatest development potential in Bolivia.
- 3.18 The departmental capital of Santa Cruz is one of the oldest cities in the country; however, because of the lack of communications facilities, its population was comparatively small up until a few years ago. The discovery of petroleum and gas deposits and the development of important agricultural projects have led to a rapid increase in the population, estimated at 100,000 inhabitants in 1966 and expected to double before the end of the century.
- 3.19 Despite its population explosion, the city of Santa Cruz had no adequate water or sewerage services only four years ago.
- 3.20 On the basis of studies prepared with the resources contributed jointly by the Governments of Bolivia, the United States and the German Federal Republic and the IDB, the Public Works Committee initiated construction of a water supply and sewerage system.

- 3.21 The project under consideration calls for continuation of the water installations began by the Public Works Committee to complete construction of what might be termed the first phase of the system, which would make it possible to serve the population during the next 25 years, based on an increase in per capita consumption from 140 to 200 liters a day.
- 3.22 The works would be executed over a four-year term at a cost of US\$3.4 million, and would consist chiefly of:
- i. Construction of deep supply wells.
 - ii. Installation of pumping equipment to raise the water to an elevated reservoir in order to maintain proper pressure.
 - iii. Installation of the distribution system.
- 3.23 The sewerage project would cost approximately US\$7.6 million and could be completed within four years. It is estimated that the sewerage system would immediately benefit 90,000 inhabitants and could serve up to 180,000 in the future.
- 3.24 The major works would be the following:
- i. Installation of drains to convey sewage to the treatment plant.
 - ii. Treatment plant.
 - iii. Stabilization of the banks of the Isuto canal, already constructed, to convey sewage from the treatment plant to the Pirai River, the final disposal point.

B. Financial Plan

- 3.25 Total program cost is equivalent to US\$17,640,000, 62% of which would be financed with the loan resources and 30% with the local contribution. Its distribution by project, source of funds, currency and use, would be as shown below.

Source	Currency of Origin		Currency of Use		Total	%
	US\$	\$b	US\$	\$b		
<u>Cochabamba</u>						
IDB	3,000	800	2,600	1,200	3,800	79.2
Local contribution		1,000		1,000	1,000	20.8
TOTAL	3,000	1,800	2,600	2,200	4,800	100.0
%	62.5	37.5	54.1	45.9		
<u>Potosí</u>						
IDB	1,000	400	800	600	1,400	76.1
Local contribution		440		440	440	23.9
TOTAL	1,000	840	800	1,040	1,840	100.0
%	54.3	45.7	43.5	56.5		
<u>Santa Cruz (water)</u>						
IDB	1,900	100	1,700	300	2,000	58.8
Local contribution		1,400		1,400	1,400	41.2
TOTAL	1,900	1,500	1,700	1,700	3,400	100.0
%	56.0	44.0	50.0	50.0		
<u>Santa Cruz (sewerage)</u>						
IDB	3,800		3,200	600	3,800	50.0
Local contribution		3,800		3,800	3,800	50.0
TOTAL	3,800	3,800	3,200	4,400	7,600	100.0
%	50.0	50.0	42.1	57.9		
TOTALS						
IDB	9,700	1,300	8,300	2,700	11,000	62.4
Local contribution		6,640		6,640	6,640	37.6
TOTAL	9,700 1/	7,940	8,300	9,340 1/	17,640	100.0
%	55.0	45.0	47.0	53.0	100%	

^{1/} Includes US\$1.4 million estimated as the indirect foreign currency cost of outlays in national currency.

- 3.26 Of the IDB loan resources in foreign currency, US\$8.3 million would be used to pay for goods and services acquired abroad, including part of the cost of technical assistance and inspection and supervision costs, and US\$1.4 million (approximately 15% of all national currency expenses) would represent compensation for the indirect foreign currency costs of depreciation of previously imported equipment to be used in the work. The national currency resources loaned (equivalent to US\$1.3 million) would be used to pay for goods and services acquired in Bolivia.
- 3.27 The local resources will be derived from the budget of each city. Among the items to be covered with these resources is payment for the services of the consulting engineers considered necessary for preparing the studies relating to works execution.

C. Expenditures Made

Cochabamba

- 3.28 In September 1966, the municipal government of the city of Cochabamba contracted the services of a consulting firm to conduct a feasibility study of the project under consideration. The cost of the services of these consultants was equivalent to US\$170,000, which was financed by the preinvestment fund administered by the Bolivian Development Corporation. This loan is outstanding and is being amortized by the municipality. The value of this study has been considered as part of the local contribution to financing of the proposed water supply project.

Potosí

- 3.29 On August 26, 1966, the Bank Management authorized the Municipality of Potosí to execute urgent works covered by the project in question, provided the usual procedures established by the Bank were followed.
- 3.30 The total cost of these works, amounting to the equivalent of US\$140,000, was paid by the municipality and has been considered as part of the local contribution to financing of the project under consideration.

Santa Cruz

- 3.31 On June 17, 1967, the President of the Santa Cruz Public Works Committee requested that the Bank acknowledge the expenditures effected, since he considered them to be essential in order to avoid bringing execution of the works to a standstill pending a decision on the loan.
- 3.32 These expenditures are as follows:

(In US\$)

To be repaid with the loan

Pipe imported from Brazil	308,000
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To be acknowledged as local contribution

Pipe installation	160,000	
Studies on systems preparation and final plans for water supply and sewerage systems	185,000	a/
Works executed (water supply)	340,000	
Works executed (sewerage)	100,000	785,000
		<hr/>
Total		1,093,000

a/ US\$125,000 of the study cost would be allocated to the sewerage system and US\$60,000 to the water system.

- 3.33 Since it was ascertained that the applicant had complied with legal provisions in Bolivia and with the procedures usually required by the Bank in the bidding held for purchase of the Brazilian pipe for a value of US\$308,000, it is recommended that this amount be repaid with the loan resources. It is suggested that the other expenditures, equivalent to US\$785,000, be recognized as part of the local contribution to the project, subject to confirmation by the Bank.

D. Financing from Other Sources

Local Contribution

- 3.34 According to the financial plan, the local contribution required to complete the program amounts to the equivalent of US\$6,640,000, distributed among the three cities where the projects will be executed as follows:

(Equivalent in US\$ thousands)

Cochabamba	1,000
Potosí	440
Santa Cruz	5,200

- 3.35 Since Potosí has already paid US\$140,000 included in the amount of the local contribution noted above, its remaining obligation would be only US\$300,000, as shown in the table below. The local contribution of Cochabamba does not require any adjustment, since the cost of the studies has not yet been paid. The amount of US\$308,000 noted in paragraph 3.33 would be repaid to Santa Cruz from the loan resources, requiring it to contribute from its own funds an additional amount equivalent to US\$4,892,000, which would be acknowledged to include the expenditures referred to in that paragraph. The obligations borne by the three cities for the local contribution to execution of the projects would then be as follows:

(Equivalent in US\$ thousands)

	<u>Annual average</u>	<u>Total 4 years</u>
Cochabamba	250	1,000
Potosí	75	300
Santa Cruz	1,223	4,892

- 3.36 These contributions would be covered by the items assigned to public service works in the annual budgets of the respective cities. In commenting on these budgets, it was indicated that in 1966 Cochabamba allotted to public service works the equivalent of US\$215,000, Potosí US\$140,000 and Santa Cruz US\$1,871,000. These resources, with the exception of the city of Cochabamba, which should increase this allocation by approximately 16%, would cover the local contribution necessary for execution of each of the projects during the four years of execution.
- 3.37 To service the loan after completion of the works, the surplus on rates following deduction of operating expenses for the respective system, including those relating to administration, operation, maintenance, interest, depreciation and amortization of nondepreciable items, would be applied proportionately to the amount of each project.
- 3.38 If such surpluses should be insufficient, each municipality or local agency would contribute the additional resources required. These contributions would have to come from the allocations for works in the respective budgets which, as indicated earlier, would be sufficient to cover the obligations.
- 3.39 In the agreements to be entered into by CORPAGUAS and the Municipalities of Cochabamba and Potosí and the Santa Cruz Public Works Committee for execution of the respective projects, the obligations corresponding to the local contribution and loan service should be clearly established.

- 3.40 The local agencies should agree to assign priority in allocating their annual resources to fulfillment of these obligations, and only when a surplus occurs, to the execution of new works. To ensure fulfillment of the above condition, the loan contract will stipulate that the local agencies should submit to the Bank each year the plan for distribution of their resources. If these obligations should subsequently be transferred to the local agencies established to administer the water supply and sewerage services, a guarantee should be included that the municipalities will supply them with the resources committed.
- 3.41 Considering that the Public Works Committee of Santa Cruz receives more revenue than Cochabamba or Potosí, CORPAGUAS might consider the desirability of transferring the loan to it on a shorter term than that granted by the Bank (possibly 15 years) and of employing the difference between the semiannual payments to be made by Santa Cruz and those made by CORPAGUAS to the Bank for the execution of water supply and sewerage projects in smaller towns, subject to the Bank's approval of such projects.

E. Execution of Projects

Status of Technical Studies

i. Cochabamba

- 3.42 The design of the distribution system has been completed, as has the model design for the deep wells.
- 3.43 Preliminary plans for the storage reservoirs, pumping stations, dams, treatment plants and other essential elements in the system have been completed, with only the final plans and specifications still pending.
- 3.44 It is still necessary to drill supply wells, test them to determine the type of pumps best suited to the system planned and design the reception system for the well field.
- 3.45 The work pending will require the services of consultants who would be contracted by the executive agency. This cost is included in the project as part of the local contribution.

ii. Potosí

- 3.46 The preliminary plans for the system are available. A number of drillings must be made near the dams to complete the information required for preparing final plans and specifications of the dams and storage reservoirs.
- 3.47 Execution of these works, with the exception of the plans for the treatment plant, which requires a specialized consultant, can be done by a civil engineer. The cost of this work is included in the project for financing by the local contribution.

iii. Santa Cruz

- 3.48 The preliminary plans for the works of both systems are 90% complete and a firm of consultants contracted by the Public Works Committee is reviewing them. The same consultants have also been entrusted with preparation of the final plans and their respective specifications.
- 3.49 In the case of the sewerage system, the consultants should propose the best method for treating the sewage and the most suitable maintenance equipment for the system.
- 3.50 The contracts with the consultants have been reviewed and pronounced satisfactory.

F. Goods and Services

3.51 i. Cochabamba

(In US\$ thousands)

	<u>Item</u>	<u>Total</u>	<u>I D B</u>		<u>Cochabamba</u>	
			<u>Total</u>	<u>Foreign currency</u>	<u>Local costs</u>	<u>Local costs</u>
I.	Sources of supply	680	580	365	215	100
II.	Conduction lines	880	880	570	310	-
III.	Treatment equipment	150	150	100	50	-
IV.	Storage and distribution	1,614	1,607	1,102	505	7
V.	Miscellaneous equipment	50	-	-	-	50
VI.	Household meters and connections	300	150	150	-	150
VII.	Working capital	61	-	-	-	61
VIII.	Consultants	285	15	15	-	270 ^{1/}
IX.	Inspection and supervision	38	38	38	-	-
X.	Interest and commitment fee during construction	262	-	-	-	262
XI.	Contingencies	480	380	260	120	100
	TOTAL	4,800	3,800	2,600	1,200	1,000

^{1/} Includes the equivalent of US\$170,000 to cover the cost of feasibility studies.

3.52 ii. Potosí

(In US\$ thousands)

Item	Total	I D B		Potosí Local costs
		Total	Foreign currency	
I. Sources of supply	396	250	-	146 ^{1/}
II. Conduction lines	240	170	-	70 ^{1/}
III. Treatment equipment	165	165	105	60
IV. Storage and distribution	526	526	486	-
V. Miscellaneous equipment	30	-	-	30
VI. Household meters and connections	120	120	100	-
VII. Working capital	34	-	-	34
VIII. Consultants	75	15	15	60
IX. Inspection and supervision	14	14	14	-
X. Interest and commitment fee during construction	70	-	-	70
XI. Contingencies	170	140	80	30
Total	<u>1,840</u>	<u>1,400</u>	<u>800</u>	<u>440</u>

3.53 iii. Santa Cruz (Water)

Santa Cruz

I. Sources of supply	400	400	320	80	-
II. Conduction lines	-	-	-	-	-
III. Treatment equipment	-	-	-	-	-
IV. Storage and distribution	2,015	1,225	1,060 ^{2/}	165	790 ^{3/}
V. Miscellaneous equipment	115	-	-	-	115
VI. Household meters and connections	250	140	120	20	110
VII. Working capital	92	-	-	-	92
VIII. Consultants	75	15	15	-	60 ^{4/}
IX. Inspection and supervision	20	20	20	-	-
X. Interest and commitment fee during construction	93	-	-	-	93
XI. Contingencies	340	200	165	35	140
Total	<u>3,400</u>	<u>2,000</u>	<u>1,700</u>	<u>300</u>	<u>1,400</u>

^{1/} The cost of works already completed under both items is equivalent to US\$140,000.

^{2/} Includes the cost of 20-inch pipe purchased by the Public Works Committee for the main circuit of the system in the amount of US\$308,000.

^{3/} Includes the cost of laying the pipe indicated in footnote 2 above, amounting to US\$160,000.

^{4/} The services of consultants for final systems studies have already been contracted at a cost of US\$60,000.

3.54 iv. Santa Cruz (Sewerage)

(In US\$ thousands)

Item	Total	I D B		Local costs	Santa Cruz Local costs
		Total	Foreign currency		
I. Household connections	200	-	-	-	200
II. Collector system	5,588	2,767	2,477	290	2,821
III. Treatment equipment	600	600	350	250	-
IV. Miscellaneous equipment	50	-	-	-	50
V. Working capital	25	-	-	-	25
VI. Consultants	140	15	15	-	125 ^{1/}
VII. Inspection and supervision	38	38	38	-	-
VIII. Interest and commitment fee during construction	199	-	-	-	199
IX. Contingencies	760	380	320	60	380
Total	7,600	3,800	3,200	600	3,800

3.55 The water supply and sewerage systems will be constructed preferably on contract. In most cases, the contractor should provide the materials in accordance with specifications, but these might be acquired by the local agency, with only their installation contracted.

3.56 Small works such as the installation of secondary pipelines and repair of existing canals could be carried out by administration, subject to consultation with the Bank.

^{1/} The services of consultants for final system studies have already been contracted at a cost of US\$125,000.

3.57 G. Tentative Investment Schedule

(In US\$ thousands)

	Years				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>Total</u>
<u>Water Supply</u>					
Cochabamba	250	250	250	250	1,000
IDB	<u>1,500</u>	<u>1,000</u>	<u>800</u>	<u>500</u>	<u>3,800</u>
Total	<u>1,750</u>	<u>1,250</u>	<u>1,050</u>	<u>750</u>	<u>4,800</u>
Potosí	210	70	80	80	440
IDB	<u>350</u>	<u>400</u>	<u>300</u>	<u>350</u>	<u>1,400</u>
Total	<u>560</u>	<u>470</u>	<u>380</u>	<u>430</u>	<u>1,840</u>
Santa Cruz	400	500	500	-	1,400
IDB	<u>900</u>	<u>600</u>	<u>500</u>	<u>-</u>	<u>2,000</u>
Total	<u>1,300</u>	<u>1,100</u>	<u>1,000</u>	<u>-</u>	<u>3,400</u>
<u>Sewerage</u>					
Santa Cruz	800	1,000	1,000	1,000	3,800
IDB	<u>1,150</u>	<u>1,000</u>	<u>1,000</u>	<u>650</u>	<u>3,800</u>
Total	<u>1,950</u>	<u>2,000</u>	<u>2,000</u>	<u>1,650</u>	<u>7,600</u>

H. Standards for Acquisition of Goods and Services

3.58 For the acquisition of machinery, equipment and other goods relating to the program and the award of construction contracts the system of public bidding will be employed in all cases where the value of such acquisitions or contracts exceeds the equivalent of US\$10,000, with the bidding procedure subject to the approval of the Bank and taking into account the pertinent legislation in Bolivia. Based on the Bank's experience in other operations, there is no obstacle to the establishment of such conditions.

I. Technical Assistance ^{1/}

3.59 As indicated in paragraph 2.10 the local agencies have the technical and administrative capacity required to execute the works but would need technical assistance in the preliminary phase for:

^{1/} For further details, see Appendix B, technical assistance plan.

- i. Preparation of final plans and designs, including specifications for works construction.
 - ii. Preparation of the bases for organizing the agencies that would be responsible for administration of the water supply and sewerage systems following completion of the works.
 - iii. Advising the local agencies administering the systems on determination of the rate structure for these services.
- 3.60 For attainment of the objectives indicated in points ii. and iii., adequate coordination should be established with CORPAGUAS in order to relate this technical assistance to that granted to the latter agency (ATP/SF-741-B0) for similar and complementary objectives.
- 3.61 The cost of this technical assistance is estimated at US\$405,000, of which US\$60,000 would be charged to the Bank loan to cover points ii. and iii. and the local agencies would contribute US\$345,000 to cover the cost of the advisory services outlined in point i. and such contingencies as may arise. Of the amount of the technical assistance financed by the Bank loan, US\$15,000 would be allocated to the city of Cochabamba, US\$15,000 to Potosí and US\$30,000 to Santa Cruz, 50% to the water subproject and 50% to the sewerage subproject.

J. Inspection and Supervision

- 3.62 The CORPAGUAS charter provides for the supervision of works and advisory services to local agencies. A project engineer appointed by the Bank will be responsible for inspection and supervision of these projects and for similar ones financed by the Bank in Bolivia. It would be the basic responsibility of the project engineer to review and approve all plans, specifications, disbursement requests, bid and award documents, lists of goods and services and construction of works 1/. It is considered that the amount of US\$110,000 allocated as part of this loan to inspection and control, plus the US\$15,000 earmarked for water supply in the city of Oruro and US\$18,000 under the loan for water service to small towns, aggregating US\$143,000, would be sufficient to cover the cost of such inspection and supervision during the four years scheduled for execution of the projects.

K. Accounting and Audit

- 3.63 For better control of the operations relating to the loan, both CORPAGUAS and the agencies responsible for managing the water supply and sewerage systems in the cities of Cochabamba, Potosí and Santa Cruz should enter them in special accounts in accordance with an accounting code and their respective manual or accounting procedures approved by the Bank. Audit of the projects and certification of the annual financial statements of the local agencies should be done by independent public accountants paid by the agency concerned. With regard to CORPAGUAS, this obligation was established in an earlier loan.

1/ In case the Bank considers necessary, a second expert would be hired who would be responsible of supervising and inspecting the administrative aspects of these projects and of other similar projects that are financed by the Bank in Bolivia.

IV. PROGRAM JUSTIFICATION

A. Technical and Financial Feasibility

- 4.01 As analyzed in the Technical-Financial Report, the projects included in the program are conceived in accordance with acceptable technical standards for the types of systems to be constructed and adapted to the present and future needs of the communities to be benefited. No problems are anticipated in the acquisition of locally produced construction materials or the importation of foreign materials, and the available labor force is considered adequate to permit execution of the project within the period scheduled.
- 4.02 The estimated costs are considered reasonable in the light of experience in similar projects under way and any differences could be covered by the contingency item, representing 10% of the total cost.
- 4.03 With regard to the feasibility of program execution, paragraph 2.10 and the Technical-Financial Report indicate that the local agencies responsible for the water supply and sewerage systems in each of the cities has available for their execution technical and administrative personnel with some experience that would be strengthened with the advisory services of CORPAGUAS and the contracting of the consultants provided for in the technical assistance plan (Appendix B).
- 4.04 The financial possibilities of the three cities during the four years of works execution are analyzed on the basis of the budgets for previous years. The amounts allotted for the item of public service works, with the exception of Cochabamba which would have to increase that allotment by 16% per annum (US\$35,000), are considered adequate to ensure the completion of each project.
- 4.05 The future financial capacity of the local agencies that would operate and administer the systems is shown in the cash flow tables of the Technical-Financial Report, Annex I. The projections are based primarily on rates estimated in accordance with the contents of the tables appearing in paragraphs 5.07 - 1, 4.07 - 2, 4.07 - 3 and 5.07 - 4 of Annex I and show that revenue received by the three cities from operation of the respective systems, upon completion of construction, would be sufficient to cover their operating and maintenance costs and to pay fully in the city of Potosí and partially in Cochabamba and Santa Cruz for amortization of the loan. Any difference that might result would be covered by the respective municipalities as agreed in their letters in to the Bank, utilizing for that purpose the resources usually allocated in their annual budgets to public service works.
- 4.06 Since the works would be constructed in four years and since the revenue derived during this period from existing services as well as the allotments for public service works in their respective budgets would be used

to operate such services and to establish the local contribution for the new project, it is deemed essential to grant a grace period of 4-1/2 years for payment of the first amortization installment.

- 4.07 The proposed 25-year period is fairly similar to the terms of water supply and sewerage loans granted to Bolivia and other member countries of the Bank. However, in view of the revenue received by the Santa Cruz Public Works Committee, it has been provided that CORPAGUAS could grant that agency a shorter term for payment of the loan and utilize the difference between the sums paid by Santa Cruz and those to be paid by CORPAGUAS to the Bank to execute water supply and sewerage projects in smaller towns.

B. Socio-Economic Evaluation

- 4.08 The cities of Cochabamba, Potosí and Santa Cruz collectively have about 300,000 inhabitants, a figure representing slightly over 20% of Bolivia's urban population. It is estimated that the population in these cities will total approximately 435,000 inhabitants by 1980.
- 4.09 In 1964, it was calculated that only 45% of Bolivia's urban population was receiving water service, although in many cases this supply was inadequate and of poor quality and was considered to be responsible for the high rates of infant mortality and infectious and intestinal diseases.
- 4.10 For 1966, the per capita GDP in Bolivia was estimated at the equivalent of US\$112. In Cochabamba, Potosí and Santa Cruz, this income was set at US\$110, US\$105 and US\$120, respectively.
- 4.11 Under the National Development Plan now in execution, 8% of total investment was programmed for social projects. As part of this plan, the construction or improvement of water supply systems for the cities of La Paz, Sucre, Oruro, Pando and Beni is currently being carried out or negotiated.
- 4.12 The cities where the program projects would be executed are among the most important in Bolivia and owing to their special characteristics can expect a rapid growth of population. However, these prospects could be negated by the lack of water supply and sewerage services, which would preclude any new investments.
- 4.13 The proposed rates would represent approximately 3% of estimated family income and maintain a certain relationship to those applied in other countries. A cubic meter of water in the three cities would cost US\$0.06, while in Peru it costs US\$0.04. Sewerage rates in Santa Cruz would not exceed 1% of family income in the region, which is also considered reasonable.
- 4.14 Accordingly, since the present rates are comparatively very low in relation to those resulting from the study, it is suggested that they be increased gradually during the four years of works construction.

- 4.15 In general, the loan is considered to be stated in terms that are adequate for the primarily social function of the program as a public service and the amortization suited to the useful life of the facilities. Execution of the project is expected to help improve public health by reducing morbidity and mortality rates, promote possible investments and increase employment opportunities. The foreign currency resources of the loan would help to maintain the general status of Bolivia's balance of payments, in view of the fact that amortization payments will be made in local currency.

V. CONCLUSIONS AND RECOMMENDATIONS

5.01 The analysis made in the preceding chapters leads to the conclusion that the Program is feasible from the technical, economic, financial and legal standpoints. It is therefore recommended that a loan be granted to the Republic of Bolivia, in an amount up to the equivalent of US\$11,000,000 from the Fund for Special Operations, subject to the conditions indicated in the respective resolution and the following conditions, which shall be included in the loan contract and which shall be carried out to the satisfaction of the Bank:

1. The debtor, represented by CORPAGUAS, shall enter into an agreement for utilizing the resources of the loan allocated for technical assistance substantially in accordance with Appendix B of this document. Within six months of the date of such agreement the experts specified therein shall have been contracted.
2. Prior to the first disbursement, other than for technical assistance or inspection of the program, there shall be submitted to the Bank the document establishing the conditions for the participation of Corporación de Aguas y Alcantarillado (CORPAGUAS) as the supervisor of the program.
3. Prior to the first disbursement for each project, there shall be presented to the Bank:
 - (a) The agreement which with the previous approval of the Bank shall be entered into between CORPAGUAS, the respective Municipality and/or the local executing entity for the project of the respective city for the utilization of the resources of the loan allocated to the project. In said agreement the formal commitment to organize the entity mentioned in paragraph 5, shall be clearly established.
 - (b) Evidence that the local entity responsible for the construction of the water or sewerage system has established adequate administrative and accounting mechanisms for the execution of the project and has engaged the technical personnel required for supervising the execution of the works.
 - (c) The complete technical specifications plans, designs and other information required for each part of the respective project to be implemented, including: (i) method of construction, and (ii) type of pipe and materials.
4. In the agreement to be entered into by CORPAGUAS and the entity responsible in Santa Cruz for executing the respective projects, the amortization period may be reduced, provided it is no less than 15 years, for the purpose of making the difference between the semiannual installments which such entity makes and which the debtor must make to the Bank in accordance with this loan, available to finance the implementation of potable water and sewer projects in rural communities with the prior approval by the Bank of the respective projects.

5. Within 18 months from the date of the loan contract there shall be organized in each city benefited by the loan, a local entity, with autonomy in the administration of its resources, which shall be responsible exclusively for operating and administering the water and sewer systems. Such entities shall be organized in such manner that their personnel and expenses are those absolutely necessary for the compliance of their objectives. The general outlines of their organization shall require the prior approval of the Bank.
 6. The local entities responsible for executing the works and those for operating and administering the potable water and sewer systems, as the case may be, shall keep separate accounts for each system and present annually to the Bank their financial statements audited by a firm of independent public accountants within 120 days subsequent to the close of each fiscal year.
 7. The contributions made by the executing agencies for the implementation of the projects in each city subsequent to August 1966, but prior to the signature of the loan contract and provided that the amounts do not exceed the equivalent of US\$170,000 for the city of Cochabamba, US\$140,000 for the city of Potosí, and US\$785,000 for the city of Santa Cruz, may be considered by the Bank as a part of the local contribution, provided that requirements substantially similar to those established in the proposed resolution and the loan contract have been fulfilled.
 8. Up to US\$60,000 or its equivalent of the resources of the loan may be used to cover costs of technical assistance. Of this amount US\$15,000 shall be applied to each of the projects of potable water for the cities of Cochabamba, Potosí and Santa Cruz and US\$15,000 to the sewer project of the last city.
 9. Up to the equivalent of US\$110,000 or its equivalent may be used to cover inspection costs. This amount shall be charged as follows: US\$38,000, US\$14,000, and US\$20,000 respectively to the potable water projects of Cochabamba, Potosí, and Santa Cruz and US\$38,000 to the sewerage system of Santa Cruz.
 10. Up to the equivalent of US\$800,000 for the city of Cochabamba, up to the equivalent of US\$400,000 for the city of Potosí, and up to the equivalent of US\$100,000 for the potable water system of the city of Santa Cruz of the resources of the loan may be disbursed in Bolivian pesos.
- 5.02 The contents of Appendix A of this document (Description of the Program) shall be substantially incorporated as an annex of the loan contract.
- 5.03 The United States dollars used in the loan shall be charged to the Fund for Special Operations pursuant to the increase approved by Resolution AG-2/65.

DESCRIPCION DEL PROGRAMA 1/

I. OBJETO Y FINANCIAMIENTO

El Programa tiene por objeto contribuir al mejoramiento y ampliación de los sistemas de agua potable de las ciudades de Cochabamba y Potosí y los sistemas de agua potable y alcantarillado de la ciudad de Santa Cruz.

El Programa consiste en: a) la planificación de los cuatro sistemas; b) construcción de las obras y c) la organización de las entidades locales que se encargarán de operar los sistemas una vez que éstos se han construído.

En general los sistemas de agua potable consistirán en el desarrollo de fuentes adecuadas, tales como pozos profundos en Cochabamba y Santa Cruz; mejoramiento de fuentes superficiales de agua en las ciudades de Cochabamba y Potosí; construcción y mejoramiento de canales y líneas de transmisión, estaciones de bombeo, tanques de almacenamiento y redes de distribución; mejoramiento de la planta de tratamiento de la ciudad de Cochabamba y la construcción de una planta de tratamiento para la ciudad de Potosí. Para cada ciudad se prevé la instalación de conexiones domiciliarias con medidores.

El sistema de alcantarillado para la ciudad de Santa Cruz consiste en la construcción de: conexiones domiciliarias y tomas en las calles; red de colectores con sus pozos de inspección y estructuras especiales; interceptores; estaciones de bombeo; línea de conducción; planta de tratamiento y línea y canal final de descarga.

Antes de iniciar la construcción para sus obras respectivas cada ciudad deberá haber presentado los planos finales con sus respectivos presupuestos, especificaciones, y lista de bienes y servicios para la aprobación previa del Banco.

Las obras que se realizarían en cada proyecto, serían, en términos generales, las siguientes:

Cochabamba

Perforación de aproximadamente 4 pozos en la zona de Quillacollo.

Instalación de bombas y equipo mecánico-eléctrico y líneas de fuerza eléctrica.

Líneas de aducción de los pozos a una estación de rebombeo.

Construcción de una estación de bombeo con bombas, pozo de bombeo, equipo eléctrico-mecánico, controles, sub-estación eléctrica y accesorios; edificio con capacidad para la etapa final.

Línea de aducción de acero de 24" de diámetro desde la estación de rebombeo hasta el reservorio nuevo en La Coronilla.

1/ Tipo de Cambio: US\$1 = \$b12

Mejoramiento del dique Escalerani y aumento de altura de aproximadamente 2 metros.

Revestimiento de canales, instalación de líneas de cañería para conducir el agua de Escalerani hasta la toma de agua Tolapucru.

Nueva toma de agua en Tolapucru, línea de aducción hasta la planta de tratamiento de agua Cala Cala.

Mejoramiento de la planta de tratamiento de Cala Cala.

Estación de bombeo adyacente a la planta de Cala Cala con línea de aducción hasta nuevo tanque de almacenamiento para la zona alta de Cala Cala.

Nueva estación de rebombeo adyacente al tanque de almacenamiento San Pedro I con bombas, líneas de conducción hasta tanque San Pedro II, equipo mecánico-eléctrico y equipo de cloración, equipos auxiliares.

Nuevo tanque de almacenamiento San Pedro II ubicado a una altura superior a San Pedro I. Capacidad de 5.000 m³ con válvulas y accesorios.

Nuevo tanque de almacenamiento en Cala Cala con capacidad de 400 m³.

Nuevo tanque de almacenamiento en La Coronilla de hormigón con capacidad de 8.000 m³.

En la red de distribución reemplazo de cañería en mal estado e instalación de nueva cañería; aproximadamente 70 kilometros de 4" - 24" de asbesto-cemento y hierro fundido.

Fondo rotatorio para 6.000 conexiones domiciliarias con medidores.

Potosí

Mejoramiento de fuentes actuales:

Impermeabilización del Dique Chalviri y elevación de la misma aproximadamente 1 metro.

Elevación de la altura del Dique San Ildefonso aproximadamente 2.7 metros con la instalación de medidores de flujo, centrales y reconstrucción de canales a lagunas interconectadas del Sistema San Ildefonso.

Reparación del Dique Muñiza e instalación de nueva toma de agua.

Construcción de una línea de conducción del dique Chalviri hasta la planta de tratamiento adyacente al Tanque Milner; aproximadamente 13 kilómetros, 14" en diámetro y de concreto.

Tanques de tratamiento cerca del Dique Chalviri.

Construcción de una línea de conducción del Dique Muñiza hasta la planta de tratamiento de 16" en diámetro.

Construcción de una planta de tratamiento con mezcladores, floculadores, coaguladores, sedimentadores, filtros, equipos de cloración, dosificación, controles, laboratorio, bombas, almacenes, edificio e instalaciones de facilidades auxiliares.

Reparación de los tanques de almacenamiento Milner, San Cristóbal y San Juan y construcción de dos nuevos tanques de almacenamiento de 800 m³ y 3.000 m³.

Reparación de la red de distribución y su extensión a través de la instalación de aproximadamente 100 kilómetros de cañería de 3" a 14" de diámetro de asbesto-cemento y hierro fundido revestido.

Fondo Rotatorio para aproximadamente 3.000 conexiones domiciliarias con medidores.

Santa Cruz (agua)

Perforación de aproximadamente 4 pozos y la instalación de bombas con motores eléctricos, controles, válvulas, accesorios y líneas de transmisión de energía eléctrica y líneas de aducción hasta el tanque de almacenamiento existente.

Instalación de válvulas y cañerías para completar los tanques de almacenamiento existente, uno elevado y otro enterrado. Impermeabilización y trabajos adicionales requeridos para ponerlos en operación.

Estación de bombeo para elevar agua del tanque de almacenamiento enterrado hasta el tanque elevado y la red. Construcción de edificio, almacenes, oficina, y la instalación de controles, equipo eléctrico-mecánico, bombas, medidores y facilidades anexas.

Instalación de aproximadamente 85 kilómetros de cañería de hierro fundido y asbesto cemento de 3" a 20" en diámetro para la red de distribución entre las Internas y Externas Avenidas de Circunvalación y en los barrios de Lazareto, Paria y Trompillo.

Instalación de 5.000 medidores y conexiones domiciliarias.

Santa Cruz (alcantarillado)

Sanitario

Instalación de aproximadamente 61 kilómetros de cañería de hormigón de 8" a 28" de diámetro para el sistema sanitario en dos cuencas de drenaje; Zona Cotaca y Zona Pirai.

Construcción de pozos de inspección, pozos a cada cambio de gradiente, dirección y nivel, estructuras hidráulicas especiales cuando requerido de mampostería y concreto.

Construcción de dos estaciones elevatorias, la una en Zona Cotoca para llevar las aguas servidas a la Zona Pirai, la otra para llevar las aguas servidas a la planta de tratamiento. Cada estación tendrá pozo de bombeo, edificio, instalaciones de medidores, controles, depósitos, equipos electro-mecánicos y facilidades auxiliares.

Planta de tratamiento de lagunas de oxidación.

Emisario final al Canal Isuto con protección para la descarga. Aproximadamente 4.000 conexiones domiciliarias.

Pluvial

Instalación de aproximadamente 49 kilómetros de colectores, interceptores y líneas finales de cañería de 10" a paralelos de 60" de diámetro de hormigón en dos cuencas de drenaje, Zona Cotoca y Zona Paria.

Construcción de bocas de toma de calle, pozos de inspección y estructuras hidráulicas especiales para cambios de gradiente, dirección y nivel; de mampostería y concreto

Obras de entrada, salida y control para la Laguna del Arenal para usarlo como laguna de retención.

Reparación y protección de los lados, fondo y entradas de alcantarillado, del Canal Isuto.

Construcción del canal de descarga de la Zona Cotoca -Canal Cotoca de aproximadamente 4.2 kilómetros de largo y revestido de concreto.

II. COSTO DEL PROGRAMA Y DISTRIBUCION DE RECURSOS

El costo del programa se estima en el equivalente de US\$17.640.000 1/ distribuido así:

(i) Cochabamba

(en miles de US\$)

<u>Rubro</u>	<u>Total</u>	<u>BID</u>	<u>Aporte Local</u>
Materiales, equipos, medidores mano de obra	3,674	3,367	307
Capital de trabajo	61		61
Asistencia técnica (incluyendo ingeniería y diseño)	285	15	270 <u>2/</u>
Inspección y vigilancia	38	38	
Intereses y comisiones durante la const.	262		262
Contingencias	480	380	100
Total	<u>4,800</u>	<u>3,800</u>	<u>1,000</u>
Porcentajes	<u>100.0</u>	<u>79.2</u>	<u>20.8</u>

1/ Tipo de cambio US\$1 = \$b 12

2/ Incluye el equivalente de US\$170.000 incurridos para sufragar el costo de los estudios de factibilidad.

(ii) Potosí

(en miles de US\$)

<u>Rubro</u>	<u>Total</u>	<u>BID</u>	<u>Aporte Local</u>
Materiales, equipos, medidores, mano de obra	1.477	1.231	246 <u>1/</u>
Capital de trabajo	34		34
Asistencia Técnica (incluyendo ingeniería y diseño)	75	15	60
Inspección y vigilancia	14	14	
Intereses y comisiones durante la construcción	70		70
Contingencias	170	140	30
Total	<u>1.840</u>	<u>1.400</u>	<u>400</u>
Porcentajes	100.0	76.1	23.9

(iii) Santa Cruz (agua potable)

(en miles de US\$)

<u>Rubro</u>	<u>Total</u>	<u>BID</u>	<u>Aporte Local</u>
Materiales, equipo, medidores, mano de obra	2.780	1.765 <u>2/</u>	1.015 <u>3/</u>
Capital de trabajo	92		92
Asistencia técnica (incluye ingeniería y diseño)	75	15	60 <u>4/</u>
Inspección y vigilancia	20	20	
Intereses y comisiones durante la construcción	93		93
Contingencias	340	200	140
Total	<u>3.400</u>	<u>2.000</u>	<u>1.400</u>
Porcentajes	100.0	58.8	41.2

-
- 1/ Incluye el equivalente de US\$140.000 correspondiente al costo de obras ejecutadas.
- 2/ Incluye el costo de tubería de 20 pulgadas de diámetro adquirida por el Comité de Obras Públicas para el anillo principal del sistema por un valor de US\$308.000.
- 3/ Incluye el costo del tendido de la tubería indicado en el 2/ anterior, por un valor de US\$160.000.
- 4/ Los servicios de consultores para los estudios finales del sistema ya han sido contratados a un costo de US\$125.000.

(iv) Santa Cruz (alcantarillado)

(en miles de US\$)

<u>Rubro</u>	<u>Total</u>	<u>BID</u>	<u>Aporte Local</u>
Materiales, equipos, medidores, mano de obra	6.438	3.367	3.071
Capital de trabajo	25		25
Asistencia Técnica (incluyendo ingeniería y diseño)	140	15	125 <u>1/</u>
Inspección y vigilancia	38	38	
Intereses y comisiones durante la construcción	199		199
Contingencias	760	380	380
Total	<u>7.600</u>	<u>3.800</u>	<u>3.800</u>
Porcentajes	100.0	50.0	50.0

III. EJECUCIÓN DEL PROGRAMA

La Corporación de Aguas Potables y Alcantarillado (CORPAGUAS) será la entidad que actuará en representación del Deudor como agente administrador de los recursos del préstamo y a la vez como organismo ejecutor mediato, será responsable de la supervisión general de las obras durante la etapa de ejecución de las mismas.

Los proyectos específicos en cada una de las ciudades serán ejecutados por las entidades locales encargadas.

Los convenios que previa aprobación del Banco se suscriban entre CORPAGUAS y cada una de las municipalidades y/o las entidades locales ejecutoras del proyecto de la respectiva ciudad para la utilización de los recursos del préstamo destinados al proyecto, deberán contener: (i) los términos en que la entidad local utilizará los fondos del préstamo; (ii) la forma en que serán aportados los recursos locales destinados a la construcción de las obras; (iii) un procedimiento que permita la información directa entre la entidad local y el Banco, con el objeto de facilitar el trámite de los desembolsos y de cualquiera otra gestión relacionada con la construcción de las obras; (iv) el compromiso de la entidad ejecutora y/o la respectiva municipalidad que destinará sus recursos anuales en forma prioritaria para cumplir con el aporte local y con las demás obligaciones derivadas del contrato de préstamo con el Banco, y de que sólo en el caso de haber excedentes destinarán sus recursos a nuevas obras; (v) el compromiso del ejecutor de presentar al Banco oportunamente el plan de distribución de sus recursos

1/ Los servicios de consultores para los estudios finales del sistema ya han sido contratados a un costo de US\$125.000.

para el año siguiente; (vi) la forma en que se recaudarán los recursos generados por el sistema y su aplicación al pago de los costos de operación y mantenimiento del mismo y demás obligaciones contractuales; (vii) la forma en que la entidad local o la municipalidad respectiva aportará recursos adicionales para el pago del servicio de la deuda, en el caso de que las tarifas no alcancen a cubrirlo; (viii) el procedimiento para el ajuste gradual y escalonado de las tarifas actuales en las zonas donde se haya mejorado el servicio, a medida que progresen las obras; y (ix) la supervisión general del sistema respectivo por CORPAGUAS.

IV. ASISTENCIA TECNICA

Dentro de los períodos que se consignan en el convenio sobre asistencia técnica deberán elaborarse los estudios y ponerse en práctica las recomendaciones de los consultores que sean aceptadas de acuerdo por el Banco y el Deudor.

ASISTENCIA TECNICA REEMBOLSABLE COMO PARTE DEL PRESTAMO ALGOBIERNO DE BOLIVIAPARA LOS SISTEMAS DE AGUA DE COCHABAMBA Y POTOSIY AGUA Y ALCANTARILLADO DE SANTA CRUZPLAN DE OPERACIONES 1/I. ANTECEDENTES

Las autoridades encargadas de ejecutar las nuevas obras de agua potable y alcantarillado en las ciudades de Cochabamba, Potosí y Santa Cruz han considerado conveniente que las entidades que actualmente administran estos servicios sean reestructuradas, con el propósito de obtener la mayor eficiencia posible en la operación y administración de las mismas cuando se terminen las obras.

Esta necesidad también ha sido reflejada en los estudios de factibilidad técnico-económica que elaboraron los consultores para cada uno de los sistemas, y que sirvieron de base para apoyar las solicitudes de préstamo que presentaron los organismos locales.

II. OBJETIVOS DEL PROYECTO

Los principales objetivos de la asistencia técnica son: (i) asesorar en la organización de las entidades autónomas que se encargarían de administrar los sistemas de agua y alcantarillado, independiente de cualquier otro servicio público; y (ii) preparar las bases para la estructuración de las tarifas de estos servicios y proponer las tarifas que deben aplicarse en cada ciudad para cada servicio.

III DESCRIPCION DEL PROYECTO

Tomando en consideración que los sistemas en cada ciudad conviene sean operados y administrados independientemente de los otros servicios públicos, CORPAGUAS contratará, con cargo a las partidas especiales asignadas a cada proyecto, los consultores que se encargarían de estudiar y recomendar la organización y reglamentación de las entidades que se crearían en cada una de las ciudades para operar y administrar los sistemas de agua potable y alcantarillado. En las mismas condiciones CORPAGUAS contrataría también la asesoría necesaria para el estudio de las bases para la estructuración de tarifas y la elaboración del proyecto de las tarifas que podrían ser aplicadas a los sistemas de agua y alcantarillado en cada una de las ciudades de Cochabamba, Potosí y Santa Cruz.

1/ Tipo de cambio: US\$1 = \$b12

IV. JUSTIFICACION DEL PROYECTO

Los estudios realizados de los proyectos de agua potable y alcantarillado a ejecutarse en las ciudades de Cochabamba, Potosí y Santa Cruz establecen la necesidad de contratar consultores en campos específicos para asegurar que dichos proyectos se administren adecuadamente y produzcan ingresos suficientes para pagar, por lo menos, sus gastos de operación y mantenimiento.

V. COSTO Y FINANCIAMIENTO DEL PROYECTO

El costo total del proyecto se estima en el equivalente de US\$60.000. Dicho monto se destinaría al pago de los honorarios de especialistas en organización de empresas y en estructura de tarifas de sistemas de agua potable y alcantarillado (2 años hombre) y sería financiado íntegramente por el Banco.

VI. INFORMES

El contrato o contratos que se suscriban con los consultores deberán incluir la obligación de éstos de presentar, con copia al Banco, informes periódicos de progreso y un informe final que deberá ser entregado con las conclusiones y recomendaciones que fueren del caso, dentro del plazo del respectivo contrato.

VII. SUPERVISION

En el contrato o contratos que se suscriban con los consultores, se establecerá que la supervisión de los mismos podrá ejercerla el Banco por intermedio de su Representante Regional.

VIII. CONVENIO

El deudor conjuntamente con el agente administrador (CORPAGUAS) deberán suscribir un convenio con el Banco substancialmente en conformidad a este Plan de Operaciones. A su vez CORPAGUAS, en su carácter de agente administrador de los recursos del préstamo, deberá suscribir un convenio con los organismos respectivos de cada una de las ciudades.

Los recursos destinados a sufragar gastos de asistencia técnica forman parte del préstamo concedido para el programa de agua potable y alcantarillado de las ciudades de Cochabamba, Potosí y Santa Cruz y se sujetarán a las condiciones establecidas en el contrato de préstamo, en lo que se refiere a período de amortización, interés, moneda de pago, comisiones y período de desembolso.

El procedimiento para la selección de los consultores, la lista de las firmas, los respectivos términos de referencia y los contratos que hayan de suscribirse con los consultores, deberán ser sometidos a la aprobación previa del Banco, dentro de los tres meses a contar de la firma del convenio.

A solicitud de las entidades ejecutoras de los proyectos y de CORPAGUAS, el Banco podrá colaborar en la búsqueda de los consultores y, en casos especiales, cooperar en la elaboración de los respectivos contratos aunque sin asumir responsabilidad al respecto. Cada una de las entidades nombraría un coordinador para colaborar con los consultores y posteriormente, poner en práctica las recomendaciones.

En el convenio de asistencia técnica que se suscribirá, se establecerá que antes del primer desembolso, los ejecutores presentarán por intermedio de CORPAGUAS, el programa para la ejecución de la asistencia técnica en la respectiva ciudad y el presupuesto detallado correspondiente.

IX RESPONSABILIDAD EN EL BANCO

La responsabilidad básica para este Plan de Operaciones será de la División de Préstamos, Zona Sur, hasta la firma del convenio. Posteriormente, la responsabilidad básica para la ejecución del Plan pasará a la División de Administración de Préstamos. En ambas fases, la responsabilidad técnica corresponderá a la División de Análisis de Proyectos.

X. RECOMENDACION

El Gerente de Operaciones recomienda este Plan de Operaciones al Comité de Asistencia Técnica, para que de ser aprobado, el Presidente someta a consideración del Directorio Ejecutivo la correspondiente Resolución.

ANNEX I

TECHNICAL REPORT
WATER AND SEWER SYSTEMS FOR
COCHABAMBA, POTOSI AND SANTA CRUZ
IN BOLIVIA

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WATER AND SEWER SYSTEMS FOR 3 CITIES IN BOLIVIA
COCHABAMBA, POTOSI, SANTA CRUZ

SECTION I - RESUME, CONCLUSIONS AND RECOMMENDATIONS

1.01 Resumé

This program is to improve and extend the water supply system of Cochabamba, Potosí and Santa Cruz and the sewer system of Santa Cruz. It will take 4 years to carry out and will benefit approximately 270,000 people at a cost of US\$ 17.6 million.

- 1.01.1 The program will be executed by the 3 cities involved with the general supervision of the national water and sewer authority, Corporación Autónoma de Agua y Alcantarillado (CORPAGUAS).

- 1.01.2 For Cochabamba, the first stage of a 25-year master plan to expand and improve the water supply system will be carried out.

It consists of the development of surface sources requiring improvements to dams and existing intake facilities, new transmission lines to an existing treatment plant, the development of groundwater resources requiring the drilling of several wells, construction of pumping facilities, improvement of the existing treatment plant, improvement and extension of the distribution system, new storage reservoirs, water meters and house connections.

A municipal agency will be established to operate and administer the water and sewage systems.

It will require 4 years to build, cost US\$ 4.8 million and improve the service to approximately 100,000 people.

- 1.01.3 For Potosí, the first stage of a 25-year master plan will be carried out.

It consists of the improvement to low dams to provide increased storage of surface water, the building of new intakes and gravity supply lines, the construction of a new treatment plant, the repair of an existing tank and the building of 2 new storage tanks, and the extension and improvement of the distribution network, water meters and house connections.

In addition, a municipal agency will be established to execute the project and operate the system with adequate rates.

The project will take 4 years to carry out, cost approximately US\$ 1.84 million and benefit approximately 85,000 people.

- 1.01.4 For Santa Cruz, the second stage of a 25-year master plan for the improvement and extension of the water, sanitary sewer and storm sewer systems will be carried out.

The water supply system will benefit 100,000 people, take 3 years to execute and cost approximately US\$ 3.4 million. It consists of the drilling of deep wells, construction of a booster pumping station, chlorination facilities, finishing of storage tanks and the installation of a new distribution network, water meters and house connections.

- 1.01.5 The sewer system will benefit 92,000 people, take 4 years to execute and cost US\$ 7.6 million. It consists of the installation of house connections, street inlets, manholes, collectors and trunklines, pumping stations, a treatment plant, and outfalls and canals for final disposition of the effluent.

- 1.01.6 A municipal water and sewer agency will be established to administer and operate these systems.

1.02 Conclusions

It is concluded that:

- a) The overall supervision of the project for the government will be done by CORPAGUAS. This will include review of bid documents, award of bids and general inspection of the work.
- b) Each municipality will require the assistance of consulting engineers for certain parts of the design and final specifications.
- c) Technical assistance is needed to help the cities in establishing local municipal water and sewer agencies.
- d) Additional soil investigations are needed for the final design of earth dams for Potosí and Cochabamba.
- e) The design criteria and the plans for the storm sewers of Santa Cruz need to be reviewed by consultants.
- f) The services of consultants are needed to prepare suitable rate structures for each city.
- g) Agreements between CORPAGUAS and each municipality are needed defining the general supervision to be carried out and the responsibility of execution by the individual cities.
- h) The IDB supervision and control of the project through a project engineer is needed.

- i) CORPAGUAS is currently structuring its organization. Due to the important role which this organization will have in the direction, control and administration of the loan resources, it will be necessary to assure its efficient functioning. In connection with this aspect, the pertinent measures should be taken so that its administrative organization be established definitely, in accordance with the measures recommended in the technical assistance to be received pursuant to the contract with IDB.
- j) As the current potable water and sewer systems of the cities covered by the loan under consideration are based on organizations for a level of operations far below the objectives of the present project, it is necessary that each one of the three cities establish a local organization with autonomy in the management of its resources, and that it be responsible for all aspects related to water and sewerage.
- k) The financial analysis made of the forecasts of fund flows shows that the projects of Santa Cruz and Cochabamba produce deficits in most of the years analyzed. The potable water project for Potosí reflects a deficit in some years; however, positive balances result for the total of all the years analyzed.
- l) An analysis of the financial capacity of each of the three cities indicates that, with regard to the local contribution, the cities appear to be able to cover their regular obligations, and they should be in a position to provide for the covering of the cash deficit for the project amounts allocated in their budget for capital expenditures.

1.03 Recommendations

It is recommended that:

- 1) The cities of Cochabamba, Potosí and Santa Cruz establish water and sewer agencies to operate and administer the water and sewer systems and with adequate powers for the fixing, collecting and utilization of rates and charges.
- 2) The cities of Cochabamba, Potosí and Santa Cruz each sign agreements with CORPAGUAS, which delegate the authority for executing the project to the cities and their special agencies; establish the responsibility of the municipalities to provide funds and personnel to execute the works; and define the responsibility of CORPAGUAS to exercise general supervision of the project. The specific agreements should be submitted for the approval of IDB prior to the first disbursement for the construction of each system.

- 3) Prior to the first disbursement CORPAGUAS with the mutual consent of each city contract the services of consultants in the organization of water supply agencies, administration, accounting and personnel to help establish the most suitable water supply authority. The procedures for the selection, the list of consultants, the terms of reference and the contract to be signed shall be approved by the Bank. The cost of these services may be paid from the loan funds.
- 4) CORPAGUAS with the mutual consent of the cities hire experts to make rate studies. This will require among other things, a census and classification of users, properties and taxes. The procedures for the selection of the consultant, the list of consultants, the terms of reference and the contract shall be approved by the IDB. The cost of these services may be paid from the loan funds.
- 5) The IDB retain the services of a project engineer to exercise overall supervision and control of the project.
- 6) For the water systems, each city shall take the measures as may be necessary in the opinion of the Bank, to insure that the rates for the systems financed with the resources of the loan shall produce revenue sufficient to cover all the operating expenses of the respective systems, including proper provision for administration, operation, maintenance interest, depreciation and amortization of the non-depreciable items.
- 7) For the sewer systems, Santa Cruz shall take such measures as may be necessary in the opinion of the Bank, to ensure that the rates produce at least sufficient revenue to cover all operating expenses including proper provision for administration, operating, maintenance and interest and, to the extent possible, depreciation and amortization of non-depreciable items.
- 8) Prior to the first disbursement for the construction of any of the systems, CORPAGUAS shall submit to the satisfaction of the Bank the procedure which shall be utilized for providing the cities with the resources of the IDB loan and for collecting and administering the funds of the cities participating in the program, either generated by the operations of the project or derived from their other resources and which will be applied to loan amortization.
- 9) CORPAGUAS shall submit its financial statements certified by independent public auditors acceptable to the IDB, commencing with the statements for fiscal 1967.
- 10) CORPAGUAS shall keep separate accounts of the program. Prior to the first disbursement, the corresponding code of accounts and accounting procedures manual shall be submitted to the IDB for approval.

- 11) Within 18 months from the signing of the contract, the three cities shall have organized entities with autonomy in the administration of their resources, responsible for the operation of the water and sewer systems in all aspects.
- 12) The entities that shall construct or operate the water and sewer system in the three cities, shall keep separate accounts of the program, as well as submit their yearly financial statements certified by independent public accountants, as corresponds.
- 13) The loan contract shall establish the specific responsibility of the government to contribute the necessary amounts, if the local contribution can not be provided by the cities.
- 14) The loan contract shall contain the obligation of the local governments to provide the necessary amounts to cover any deficits that may arise.

SECTION II - TECHNICAL DISCUSSION OF THE BORROWER AND EXECUTING AGENCIES

2.01 Cochabamba Water System

The Municipality of Cochabamba operates the city water supply system. It is also responsible for the other public facilities such as zoning, the sewer system, streets, public markets and slaughter-houses.

The water and sewer systems are operated by the Municipality's Department of Water and Sewers consisting of a staff of 63 for the water and 13 for the sewer system.

2.01.1 Fees and Income of Cochabamba Water Supply

In 1966 an annual fee was charged, based on the assessed value of the property. The method was established over 20 years ago.

These fees amounted to US\$ 1.25 per year per connection and was paid into the general treasury.

2.02 Potosí Water System

The water supply system of Potosí is operated by the Junta Departamental de Obras Públicas. The Junta is also responsible for other public services.

The Junta income is derived from mining royalties and government subsidies. The present operation of the system needs to be improved. It will need the assistance of CORPAGUAS and consultants to execute the project.

2.02.1 Fees and Income of Potosí Water Supply

Potosí charges an annual fee in a similar way as Cochabamba. This fee is approximately US\$ 1.00 per connection per year.

2.03 Santa Cruz Water and Sewer System

The systems are operated by the Comité de Obras Públicas de Santa Cruz, an autarchic organization with 217 full time employees of which 28 are professionals.

It is governed by a board of directors and a president. The latter is appointed by the President of the Republic. The organization is divided into two main departments, administrative and technical.

The technical department is subdivided into paving, sewer, water supply, electricity, architecture and city planning and mechanical sections. It carries out the operation, maintenance and extension of these services.

The administrative department is subdivided into personnel, accounting, purchasing and warehousing sections.

2.03.1 Fees and Income for Santa Cruz Water and Sewer Systems

Since at present the sewer system has not reached a stage when it can be operated, the only charge is for the use of water. This charge is temporarily US\$ 12 per year per connection.

2.03.2 Administrative Capabilities

The organization is considered capable of executing the project.

At the present time it is paving the central areas in the city, and completing the first phase of the water systems.

The committee has also hired the firm of independent auditors to establish a new accounting system, reorganize the purchase, warehouse and supply systems and prepare the annual audit.

2.04 Description of Existing Installations and Facilities

2.04.1 Cochabamba Water System

There are two sources of water supplying the system: one of these consists of a series of small dams on a high plateau, 25 kilometers from the city; the other is from infiltration galleries and shallow wells.

The Escalerani Dam is an earth dam, rebuilt in March 1959.

Cala Cala Treatment Plant. This plant is located on the north side of the city. It was built in 1940 and consists of the following:

Sand trap	46.6 m2 x 1 m. deep
3 Sedimentation basins	215.0 m3 each
6 Rapid sand filters	20.0 m2 each
Clear well (2 compartments)	20.0 m2 each
Wash-water pumps - inoperable	
Elevated tank for wash-water	

The plant is in poor condition because of damage from ground settlement and lack of maintenance. Since the 2 wash-water pumps do not work, the filters are backwashed with water from the Tirani Infiltration Gallery.

The filter plant needs new mechanical and electrical equipment, control valves, new pumps, reconstruction of the filters, chlorination facilities and additional sedimentation capacity.

Tirani Infiltration Gallery. This is 2 kilometers north of the Cala Cala Treatment plant and provides wash-water for the filters. It was built in 1956 and consists of a tunnel 30 m. in length and 8 m. below ground.

The yield varies from 100,000 to 311,000 m3/year (3-10 l.p.s.). The water is conducted by 25 cm. diameter concrete pipe to an elevated tank of 185 m3 capacity at the plant.

Arocagua Wells. This source consists of 19 shallow wells and is located northeast of Cochabamba in the Sacaba Valley. The output varies between 0.5 - 3.7 million m3/year (15-20 l.p.s.). The water from the wells is brought to a collection chamber. These structures were built in 1926-1930.

Chunlara Infiltration Gallery. This is east of the wells. It consists of a tunnel 70 meters long and 5 meters below ground level and receives surface and groundwater. It produces 0.2 - 0.6 million m3/year (5-20 l.p.s.).

Water is conducted from the gallery by a 30 cm. concrete pipe 3.8 kilometers to the Arocagua collection chamber.

Conduction Lines. The capacity of these lines is 135 l.p.s.

These consist of two parallel lines that conduct the water from the Arocagua collection chamber to the San Pedro storage tank. One line is of steel, 25 cm. diameter, and the others of concrete, 30 cm. diameter.

Storage Capacity. The total capacity of the system is 10,200 m3, and consists of 2 masonry reservoirs:

	<u>Year Built</u>	<u>Design</u>	<u>Total Volume</u>
Cala Cala Clear Water Reservoir	1940	2 comp.	5,000 m3.
San Pedro Tank located on the east side of the city	1928	2 comp.	5,200 m3.

Distribution Network. The distribution network consists of approximately 80 kilometers of steel pipe which has suffered considerable damage from exterior and interior corrosion and consequently needs replacement. More than half of this pipe (58%) is of 2" diameter. The pipe ranges in size from 2-14" diameter.

The downstream face of the dam is eroded due to leakage. The estimated usable yield of this source is 1.35 million cubic meters per year.

The Toro Dam is a simple earth dam, rebuilt in 1953. It is estimated that this source produces 0.57 million cubic meters per year. The water from this dam flows into the Escalerani Dam.

The combined production is 1.92 million cubic meters per year.

The water is conducted from these dams in an open canal, 15.3 kilometers to the edge of the plateau where it is discharged into an unlined chute, 6.5 kilometers long.

The chute discharges into collection works at Tolapucru, to the Cala Cala Treatment Plant on the edge of the city.

The Tolapucru Collection Works. These consist of a bed of gravel, retaining structures and a sand trap. From here the water flows by gravity in a pipeline to the Cala Cala Treatment Plant, 12 kilometers.

Service Connections. The data submitted by the consultants shows numbers of house connections, as follows:

	<u>Quantity</u>	<u>People Served</u>
Water Service (with sewer)	5,455	54,550
Water Service only	4,526	45,260
Public Faucets	--	35,190

2.04.2 Potosí Water System

The city of Potosí grew from the mining of silver in the mountain on which it is built. Silver deposits were discovered in the Cerro Rico in 1545 and mining started shortly thereafter. In order to provide water for the mills, creeks as far as 20 kilometers away were dammed up.

To bring in a larger supply of water, additional low dams were built in 1573-1576, which are still in use today. The construction was done with a labor force of 20,000. These dams were repaired in 1613-1616 and then again in 1930-1936.

The present system consists of the following:

Source of Water

Chalviri Dam. This is an earth dam approximately 7.5 meters high with a storage capacity of 2,480,000 m³. The drainage area is 16.5 km².

San Sebastián Dam. This is an earth dam 7 meters high with a drainage area of 13 km². and a storage capacity of 288,000 m³. Due to leaks in the dam, little water has been obtained from this source since 1934.

San Ildefonso System of Dams. These dams have a total drainage area of 9.3 km². The main dam San Ildefonso has a storage capacity of 870,000 m³. and the secondary dams San Pablo and San Fernando have storage capacities 419,000 and 213,000 m³. respectively.

Aqueducts and Canals

Water is stored by the dams and by means of concrete pipelines and unlined canals, approximately 18 kilometers in length, is brought to the main storage tank of the city, Tanque Milner.

Storage

There are 3 storage tanks which are filled during the night and supply water to the distribution system during the day.

The water first flows into Tanque Milner which is 50 meters above the city (altitude of tank, 4,165 m. above sea level). The tank is of masonry, uncovered, and has a capacity of 3,000 m³. From this tank the water enters the distribution system and 2 other storage tanks, San Juan with a capacity of 500 m³. and San Cristóbal with a capacity of 250 m³.

Distribution System

The distribution system was built in 1939-1941 and serves 55% of the population (35,000 people approximately). There are approximately 31 kilometers of mostly steel pipe and some cast iron pipe in the network. The pipe is 2" to 10" in diameter with approximately 70% of 3" diameter.

There are 20 public faucets. There are no water meters and the number of house connections is unknown.

Consumption of Water

Since there is a shortage of water, it is rationed and only turned on from 8 a.m. to 4:30 p.m. in alternate zones of the city.

2.04.3 Santa Cruz Water and Sewer Systems

Prior to 1961 there was a small water system serving a limited area of the city. The water was obtained from shallow wells and distributed by public faucets and a few house connections.

In 1961, the Comité de Obras Públicas started the construction of a new water supply system for the city of Santa Cruz. A distribution network was built for the center of the city. An elevated tank of 1,000 m³ capacity and a ground storage tank, 10,000 m³ capacity, were built. Four deep wells were drilled in 1964 and 1965. Two of these wells are being used, providing 100 m³/hour.

Work on the system has been continuing and the distribution network extended to a length of approximately 84.6 kilometers to serve the area of the city bounded by the Avenida de Circunvalación Interna and to serve a population of 43,800 inhabitants. The pipe is of cast iron and ranges in size from 2" to 24" diameter. The cost of this work was US\$ 1.32 million.

To complete these works, the following needs to be done: finish the building for the horizontal pumps and install the pumps, electrical, mechanical and chlorinating equipment, connect the storage tanks to the mains of the distribution system, and finish elevated and ground tanks. This is estimated to cost US\$ 332,000.

As of February 1967 there were a total of 4,103 connections to the system.

Sewer System

In 1964, construction work was started on the first stage of the sanitary and storm sewers. The main outlet for the storm sewers, Canal Isuto to the Pirai River, has been excavated, and its sides are being protected.

Collectors and laterals are being laid in the central part of the city. There will be 33,886 m. of storm sewer lines and 40,921 m. of sanitary sewer lines. Catch basins for the storm sewers are being built. Branch lines for the house connections in the sanitary system are being installed simultaneously.

This first stage of the sewer system will serve a population of 41,000 people.

2.05 Technical Capacity of the Executing Agency

2.05.1 Cochabamba

The present organization will require assistance in carrying out the project. The staff is fully occupied operating the system under difficult conditions and a limited budget.

Under the present organization, the municipality would execute the project through its Engineering Services Division and its subordinate Department of Water and Sewer. This Department has a total of 75 workmen and semiprofessionals. It does not have a construction or inspection division. Its main functions are to operate and maintain the system.

The men in charge of the Engineering Services of the Municipality and its Water and Sewer Department are experienced. However, additional personnel for inspection and supervision of the contract work would be needed.

In addition, Cochabamba will require assistance in the preparation of final plans, specifications, and the review of bids.

2.05.2 Potosí

The city of Potosí will require assistance in the preparation of final plans, specifications, bidding documents, and award of bids. There are several local engineering firms that are capable of doing the final design work of the dams, supply lines, and distribution tanks. The design of the treatment plant is more complex and will require a specialist.

2.05.3 Santa Cruz

The Comité de Obras Públicas is considered capable of executing the project. It has already successfully carried out almost all of the first stage of the master plan.

It has hired a consulting engineering firm to revise the plans, specifications, rate studies and review the proposed organization of a local water and sewer authority to manage the system.

2.05.4 CORPAGUAS

The national water and sewer authority will exercise general supervision and provide general advisory services to the cities. It will assist each city in the review of plans, specifications and bid documents as determined in each city agreement, and the evaluation and award of bids and provide general guidelines in accordance with its charter.

It will, with the mutual consent of the cities, contract the consultants for the administrative and rate studies that are considered necessary under the technical assistance phases of the program.

It has a trained staff of 38 professionals with experience in the planning, design and construction of water systems as well as purchasing, supply and basic rate studies.

SECTION III-- OTHER SIMILAR WORK IN PROGRESS

3.01 Current Status and Technical Evaluation of Projects Previously Financed by IDB and Other Agencies with the Same Executing Agencies

- 3.01.1 Cochabamba contracted a consultant firm to complete the groundwater studies, evaluate the surface water studies, update the previous consultants' report and make recommendations concerning administration and rates.

The report was completed in June and provides additional information for the present project under consideration.

The funds for these services were obtained from the preinvestment funds managed by the Corporación Boliviana de Fomento (CBF). The cost of these services was \$ 170,000.

- 3.01.2 In Potosí, the city has gone ahead with repairs and improvements to the existing system and these are in accordance with the proposed project.

The work consists of repairs to dams, and the installation of supply lines from them. Measuring devices have also been installed at the dams and the Milner storage tank.

The access roads also have been repaired and a telephone has been installed to the Chalviri dam.

The cost of these works was US\$ 140,000.

- 3.01.3 In Santa Cruz the Public Works Committee has with its own funds retained the services of a consulting firm to review the plans and specifications for the water and sewer works, update the costs, and prepare final plans and documents. The cost of these services is US\$ 185,000, of which it is estimated that US\$ 60,000 is for water and US\$ 125,000 is for sewer.

The Committee has also purchased pipe for the main water lines of Stage 2, at a cost of US\$ 308,000 and awarded a contract for its installation at a cost of US\$ 160,000 in accordance with the laws of Bolivia and the standard requirements of the Bank. It has also done works on the second stage of the water system amounting to US\$ 340,000 and on the sewer system amounting to US\$ 100,000.

SECTION IV - TECHNICAL ANALYSIS OF THE PROGRAM

4.01 Technical Descriptions

The projects consist of the improvement of the water systems of Cochabamba, Potosí and water and sewer systems of Santa Cruz.

4.01.1 Cochabamba Water System

For this city, first stage works of a 25-year plan to improve the water supply of Cochabamba will be built to provide for the needs 15 years into the future.

It consists of the development of groundwater sources for additional water, improvement to the treatment plant and repair and extend the existing distribution system.

It will take 4 years to build, cost approximately US\$ 4.8 million and provide water for a future population of 190,000.

Improvement of Existing Sources

Escalerani Dam. It is proposed to raise the height of the Escalerani Dam 2 meters to obtain additional storage of 580,000 m³., which will bring the total storage to 1,930,000 m³. To stop the present dam from leaking it is proposed to install a row of piles upstream of the existing core-wall and enlarge the downstream face of the dam.

Canal and Supply Lines from Escalerani Dam to Cala Cala Treatment Plant. To reduce water losses in this canal, it will be lined and repaired with masonry.

Intake Works. A new intake will be built at Tolapucru and from it a new concrete pipeline to the Cala Cala Treatment Plant.

Cala Cala Treatment Plant. This plant requires extensive modifications and improvements as follows:

- 2 - Chemical dry feed machines for alum will be installed and a building built for housing them and chemical storage.
- 2 - Flash mixers and basins will be built.
- 2 - Coagulating basins with mechanical mixers.
- 2 - Settling tanks.
 - Rebuild filters.
 - New filter bottoms.
 - New sand and gravel.
 - New washwater troughs.
- 1 - Back wash pump for the filter.
- 1 - Chlorinator.
- 1 - Meter Reservoir.

Cala Cala Clear Water Reservoir. The bottom of this reservoir would be covered with a reinforced concrete layer. The arched ceiling of the tank would also be repaired in the same way and the top sealed with bitumastic covering.

Storage Tanks and Booster Pumping Station. At the existing storage tank San Pedro I, a booster pumping station would be built to raise the water to a higher level where a second tank will be located. This would provide higher pressure in the system.

The pump station will have a horizontal electric motor driven pumps capable of pumping 140 l.p.s. at a 22 m. head. It will include chlorination facilities.

A new storage tank San Pedro II will be constructed higher up the hill. It will consist of 2 compartments of 2,500 m³. each and have metering facilities.

Additional Sources

Wells. Four wells will be drilled and developed in the Quillacollo area to provide an average of 50 l.p.s. each for a total of 6.2 million m³/year. Deep well electric driven pumps will be installed. The water will be pumped from the wells to a booster station - Quillacollo Pumping Station.

The pumps will be supplied from a substation receiving power from an electric line from Cochabamba and standby generators at the Quillacollo Pumping Station.

Quillacollo Pumping Station. A building will be constructed large enough for the first and second stages. It will consist of room for pumps, standby electric generators, transformers and controls. Adjacent to the building there will be a 500 m³. pump well.

The mechanical-electrical equipment will be for the first stage and include the installation of horizontal electric motor driven pumps, control panel and meters, chlorinators, a diesel engine driven generator, a transformer, and a power line from Cochabamba to the pumping station.

Force Main Quillacollo-Cochabamba. A coated steel pipeline of 24" diameter will go from the pumping station to new storage tank at Coronilla hill in the center of the city. It will be provided with air relief and blow-off valves.

Coronilla Tank. The Coronilla Tank will be of reinforced concrete and a capacity of 8,000 m3.

Cala Cala High Zone. To serve the area higher than Cala Cala a booster pumping station at the existing San Pedro tank will be built and a new tank at a higher elevation to be called San Pedro II.

The water will be pumped to a tank of 400 m3. capacity at a suitable elevation.

Distribution Network

The distribution system will be repaired and extended by installing larger diameter pipes and replacing the corroded ones. It is planned to install approximately 70 kilometers of 4" to 27" pipe of asbestos cement, cast iron pipe, and steel pipe.

4.01.2 Potosí Water System

The works are the first stage of a 25-year master plan for improving the water supply system of the city of Potosí.

It will take 4 years to build, cost approximately US\$ 1.84 million, and provide water for a future population of 85,000.

Source

It consists in the improvement of the dams at Chalviri, San Sebastián and San Ildefonso, to provide 4.55 million m3. of storage as follows:

- Chalviri Dam - Water proof and increase the height of the dam approximately 10 meters; install flow meter in intake. Capacity 2.6 million m3.
- San Ildefonso System - Raise height of San Ildefonso Dam 2.65 m.; install flow meter in intake and rebuild supply canal. Capacity 1.95 million m3.
- San Sebastián System - Rebuild Muñiza Dam and intake works. Capacity 180,000 m3.

Total Storage - 4.73 million m³.

Transmission Lines

Chalviri Dam to Milner Reservoir. A supply conduit, 13 kilometers long, will be built from Chalviri Dam to a new treatment plant adjacent to Milner Reservoir, on the west side of the city. The conduit will be of concrete pipe 14" in diameter. To reduce its corrosiveness, the water will be treated in a lime contact tank at the dam.

San Sebastián System to Milner Reservoir. A new 16" diameter supply line will bring water directly from Muñiza Dam in the San Sebastián System to the new treatment plant near Milner Reservoir. It will have an average slope 1:100 and a capacity of 166 l.p.s.

Treatment Plant

The water will flow into the intake tank of the treatment plant. The plant will include mixing, flocculation, coagulation, sedimentation, filtration, chlorination and lime stabilization facilities. From the plant the water will flow to the Milner Reservoir.

Milner Reservoir and Storage Facilities

The present Milner Reservoir as well as the San Cristóbal and San Juan Storage Tanks will be repaired. In addition, two new storage tanks will be built. The capacity of these tanks will be as follows:

Milner Reservoir	3,000 m ³ .
San Cristóbal Tank	250 m ³ .
San Juan Tank	1,000 m ³ .
New Storage Tank	800 m ³ .
New Storage Tank	3,000 m ³ .

Total Storage 8,050 m³.

Distribution System

The distribution system will be improved and extended. Approximately 25 kilometers of 4 to 14" diameter and 75 kilometers of 3" pipe will be installed.

In addition, funds will be provided for approximately 3,000 house connections and water meters.

4.01.3 Santa Cruz Water and Sewer Systems

4.01.3. 1. Water System

These works are the second stage of the water and sewer program

for Santa Cruz.

It consists of the drilling of new deep wells, the completion of ground and elevated storage tanks, the installation of a booster station, distribution network and house connections with meters. It will take 3 years to carry out, cost US\$ 3.4 million, and will benefit approximately 90,000 people with capacity for a future population of 180,000.

Source

Additional deep wells will be drilled in the existing well field to a depth of approximately 100 meters and provided with electric motor driven pumps. Since this water is of good quality, no treatment other than chlorination will be required.

Transmission Lines

Pipelines from the wells to the ground storage will be installed with the necessary valves and accessories.

Storage Tanks

The existing 10,000 m³. ground storage tank and the 1,000 m³. elevated storage tank will be provided with the piping, painting and waterproofing necessary to put them into operation.

Pumping Station

A pumping station to raise the water from the ground storage tank to the elevated storage tank and to feed water into distribution network will be built. It will be provided with pumps, electrical-mechanical equipment, controls, chlorinators, storage, and office facilities.

Distribution System

The distribution system has been designed to be developed by stages in concentric areas. This project will extend the distribution system to the area between the inner and outer circumferential avenues and the barrios of Lazareto, Paria and Trompillo.

It will require the installation of 84.6 kms. of 3" to 20" pipe.

Provision has been made for financing 5,000 meters and house connections.

4.01.3. 2. Sewer System

These works represent the second stage of the sanitary and storm sewers for the city of Santa Cruz. They include house connections,

street inlets, laterals, collectors, manholes and special structures. interceptors, pumping stations, main discharge lines, treatment facilities, and outfalls and canals.

These will take 4 years to build, cost US\$ 7.6 million, benefit 90,000 people and provide for a future population of 180,000.

Because of a ridge dividing the city the storm water system will be divided into two areas to permit gravity operation. One area, the Pirai area, will drain through the Canal Isuto into the Pirai River and the other, the Cotoca Area, to a low area near the Cotoca Road where the water will infiltrate into the sandy soil.

In a similar manner as the storm sewer system, the sanitary sewer system will be divided into two areas. At the end of each area, the sewage will be collected in pump wells and pumped to an area near the Canal Isuto, where it will be adequately treated before final discharge into the Canal which leads to the Río Pirai.

Treatment is necessary because the Río Pirai dries up for several months.

The system consists of the following:

Street Inlets and House Connections

Storm water will drain from the properties by means of pipes or canals that pass under the sidewalks to the gutters. The water will flow in the gutters to catchbasins suitably located at street intersections and at a maximum distance of 45 meters. The catchbasins deliver the water into the collectors.

The sanitary sewage will be conducted from each property by a suitably sized pipe to the sanitary sewer line in the street.

Collection Network

The collectors will conduct the waste waters through manholes to the trunklines and canals.

The pipe will be of plain and reinforced concrete according to its size. In the storm sewer, where larger capacities are needed, twin lines may be used.

The storm sewers will require approximately 49 kilometers of collectors, interceptors and final lines of 10" to twin 60" diameter pipes. The sanitary sewers will require approximately 61 kilometers of 8" to 28" pipe.

The manholes, special structures, and inlet structures for each system will be built of brick and concrete.

Storm Water Ponding Basin

The storm water will pass through a ponding basin, the Laguna del Arenal within the city limits. The basin will serve to accumulate the peak flows of storm water for a gradual release. This storage permits the use of smaller pipelines and make a more economical system.

Isuto Canal

This canal was excavated 1961-1962 and needs to have the sides stabilized. It receives all the storm water in the area of the city which slopes towards the Pirai River, as well as the sanitary sewage of the entire city and conducts it to the river.

The Canal is 8 m. wide, has banks that slope 1:2, and is unlined. It has a grade of 2%.

The Cotoca Storm Water Canal

The storm from the other area of the city (Cotoca Area) flows into the Cotoca Canal which conducts the water to an infiltration area. The Canal is concrete lined, and approximately 4.2 kms. in length.

Pumping Stations for Sanitary Sewage

Two low lift pumping stations will be required; one to lift the sewage from the Cotoca Area into the Pirai Area; and the other, at the end of the Pirai Area, to deliver the total sewage into a pipeline leading to the treatment plant.

This pipeline will have a diameter of 52" and a length of 1.66 kms. and will conduct the sewage to the treatment plant. From the treatment plant the effluent will flow through a 48" line to the Isuto Canal.

Treatment Plant and Oxidation Ponds

The first consultants proposed and activated sludge plant to treat the sewage. This would require extensive electrical and mechanical and relatively high operating costs.

The consulting firm now employed by the Comité de Obras Públicas is studying the possibility of providing the necessary treatment by means of oxidation ponds, thus eliminating the proposed treatment plant.

4.02 Basis of Need for the Project

4.02.1 Cochabamba

The present supply of water is inadequate for the needs of the city of Cochabamba. The distribution system is of small diameter pipe that cannot transport the water in the quantities required. The pipes are corroded and leak badly. The water is of poor quality and dangerous to drink. Since the service is intermittent and the pipes leak, contaminated water is sucked into the system. Much of the city is not served by the system and is supplied by tank trucks or water vendors. In 1966 the inhabitants paid as much as \$B 2.0 for a 55 gallon drum of water (200 liters). This is equivalent to US\$ 3.00 per 1,000 gallons.

4.02.2 Potosí

The present amount of water reaching the city of Potosí is inadequate. It is rationed by areas and only supplied for a few hours a day. Approximately 50% of the city does not receive even this poor service and must obtain water from a few public faucets or purchase it from vendors.

4.02.3 Santa Cruz (Water System)

At the present time in Santa Cruz approximately 30% of the population is served by the first stage of the water system now under construction. The service is limited by the capacity of the wells and pumps. During hours of heavy usage, there is not enough water to meet the demands.

The rest of the population, must obtain its water from shallow wells, cisterns or vendors. This water is contaminated and dangerous to drink. The city is growing rapidly and needs an immediate solution to the water supply problem.

4.02.4 Santa Cruz (Sewer System)

Until 1964 the city of Santa Cruz had no storm water system or sanitary sewer system. Work has been started on these but the situation is still very serious. Domestic sewage is usually disposed of in soakage pits which are contaminating the ground water and constitute a health hazard. In the other cases the wastes are simply disposed on the surface of the ground, where it either filters into the ground or is flushed into the street during rainstorms.

Limited provisions for dealing with the storm water are being made in the works being built. In the majority of the city the water runs into the streets often flooding them. Heavy rainstorms producing a runoff of as much as 150 liters/sec/hectare, are frequent. The result is that some streets serve as natural drains and carry flows of water as much as 100 liters/sec (over 2 million gallons per day).

As a result, the houses are built at least one meter above street level. There is considerable erosion of the streets which are unpaved and in some instances it is so severe that the houses are in danger of caving in.

4.03 Design Criteria

4.03.1 Cochabamba

The design of the water system for Cochabamba was based on the "Plano Regulador General". This plan defines the future development of the city, population density and building heights.

Previous studies of the surface water sources and topographic data were used in the analysis of the amount of water available. Groundwater tests were conducted by consulting firms to determine the capacity of the aquifers and the best location for the well field.

Population

Based on various methods of analysis and the data from 6 censuses, the consultants have estimated the future population from 1965 as shown below:

<u>Year</u>	<u>Population</u>	<u>Rate of Increase in %</u>
1825	7,500	
1854	36,000	
1900	36,000	1.03
1935	52,500	4.14
1945 (*)	78,000	3.14
1960	124,000	
1965	140,000	
1970	157,000	
1975	170,000	
1980	198,000	
1985	222,000	
1990	250,000	

(*) From 1935 to 1945 the city area was extended, soldiers returned from the Chaco War, public facilities were provided and new roads to other areas were built.

Demand

The water requirements have been calculated considering the following distribution of usage:

Domestic	70%
Commercial and Industrial	10%
Water losses and Public usage	20%
	<hr/>
	100%

It was assumed that the average per capita demand will rise from 90 liters/day in 1965 to 165 liters/day in 1980. The maximum demand has been taken as 1.25 times the average demand.

4.03.2 Potosí

The consultants made a detailed review of the needs of the city of Potosí and a study of the existing and potential surface water sources and found them adequate.

Population

A census was made in 1965 by the city to determine the population and projections were made to estimate the future population. The results were as follows:

	<u>Census 1965</u>	<u>Year</u>	<u>Population</u>
		1900	20,900
		1929	28,000
		1938	37,000
		1950	45,800
Inhabitants	63,500	1965	63,500
Families	13,500	1970	70,200
Houses	6,900	1975	77,400
No. of Rooms	32,400	1980	85,500
		1985	94,500
		1990	104,000
		1995	115,000

From these projections it was estimated that Potosí would have a population of 85,500 in 1980 and 115,000 in 1995 and the systems was designed on this basis to be carried in several stages.

Demand

Average demands, taking into consideration domestic, industrial, commercial, public and leak consumption, were developed and the distribution of usage was 70% domestic, 15% public, and 15% waste.

It was assumed that the average per capita demand would increase from 90 liters per day in 1965 to 125 liters per day in 1980. The maximum demand was calculated as 1.25 the average daily demand.

Surface Water Supply

An extensive study was made of the hydrological characteristics of the water-sheds of the lakes to be used. Rainfall data was available for 20-year periods in some cases. The average rainfall in this area ranges from 340 mm. to 512 mm. per year (14" to 20"/year). It was estimated that the runoff coefficients ranges from 0 in the dry season to 0.5 in the rainy season and that the evaporation was as much as 4 mm. per day. A loss of 10% in transmission was also considered.

Based on this analysis, the consultants have estimated that 8,704,000 m3. per year of water were available annually or enough to supply the needs of Potosí until 1990. For 1980, amount of 5,600,000 m3. per year was needed and this could be obtained by improvements to dams to produce 4,300,000 m3. of storage capacity.

Quality

The water has been tested and is bacteriologically and chemically acceptable requiring only pH adjustment to protect the distribution system. During the rainy season the water becomes turbid and requires clarification and filtration.

4.03.3 Santa Cruz (Water)

The Santa Cruz water system is based on the development of ground-water sources. The wells that are being used for the present system (the first stage) are 180 meters deep and 14" and 10" in diameter. The lower 100 meters of pipe casing is of slotted pipe with a gravel pack instead of the more adequate filter screens with a gravel pack. The yield of these wells is 700 gpm and 1,000 gpm an excellent yield and the water quality is good.

Source

Additional wells will be drilled to obtain more water. These wells will be built in accordance with AWWA (American Water Works Association) specifications (properly selected filter screen and gravel, pack, protection of well, and correct sizing of pumps). Adequate groundwater reserves of good quality exist as proven by various pumping tests.

Population

In the last few years the population growth of Santa Cruz has exceeded all predictions and is now estimated at 100,000 people. The growth has been accelerated by the agricultural as well as the oil and gas developments. The effect of this population boom is to require enlargement of the system sooner than expected.

The following table shows how the population in 1966 exceeded the estimates for that year:

<u>Year</u>	<u>P O P U L A T I O N</u>	
	<u>Consultants Data and Estimates</u>	<u>Public Works Committee Data</u>
1900	18,300	
1914 (*)	16,000	
1922	20,600	
1943	37,500	
1950	42,500	
1956	50,200	
1965	70,000	
1966	72,500	100,000
1970	84,700	
1980	123,500	
1990	180,000	

(*) Population declined because of migration to rubber gathering areas.

Consumption

The system has been based on an estimated average domestic consumption of 140 l.p.c.d. in 1966 increasing to 200 l.p.c.d. in 1990. The maximum consumption was taken as twice these values. In addition to this there will be an industrial demand on the system equal to 15% of the total demand. The public usage has been estimated at 5% and leakage at 10%.

4.03.4 Santa Cruz (Sewer)

Velocities

The sanitary sewer system has been designed with a minimum velocity of 1.3 ft/sec. and a maximum velocity of 11.5 ft/sec. These velocities are in accordance with those generally employed. The minimum velocity generally used is 2 ft/sec. dropping to 1.5 ft/sec. if the pipe is very smoothly finished. Deposits may form in the pipe at low velocities and may cause clogging. The higher velocities may cause erosion of the pipe.

The storm sewers have been designed with the following velocities:

Minimum velocity (full flow)	: 2.6 ft/sec.
Minimum velocity (partial flow)	: 1.6 ft/sec.
Maximum velocity	: 10.0 ft/sec.

which are standard practice and acceptable.

Waste Water Volume

Sanitary. In order to calculate the collection network the maximum consumption for domestic and industrial use for 1990 was used. The waste water produced by homes with private wells and cisterns was also considered. Based on the population density and these flows, the quantity of waste water to be handled by the different parts of the system were estimated and the system designed accordingly.

Storm. Since rainfall intensity and runoff data for the city of Santa Cruz was not available, detailed studies made for the city of Corumbá on the Brazilian border were used as a guide.

The average annual rainfall in Santa Cruz, as recorded in 14 years of available data, is 54". A design storm with a 15 minute duration occurring twice a year was used. This is calculated as a rainfall of 2.4 inches per hour and results in a quantity of water equivalent to 166 lts/sec/hectare. Coefficients of runoff from 0.15 to 0.60 were used to calculate the runoff of the various areas entering different sections of the sewer system and these are acceptable. For this design storm the calculations showed a runoff of 7lm³/sec. for the Pirai Area and 21 m³/sec. for the Cotoca Area.

The general practice in the US is to design the storm water system on the basis of a storm occurring once every 5-15 years with an intensity that occurs during the time of concentration, which in this case is 15 minutes. The basic design of the system is being reviewed by the consulting firm.

Sewage Treatment

The Pirai River which receives the waste waters has a very low flow from June to September and cannot provide adequate treatment by dilution.

The original consultants proposed an activated sludge plant to provide a removal of 40% BOD (Biochemical Oxygen Demand).

The proposed treatment plant would consist of the following:

- Screens to remove trash and solids
- Comminutor
- Venturi Meter - 1,200 l.p.s.
- Aeration basins and air pumps, 2 at 600 l.p.s. (6 min. retention)
- Settling basins
- Digestion tank
- Sludge drying beds
- Operating house and shops

An alternate to this are oxidation ponds which are being studied by the Comité de Obras Públicas and the present consultants.

4.04 Status of Design

4.04.1 Cochabamba Water System

The design of the distribution system and a typical well are complete. Preliminary plans for the storage reservoirs, pumping stations, dams, force mains, power lines and treatment plant improvements are available. Final plans and specifications are required for these elements.

In addition, production wells must be drilled and tested to permit pump selection and final design of the well field collection system. A review of the rates and proposed organization was made by consultants in 1967.

4.04.2 Potosí Water Supply System

Plans are available for all parts of the system. Some soil borings are necessary to complete the information for final plans and specifications for the dams. Some additional design work is needed for the dams and storage tanks.

The majority of the works are of a standard civil engineering nature except the water treatment plant which requires special knowledge. A consultant will be needed to complete the plans for this.

4.04.3 Santa Cruz Water Supply and Sewer Systems

Plans for these are 90% complete. They are being reviewed and completed. They are being reviewed and completed by a consulting firm retained by the Committee. The additional plans and specifications required are being prepared by the Committee.

4.05 Review of Cost Estimates

The cost estimates for Cochabamba were revised in 1967 by the consulting firm in collaboration with the municipal engineers. An allowance of 10% has been made for contingencies.

The estimates for Potosí have been revised by the municipal engineers and are based on the original estimates made by the consultants and increased approximately 15%. A provision for contingencies of approximately 10% has been included.

The costs estimates for Santa Cruz have been revised by the Committee and its consultants. These costs include approximately 10% for contingencies.

The per capita costs range from US\$ 21.7 for Potosí to US\$ 68 for the sewer system of Santa Cruz. The cost for Potosí is lower because the work to be done consists essentially of extensions to the distribution system.

The costs for the sewer system appear to be higher, but are considered reasonable because they represent the largest part of the total future system which necessarily has to be built first.

<u>City</u>	<u>Cost of System</u>	<u>Population Benefitted</u>	<u>Cost per Person</u>
	US\$ million		US\$
Cochabamba	4.8	190,000	25.3
Potosí	1.84	85,000	21.7
Santa Cruz			
Water	3.4	92,000	37.0
Sewer (*)	7.6		68.0 (*)
		367,000	

(*) The sewer system will also serve industrial users with independent wells that represent an additional equivalent population of approximately 20,000.

4.06 Alternatives Considered

4.06.1 Cochabamba

The possibility of developing groundwater sources in the Punata and Sacaba Valleys was investigated, as was that of various surface sources for the city of Cochabamba. It was found that the most feasible source of new water was the groundwater near Quillacollo and that certain surface sources could be further developed.

It was decided to improve the present sources and develop additional sources near Quillacollo.

4.06.2 Potosí

Due to the location of this city, there are no other surface sources that can be as easily developed. A selection was made of the best lagoons to serve the city.

The groundwater resources of the area are unknown, but because of the local geological condition, the possibility of such a development is very remote. The only possible areas would require high pumping and consequently cannot compete with the gravity supply improvements planned.

4.06.3 Santa Cruz (Water)

In Santa Cruz the development of a surface source is not considered feasible. The closest rivers frequently dry up in the summer. Because of the topography there are no practicable storage sites.

The rivers with a year round flow are over 50 kilometers away and have highly turbid waters. The water from these sources would require extensive pumping, long lines, and a treatment plant.

An alternate to this is the construction of a battery of wells along the banks of the Pirai River which would derive their water by infiltration from the river. This water would also require treatment and pumping through a long line to the city.

The best quality source requiring the least treatment and pumping was the close to Santa Cruz.

4.06.4 Santa Cruz (Sewer)

As an alternate solution for removing the waste waters, a system of combined sewers was considered. This would have resulted in an estimated initial savings of 15% in the construction cost of the system. The combined system, however, would at certain times of the year (the rainy season) collect large quantities of water that could not be treated with a plant of adequate capacity for the average sanitary sewage flows. The excess waste water would overflow into the natural watercourses and cause contamination.

The separate system has the advantage of allowing independent expansion of each system, a more uniform degree of treatment, simpler design and construction, and lower operating costs. In view of the relatively low difference in costs and the greater technical advantages, it was decided to build the separate systems.

Under review by the consultants, is a reduction in the number of pumping stations and the feasibility of the use of oxidation ponds instead of an activated sludge treatment plant. If oxidation ponds are feasible, a very simple treatment installation can be made without any mechanical equipment.

4.07 Methods of Construction

The supply of materials and the construction of the major works will be by contracts, awarded through public bidding.

Although the prospective executing agencies propose to do some minor works by administration, such as dam repair and the installation of small pipelines, this is not considered advisable in the case of Potosí and Cochabamba because of the limited staffs.

There are no particularly complicated works to be built, except for the treatment plants and pumping stations. Due to the nature of the soil in Santa Cruz, the large diameter mains will have to be laid on special concrete bedding to prevent sinking.

4.08 Analysis of Rates and Charges

For the purposes of determining the estimated rates and charges, the consultants assumed that each system would have to be self-financing. The operating costs assumed by the consultants were based on proposed organizations which have been considered to be too large and expensive. These aspects have been reviewed, and the following assumptions made for the purposes of analysis:

Water Systems (*)

Domestic consumption : US\$ 0.057 - 0.07/m³ (US\$ 0.22 - 0.26/1000 gallons)
 Industrial consumption : US\$ 0.10/m³ (US\$ 0.38/1000 gallons)

Sewer Systems

Connection fee : US\$ 25.00
 Monthly rate/connection : US\$ 0.50
 Annual Tax : US\$ 0.04/meter fronting on sewer

(*) In Perú, typical rates for smaller towns are US\$ 0.04/m³ for domestic consumption and US\$ 0.11/m³ for industrial consumption.

For the average family of 5 people, these rates and charges would result in the following:

	Rate per m ³ . US\$	Consumption per Family m ³ /month	Monthly Charge	Annual Income	Equivalent Days Wages
Cochabamba	0.07	21	\$ 1.47	\$ 550	12.0
Potosí	0.065	20	\$ 1.30	\$ 525	11.0
Santa Cruz Water	0.057	31	\$ 1.72	\$ 600	12.4

The Santa Cruz sewer rates would result in an annual charge of \$ 7.00 per year.

4.09 Operation and Maintenance

A national decree was passed on July 12, 1967, to create an agency called Servicios Municipales de Agua Potable (SEMAPA) to eventually administer the water and sewer systems of Cochabamba. Similar agencies are needed for Potosí and Santa Cruz. Technical assistance furnished by consultants will be required for each city to develop the technical and administrative capabilities of these agencies.

The water systems will require different levels of operators due to the varying complexities of the facilities to be constructed. Cochabamba will have the most difficult problems in operation and maintenance because of the need for a treatment plant, deep well pumps, and a booster station, as well as the coordinated operation of the dam outlets.

Potosí will have a lesser problem because the simpler operation of a small treatment plant and dam outlets.

Santa Cruz is already operating a simple system supplied by wells without difficulty and the new system will basically add new wells.

The sewer system, however, will require a reliable cleaning program to prevent the forming of deposits that might obstruct the lines in sections where the grade is flat. The studies being made by the consulting firm include the selection of adequate equipment for this purpose. If the proposed sewage treatment plant can be avoided and replaced by oxidation ponds, the operating problems will be reduced to a minimum.

The present information concerning operating and maintenance indicates the following annual costs:

<u>City</u>	<u>Annual Cost in US\$</u>
Cochabamba	55,000
Potosí	2,500
Santa Cruz	60,000

Based on these costs, and an improved organization, and a detailed study of the consultants, estimates have been prepared for the future operation of these systems. The operating and administration costs are US\$ 15 per connection per year for Cochabamba, US\$ 10 per connection per year for Potosí, and US\$ 19 per connection per year for Santa Cruz (water and sewer) and are considered reasonable.

4.10 Future Expansion

4.10.1 Potosí

Based on an analysis of the available hydrological data and the feasible storage that can be developed, it is believed that the proposed sources can satisfy the needs of Potosí until 1995. The dams in this project have been built to provide for the estimated needs until 1980 at which time additional dams will be needed to increase the water supply. The canals and main distribution lines have adequate capacity for the future needs. The distribution system, treatment works and storage facilities can be expanded as needed.

4.10.2 Cochabamba

The Cochabamba surface sources have almost been developed to their maximum capacity. In the future, additional water will have to be obtained by the drilling of additional wells near the well field proposed for this project. The groundwater source in this area has been demonstrated by the consulting engineers to be ample to meet the needs of Cochabamba beyond 1990. The main supply line from this area, the pumping station, the wells, key elements of the distribution system, and the treatment have been designed for the needs of 1980 and to be expanded as needed.

4.10.3 Santa Cruz

The Santa Cruz water supply system can be expanded as needed by developing additional wells, adding more storage capacity and extending the distribution system. Pumping tests have indicated that there are extensive groundwater deposits to meet the future needs.

The sewer systems have had the outlet works and final collector designed for the future needs of the city based on population densities and the best hydrometeorological analyses. The systems can be extended as needed and the treatment works expanded as the city grows.

SECTION V - PROJECT EXECUTION

5.01 Proposed Construction Schedule

For Cochabamba it is planned to complete the well-drilling program, construct the improvements of the dams and complete the design for improving the Cala Cala Treatment Plant and the additional storage facilities during the first year.

During the latter part of the first year bids will be let for the supply lines, storage tanks, and distribution system. Work will continue on the improvements to the existing sources and intake works.

During the second year work will start on the supply lines, storage tanks and distribution system. Bids will be let on the treatment plant, auxiliary equipment and water meters. Installation of the meters will be coordinated with the improvements to the distribution system. It is expected that all work will be completed in 4 years.

In Potosí, soil borings will be done during the first year to facilitate the dam and treatment plant design. Plans and specifications should be completed during this year for all the works and construction started on the dams and canals. Bids for water meters, equipment and the distribution system will be let.

During the second year, construction will begin on the treatment plant and pipeline. Work on the dams be nearing completion. The metering program will be coordinated with the construction of the distribution system. All the work will be completed in 4 years.

In Santa Cruz, construction on the water system can start the first year since the materials have been ordered for the distribution system and contracts can be let for drilling the additional wells needed. Bids can also be let for the purchase of well pumps upon completion of the well drilling program; and for chlorinators, and auxiliary equipment.

Final plans and specifications for the sewer system outlet structures, main collectors, pumping stations and treatment facilities should be prepared during the first year. Construction can be done on the inlets, house connections, sewer laterals and local collectors.

Bids can be let the second year for the large diameter collectors, pumping stations, and outlet structures as well as continuing work on the laterals.

It is expected that the water system will be completed in 3 years and the sewer system in 4 years.

5.02 Proposed Schedule of Investments

The amount of funds required to execute the project is as follows:

	<u>I D B</u>	<u>Municipality</u>	<u>T o t a l</u>
	In US\$ 1,000		
Cochabamba	3,800	1,000	4,800
Potosí	1,400	440	1,840
Santa Cruz			
Water	2,000	1,400	3,400
Sewer	3,800	3,800	7,600
T o t a l	11,000	6,640	17,640

The cities are proposing to finance these projects from their revenues derived from mineral royalties, federal grants and their general income from taxes and fees. The investment program, therefore, is in accordance with their predicted availability of funds.

In US \$ 1,000

Years	1		2		3		4		T O T A L		
	IDB	MUN	IDB	MUN	IDB	MUN	IDB	MUN	IDB	MUN	Total
Cochabamba	1500	250	1000	250	800	250	500	250	3800	1000	4800
Potosí	350	210	400	70	300	80	350	80	1400	440	1840
Santa Cruz											
Water	900	400	600	500	500	500	- -	- -	2000	1400	3400
Sewer	1150	800	1000	1000	1000	1000	650	1000	3800	3800	7600

5.03 Plans and Procedures for Securing Contracts for Procurement, Construction, Materials and Supplies

The construction of the water and sewer system will be done by contract and administration.

All the major works will be done by contracts awarded through public bidding. The construction may be broken down into several contracts according to the materials and skills required or done in one contract.

In most cases the contractors will furnish materials in accordance with the specifications and in others the municipalities may find it advantageous to purchase the materials and contract their installation.

Certain minor works such as the installation of small pipelines in densely populated districts or the repair of existing canals and conduits may be done by administration.

5.04 Technical Assistance

5.04.1 Engineering Plans and Specifications

Cochabamba will require a limited amount of assistance by consultants in the execution of soils investigations and in the preparation of final plans and specifications for the improvements to the Cala Cala Treatment Plant, the well field collection system, booster pumping station, and the selection of pipe of material that can resist the corrosive nature of the soil. The cost of these services is estimated at US\$ 100,000.

Potosí will require the assistance of consultants for the preparation of final plans and specifications for the treatment plant, the execution of the soils investigations for the dams. The cost of these services is estimated at US\$ 60,000.

Santa Cruz has contracted the services of consultants to review the design of the sewers, determine the best method of sewage treatment, select adequate sewer maintenance equipment, make rate studies, and

prepare the final plans and specifications for the water and sewer system. This work is considered sufficient. The cost of these services is US\$ 185,000.

5.04.2 Administration and Rates

For each city, new water and sewer agencies to administer the systems will be created. Assistance by CORPAGUAS as well as special consultants in organization, finance, management and administration will be needed.

Rate structures adapted to the local needs and capabilities of each city are needed. The proposed rates are average figures and need to be adjusted for the different economic levels encountered within each city. Because of the relative lack of experience in this field of the people presently operating the systems, it is advisable to contract the services of consultants to set up this type of rate structure.

The three cities, therefore, will require assistance in organizing and developing their respective water and sewer authorities and carrying out the studies necessary for adequate rate structures. It is estimated that for the 4 systems, consultants working for a period of 2-man years will be required and will cost US\$ 60,000.

5.05 Control of Execution by the Executing Agency

The government of Bolivia will carry out its supervision and control of the project through CORPAGUAS.

CORPAGUAS, in accordance with its powers, will sign an agreement with each city delegating the responsibility for the execution of the project to a Municipal Water and Sewer Authority and establishing the necessary conditions according to the IDB loan contract. This agreement will also define the functions and responsibilities of each municipality and CORPAGUAS.

CORPAGUAS will supervise in a general way the development of the program, and assist the municipalities in the selection of consultants and award of bids. CORPAGUAS will carry out this work with its regular budget.

Each city will carry out its control and supervision of the project through its technical services assisted by its appropriate technical and financial departments.

The executing agency in each city will be the corresponding technical department which will proceed to the contracting of all major works.

5.06 Proposed Inspection and Supervision by the Bank

The Bank will carry out its supervision by means of a project engineer. The engineer will reside in La Paz where he will be in contact with CORPAGUAS.

He will review and approve all the plans, specifications, disbursement requests, bidding documents, award of bids, lists of goods and services, and construction works.

He will be responsible for the overall inspection and supervision of the water supply projects in the cities of Cochabamba, Potosí and the water and sewer systems in Santa Cruz. The estimated cost of his services will be US\$ 110,000.

5.07 Schedule of Financial Requirements

Based on the information presented in the feasibility reports of the consultants and the rates and operating costs derived thereof, a schedule of financial requirements for the systems in each city has been prepared and is shown in the following tables 5.07.1, 2, 3 and 4.

5.07.1 SCHEDULE OF FINANCIAL REQUIREMENTS FOR COCHABAMBA

Estimated Revenue and Operating Costs

Number of Connections	Annual Consumption (1000 m3)					Annual Revenue (US\$ 1000)			To Oper
						Commercial &			
	House	Industrial	Public Faucets	Leakage	Total	House	Industrial	Total	
	70%	10%	5%	15%	100%	(1)	(2)		
10.000	3720	532	265	798	5315	100	53	153	
10.500	3906	558	279	837	5580	126	56	182	
11.000	4092	585	293	876	5846	165	59	254	
11.500	4278	611	305	917	6111	285	61	246	
12.000	4464	638	318	956	6376	298	64	361	
12.500	4650	664	332	995	6641	310	66	376	
13.000	4836	690	344	1036	6906	322	69	391	
13.500	5022	716	358	1075	7171	335	72	406	
14.000	5208	743	371	1114	7436	347	74	422	
14.500	5394	770	385	1152	7701	359	77	437	

ted on connections with average of 1-1/2 families: year 1 - US\$ 10.00 per connection
 " 2 - " 12.00 " "
 " 3 - " 15.00 " "
 years 4-10 - US\$ 24.80 per connection

ted at US\$ 0.10 per m3.

tal operating costs for the system, excluding depreciations, have been estimated considering an increase and reasonable cost allowances.

5.07.2 SCHEDULE OF FINANCIAL REQUIREMENTS FOR POTOSI

Estimated Revenue and Operating Costs

Years	Number of House Connections	Annual Consumption (1000 m3)				Annual Revenue	Total
		House	Public Faucets	Leakage	Total	(US\$ 1000) (1)	Annual Oper- Costs (US\$) (2)
		70%	15%	15%	100%		
1	3000	1440	310	310	2060	8	25
2	3500	1680	360	360	2400	42	30
3	4000	1920	410	410	2740	100	35
4	4500	2160	460	460	3080	141	40
5	5000	2400	510	510	3420	157	50
6	5100	2450	520	520	3470	160	60
7	5200	2500	530	530	3060	163	60
8	5300	2540	540	540	3580	166	60
9	5400	2590	550	550	3600	170	60
10	5500	2640	560	560	3760	173	60

- 1) Estimated on connections with average of two families: year 1 - US\$ 2.50 per connection
" 2 - " 12.00 " "
" 3 - " 25.00 " "
years 4-10 - US\$31.40 per connection
- 2) The total operating costs for the system, excluding depreciation, have been estimated considering increased staff and reasonable cost allowances.

5.07.3 SCHEDULE OF FINANCIAL REQUIREMENTS FOR SANTA CRUZ (WATER)

ESTIMATED REVENUE AND OPERATING COSTS

(In US\$ 1,000)

ARS	No. House Connections	ANNUAL CONSUMPTION (1000 m3)					ANNUAL REVENUE			Total Operating Costs
		House	Commerce & Industry	Public Faucets	Leakage	Total	House	Commerce & Industry	Total	
		70%	15%	5%	10%		1/	2/		3/
1	5,000	235	50	17	33	335	60	60	120	8
2	6,500	306	66	22	44	438	117	78	195	12
3	8,000	376	83	28	55	544	192	96	288	17
4	9,500	447	96	32	64	639	257	114	371	18
5	11,000	517	111	37	74	739	297	132	429	20
6	11,500	541	115	38	77	771	311	138	449	22
7	12,000	564	121	40	81	806	325	144	469	24
8	12,500	588	126	42	84	840	339	150	489	26
9	13,000	611	131	44	87	873	353	156	509	28
0	13,500	635	137	46	91	909	367	162	529	30

1/ Estimated number of families per connection is 1 1/2. Year 1 : US\$ 12 per connection
Year 2 : US\$ 18 per connection
Year 3 : US\$ 24 per connection
Year 4-10 : US\$ 27 per connection

2/ Estimated at US\$ 0.10 per m3. 3/ See Chart 5.07.4

5.07.4

SCHEDULE OF FINANCIAL REQUIREMENTS FOR SANTA CRUZ SEWEREstimated Revenue and Operating Costs

in US\$ 1000

<u>Years</u>	<u>Number of House Connections</u>	<u>Connection Fees</u>	<u>Rates for Sanitary Sewer</u>	<u>Property Tax Storm Sewers</u>	<u>Total Annual Revenue</u>	<u>Total Ann Operating Co</u>
		(1)	(2)	(3)		(4)
1	2000	50	12	4	66	80
2	3000	25	18	6	49	120
3	4000	25	24	8	57	150
4	6000	50	36	12	98	180
5	8000	50	48	16	114	200
6	8000		48	16	64	220
7	8000		48	16	64	240
8	8000		48	16	64	260
9	8000		48	16	64	280
10	8000		48	16	64	300

1) Connection fee of \$ 25 is paid once.

2) The estimated annual charge for sanitary sewers is \$ 6.00 per connection.

3) An annual tax of US\$ 0.04 per front meter for the storm sewers.

4) This cost is operation and maintenance of the water and sewer systems. (See Chart 5.07.3)

5.08 LIST OF GOODS AND SERVICES5.08.1 COCHABAMBA

(in 1,000 US\$)					
		BID		Cochabamba	
		Total	Total	Foreign Costs	Local Costs
I.	Intake Works, Dams and Wells	680	580	365	215
II.	Supply Lines	880	880	570	310
III.	Treatment Facilities	150	150	100	50
IV.	Storage and Distribution	1,614	1,607	1,102	505
V.	Equipment	50			
VI.	Meters and House Connections	300	150	150	
VII.	Operating Capital	61			
VIII.	Consulting Engineers	285	15	15	
IX.	Inspection and Control	38	38	38	
X.	Interest and Service Charge during construction	262			
XI.	Contingencies	480	380	260	120
T O T A L		4,800	3,800	2,600	1,200

1/ Includes the equivalent of US\$ 170,000 for the payment of engineering slud.

5.08.2 POTOSI

(in 1000 US\$)

		BID			Potosi
		<u>Total</u>	<u>Total</u>	<u>Foreign Exchange</u>	<u>Local Costs</u>
I.	Dams and Intake Works	396	250		250 146 <u>1/</u>
II.	Supply Lines	240	170		170 70 <u>1/</u>
III.	Treatment Facilities	165	165	105	60
IV.	Storage and Distribution	526	526	486	40
V.	Equipment	30			30
VI.	Meters and House Connections	120	120	100	20
VII.	Working Capital	34			34
VIII.	Consulting Engineers	75	15	15	60
IX.	Inspection and Control	14	14	14	
X.	Interest and Service Charge during Construction	70			70
XI.	Contingencies	170	140	80	60 30
T O T A L		1,840	1,400	800	600 440

1/ This includes works already carried out with a combined value equivalent to US\$ 140,000 in Categories I and II.

5.08.3 SANTA CRUZ (Water)

(in 1000 US\$)

	<u>Total</u>	<u>BID</u>		<u>Sta. Cruz</u>	
		<u>Total</u>	<u>Foreign Exchange</u>	<u>Local Costs</u>	<u>Local Costs</u>
I. Well field	400	400	320	80	
II. Supply Lines	--	--	--	--	
III. Treatment Facilities	--	--	--	--	
IV. Storage and Distribution	2,015	1,225	1,060 <u>1/</u>	165	790 <u>2/</u>
V. Equipment	115				115
VI. Meters and House Connections	250	140	120	20	110
VII. Working Capital	92				92
VIII. Consulting Engineers	75	15	15		60 <u>3/</u>
IX. Inspection and Control	20	20	20		
X. Interest and Service Charge during Construction	93				93
XI. Contingencies	340	200	165	35	140
T O T A L	3,400	2,000	1,700	300	1,400

1/ Includes the cost of 20" cast iron pipe purchased by the Comité de Obras Públicas for the main distribution loop at a cost of US\$308,000.

2/ Includes the cost of the installation of the pipe in 1/ above at a cost of US\$160,000.

3/ Includes engineering services already contracted at a cost of US\$60,000.

5.08.4 SANTA CRUZ (Sewer)

(in 1000 US\$)

	<u>Total</u>	<u>BID</u>		<u>Sta. Cruz</u>	
		<u>Total</u>	<u>Foreign Exchange</u>	<u>Local Costs</u>	<u>Local Costs</u>
I. House Connections	200				200
II. Collector Network	5,586	2,767	2,477	290	2,821
III. Treatment Facilities	600	600	350	250	
IV. Equipment	50				50
V. Working Capital	25				25
VI. Consulting Engineers	140	15	15		125 ^{1/}
VII. Inspection and Control	38	38	38		
VIII. Interest and service charge during Construction	199				199
IX. Contingencies	760	380	320	60	380
T O T A L	7,600	3,800	3,200	600	3,800

^{1/} The services of consulting engineers have already been contracted at a cost of US\$ 125,000.

SECCION VI. ANALISIS FINANCIERO DEL PROGRAMA6.01 Enfoque del Informe Financiero

Considerando que el prestatario ha de ser la República de Bolivia y que el proyecto ha de ser ejecutado por las ciudades de Potosí, Cochabamba y Santa Cruz, con la supervisión general de la Corporación Autónoma de Agua y Alcantarillado, CORPAGUAS, la que deberá repagar al BID con los fondos que le pongan a su disposición las respectivas ciudades, se enfocó el informe con la siguiente ordenación de temas:

1. Revisión general de CORPAGUAS, organismo que actuará únicamente en su carácter de supervisor general del proyecto, canalizando y administrando los préstamos.
2. Análisis de los distintos proyectos en su aspecto financiero.
3. Estudio de la capacidad financiera de las distintas ciudades para hacer frente a las necesidades de fondos inherentes al proyecto.

6.02 CORPAGUAS

La ley del 8 de marzo de 1967 que creó CORPAGUAS, estableció una contribución del gobierno Central al presupuesto anual del organismo de hasta US\$ 292,000. Esta cifra se basó en las partidas presupuestales que tenía el anterior organismo del Ministerio de Salud Pública denominado "Administración Boliviana de Obras Sanitarias."

Dado lo reciente de su creación CORPAGUAS no ha cerrado aún su primer balance.

La comparación de los gastos reales para los primeros ocho meses y una estimación de los últimos cuatro meses de 1966 de la Administración Boliviana de Obras Sanitarias con el presupuesto de CORPAGUAS para 1967, es la siguiente:

(En Miles de US\$)				
	Administración Boliviana de Obras Sanitarias		CORPAGUAS	
	<u>1966</u>	<u>%</u>	<u>1967</u>	<u>%</u>
Sueldos y salarios (incluyendo leyes sociales)	100	37	109	37
Gastos Generales	82	30	96	34
Materiales y equipos para la construcción de sistemas de agua	88	33	83	29
Total	270	100	288	100

Aproximadamente el equivalente de US\$ 35,000 de la cifra que se muestra en el grupo de gastos generales se incurrieron en gastos de viajes.

El pequeño aumento de salarios y sueldos entre ambos años se debe principalmente al aumento de tres nuevos empleados, que elevó el total del personal a 38 en 1967. Puede verse que aproximadamente 1/3 del presupuesto está destinado para materiales y equipos para la construcción de sistemas de agua. El 20% del presupuesto para 1967 está respaldado por contribuciones de USAID. Este apoyo presupuestal se retirará en el año 1968.

Auditoría

La ley indica que la Contraloría General de la República ha de fiscalizar las transacciones financieras de CORPAGUAS y que el Director General del Presupuesto del Ministerio de Hacienda ha de controlar la preparación y realización del presupuesto del organismo.

Organización Contable

Los deberes específicos del departamento de contabilidad del organismo son:

- a) Mantener la contabilidad de los gastos y los ingresos presupuestales.
- b) Dar información sobre costos.
- c) Controlar inventarios.
- d) Solicitar cotizaciones a los proveedores de material de construcción y equipo y colocar las órdenes de compra.

Con motivo del préstamo del BID para sistemas de Agua Potable de 60 pueblos menores, (Préstamo 154/SF) CORPAGUAS se ha obligado a organizarse bajo la dirección de consultores aceptables al BID, contratar los servicios de auditores públicos independientes y estructurar un sistema eficiente de trabajo con los distintos sistemas de agua.

6.03 Aspectos Financieros de los Gobiernos Locales

Los gobiernos locales están representados por las Prefecturas Departamentales, las Municipalidades y los Comités Departamentales de Obras Públicas (estos últimos de creación opcional). Cada uno de estos organismos recibe apoyo del Gobierno Central a través del presupuesto General de la Nación.

En el caso que se estudia en este préstamo, existen Comités Departamentales de Obras Públicas para Potosí y para Santa Cruz, no así para la ciudad de Cochabamba. Los Comités Departamentales se crearon por ley el 19 de febrero de 1941, que determinó el establecimiento en cada capital de departamento de un organismo denominado "Junta de Obras Públicas", con la facultad de administrar, financiar y precautelar los recursos destinados por ley y disposiciones correspondientes a la atención y estudio de las obras fiscales que se realicen en la ciudad, así como de verificar el control y dirección técnicas de las mismas de acuerdo a sus necesidades. En el caso de Potosí y de Santa Cruz, podemos ver que todas las operaciones financieras en torno de la construcción de sistemas de agua y de alcantarillado giran justamente en torno de los Comités Departamentales de Obras Públicas y no de la Municipalidad de la ciudad, que por dicha ley ha quedado separada del establecimiento de los sistemas de agua. Por tal razón en dichas ciudades han de ser dichos Comités Departamentales de Obras Públicas los que han de ejecutar el préstamo.

Otro punto que es interesante considerar a los efectos del análisis financiero que sigue, es la ley del 8 de noviembre de 1960, que estableció que del total de los ingresos que percibe el Estado por concepto de regalías mineras se asigne un 6% como ingreso de carácter departamental, porcentaje que se considera como ingreso ordinario departamental. Posteriormente, la ley del 10 de febrero de 1967 elevó dicho porcentaje al 12%, manteniéndole el carácter de ingreso ordinario departamental. Además, en su Artículo Segundo dispuso que "el 50% de los fondos recaudados por concepto de esta ley en cada departamento, será destinado a la ejecución de proyectos específicos de agua potable, alcantarillado, pavimentación, energía eléctrica y obras de infra-estructura urbana", estableciéndose que estos recursos no podrán ser utilizados bajo ningún concepto en otras obras que las especificadas.

6.04 Pronóstico Financiero del Proyecto

A) Enfoque

A los efectos de realizar el pronóstico financiero del proyecto, hemos considerado necesario realizar tres pronósticos de estados de resultados y tres pronósticos de estados de movimiento de fondos (para la ciudad de Potosí, para la ciudad de Cochabamba y para la ciudad de Santa Cruz; comprendiendo éste el subproyecto de agua potable y el subproyecto de alcantarillado).

B) Los Supuestos Adoptados

Los supuestos adoptados para la realización de los pronósticos (aparte de los generales del préstamo), fueron los siguientes:

1. La depreciación se calculó de manera lineal, considerándose una vida útil de 50 años.
2. El capital de trabajo se tomó como equivalente a tres meses de ventas.

C) Realización

Sobre la base de esos principios, hemos realizado pronósticos de estados de resultados y de estados de movimientos de fondos que mostramos en los Anexos No. 001, 002 y 003.

D) Conclusiones

Los resultados a que hemos llegado en dichos estudios los hemos resumido en el cuadro que sigue:

PRONOSTICO DE RESULTADOS Y
PRONOSTICO DE MOVIMIENTO DE FONDOS
(Miles de US\$)

Años	Potosí (Agua)		Cochabamba (Agua)		Santa Cruz (Agua y Alcantar.)	
	Ingresos Netos	Saldo de Fondos	Ingresos Netos	Saldo de Fondos	Ingresos Netos	Saldo de Fondos
1	(17)	(17)	73	73	108	108
2	7	10	65	75	81	111
3	52	59	104	124	60	140
4	67	82	(4)	46	(12)	158
5	29	(4)	(11)	(124)	(49)	(124)
6	28	(2)	4	(84)	(90)	(138)
7	29	(1)	17	(71)	(82)	(143)
8	29	(1)	31	(57)	(74)	(135)
9	30	-	45	(43)	(64)	(125)
10	30	-	57	(31)	(58)	(119)
Total	284	126	381	(92)	(180)	(267)

Puede verse que:

- 1) Los ingresos netos son prácticamente favorables para los proyectos de Potosí y Cochabamba, en casi todo el período del estudio.

Los proyectos de Santa Cruz dan resultados negativos que se hacen menores con el correr de los años.

- 2) Los fondos en el pronóstico resultan positivos en el proyecto de Potosí aunque tiene años con saldos negativos. Existe déficit de fondos, en cambio, para los proyectos de Cochabamba y de Santa Cruz.

6.05 Análisis de la Capacidad Financiera de las Tres Ciudades en relación al Proyecto

a) La ciudad de Potosí

1. Administración

La Administración del Agua Potable se ha venido realizando hasta el presente directamente por la Municipalidad de Potosí, de manera rudimentaria.

A efectos de encauzar el buen desarrollo de la etapa de construcción y la posterior eficiente operacionalidad de los sistemas a construirse con los recursos del préstamo, por resolución 3/67 del 30 de marzo de 1967 la Junta Departamental de Obras Públicas de la Municipalidad de Potosí creó el Departamento de Aguas Potables, como dependencia de la Junta de Obras Públicas.

Tal solución, en cambio, no contempla la línea general para el tratamiento del problema del agua y alcantarillado que se encara para Bolivia. Se está recomendando, por lo tanto, la organización de una entidad local con autonomía en el manejo de sus recursos, que se encargue específicamente de los problemas de agua y alcantarillado para Potosí.

2. Información Financiera

La Municipalidad de Potosí no produce estados financieros. Presenta sí estados presupuestales.

3. Recursos

Los ingresos ordinarios de la Municipalidad de Potosí están formados fundamentalmente por los rubros Patentes, Impuesto al Consumo, Derechos Arancelarios y Retenciones sobre recaudaciones efectuadas para terceros. Complementan dichos ingresos, las entradas por concepto de participación en Regalías Mineras que el Comité de Obras Públicas ha venido recibiendo en sumas crecientes. (Recuérdese que la ley del 10 de febrero de 1967 aumentó la participación de los distritos productores del 6% al 12%).

Para 1966, la Resolución Suprema No. 13644 fijó el presupuesto del Comité de Obras Públicas de Potosí en Miles US\$ 542.1. Para 1967, el presupuesto del Comité de Obras Públicas, según el Decreto Supremo No. 07923, del 14 de febrero de 1967, es de Miles US\$ 346.3.

4. Capacidad Financiera para Atender las Necesidades del Proyecto

Según el pronóstico de Movimiento de Fondos realizado, las sumas que necesitará el Comité Departamental de Obras Públicas de Potosí, en los años más difíciles, son las siguientes:

<u>Necesidades de Fondos para el Proyecto</u>			
(Miles de US\$)			
<u>Año</u>	<u>Aporte Local</u>	<u>Necesidades del Cash-Flow</u>	<u>Total</u>
1	210	17	227
2	70	(10)	60
3	80	(59)	21
4	80	(82)	(2)

Teniendo en cuenta que del proyecto ya se han realizado obras por Miles US\$ 140, a imputarse al aporte local, no vemos que Potosí tenga dificultades para hacer frente a las necesidades financieras que se han de derivar del proyecto. (Durante el período de operación los déficits de Caja previstos son de muy poca significación).

b) La ciudad de Cochabamba

1. Administración

En el año 1950, la operación del servicio de agua potable pasó de la Prefectura de Cochabamba a la Municipalidad de Cochabamba. La Municipalidad ha constituido el Departamento de Aguas Potables y Alcantarillados dependiente del Servicio de Ingeniería de la Municipalidad.

La organización del Departamento es incipiente. El volumen de las operaciones de Agua Potable es muy limitado (Miles US\$ 60 anuales de ingresos).

Los ingresos totales alcanzan a cubrir el 94% de los egresos del Departamento (en su Sección Agua Potable). La composición de los ingresos es aproximadamente la siguiente:

Venta de agua	18 %
Conexiones	4 %
Participación en impuestos	73 %
Otros	5 %
Total	<u>100 %</u>

Es decir, que se está ante un servicio que opera a pleno déficit. Sin embargo en el Estado de Resultados del Departamento de Agua Potable se reduce fuertemente la influencia de dicho déficit por la importancia que en los ingresos tienen los impuestos.

Dado que el proyecto sobrepasa en amplitud las condiciones en que actualmente opera el Departamento de Agua Potable y Alcantarillado, se está recomendando una completa reorganización del mismo, mediante el establecimiento de un servicio local con completa autonomía en el manejo de sus recursos.

2. Información Financiera

La Municipalidad de Cochabamba no produce estados financieros. Presenta sí estados presupuestales que han sido analizados.

3. Recursos

La evolución de los resultados de ejecución presupuestal de la Municipalidad es la siguiente:

	<u>Ingresos</u> <u>Miles US\$</u>	<u>Egresos</u> <u>Miles US\$</u>	<u>Saldo</u> <u>Miles US\$</u>
1962	1.267.6	1.267.1	0.5
1963	1.421.7	1.395.0	26.7
1964	1.522.8	1.541.1	(18.3)
1965	1.663.4	1.534.5	128.9
1966	1.722.6 (1)	(2)	

(1) Cifra sujeta a ajuste.

(2) Aún no se recibió la información correspondiente.

El presupuesto para el año 1966 fue el que sigue:

PRESUPUESTO DE INGRESOS Y EGRESOS

<u>Ingresos (1)</u>	<u>Miles</u> <u>US\$</u>	<u>%</u>	<u>Egresos</u>	<u>Miles</u> <u>US\$</u>	<u>Miles</u> <u>US\$</u>	<u>%</u>	<u>%</u>
<u>Recursos Or-</u> <u>dinarios</u>	1.231.4	66.2	<u>Recursos Or-</u> <u>dinarios</u>				
<u>Recursos con</u> <u>destino espe-</u> <u>cial (Préstas-</u> <u>mos recibidos)</u>	182.4	9.8	<u>Personal</u>	693.1		56.3	
<u>Recursos (par-</u> <u>ticipación en</u> <u>impuestos, fun-</u> <u>damentalmente)</u> <u>con destino a</u> <u>diversas enti-</u> <u>dades</u>	446.7	24.0	<u>Obligaciones</u> <u>gestiones an-</u> <u>teriores</u>	87.4		7.1	
			<u>Gastos Generales</u>	193.7		15.8	
			<u>Realizaciones</u> <u>y mant.Obras</u>	214.4		17.4	
			<u>Otros</u>	<u>42.8</u>	1.231.4	3.4	66.2
			<u>Destinos espe-</u> <u>ciales (Estudios</u> <u>Agua Potable)</u>		182.4		9.8
			<u>Entidades diversas</u>		<u>446.7</u>		<u>24.0</u>
	<u>1.860.5</u>	<u>100.0</u>			<u>1.860.5</u>	<u>100.0</u>	<u>100.0</u>

(1) Incluyendo remanentes de ejercicios anteriores.

Los recursos ordinarios están compuestos fundamentalmente por los siguientes rubros: Ingresos del Dominio Municipal (15.3%); Servicios, Tasas y Derechos (6.7%); Impuestos y Patentes (42.3%); Diversos Ingresos (23.5%); Otros (12.2%).

Nótese que Cochabamba no se beneficia de la ley de regalías, fuerte fuente de ingresos para las otras ciudades en estudio.

La partida presupuestal con que cuenta la Municipalidad de Cochabamba para el año 1967, según ley del 14 de febrero de 1967, es la suma de Miles US\$ 1.637.4.

4. Capacidad Financiera para Atender las Necesidades del Proyecto

Según el pronóstico de movimiento de fondos que hemos realizado, las necesidades financieras de Cochabamba en el período de construcción del proyecto han de ser las siguientes:

Necesidades de Fondos del Proyecto
(Miles de US\$)

<u>Año</u>	<u>Aporte Local</u>	<u>Necesidades del Cash-Flow</u>	<u>Total</u>
1	250	(73)	177
2	250	(75)	175
3	250	(124)	126
4	250	(46)	204

Para hacer frente a estas obligaciones, la Municipalidad de Cochabamba cuenta con las partidas que regularmente se aplican a Realización y Mantenimiento de Obras, Miles US\$ 214.4 en 1966 en la parte a destinar para obras nuevas.

Consideramos que con las partidas que normalmente cuenta la Municipalidad dispondrá de los fondos necesarios para enfrentar satisfactoriamente el proyecto en el plano financiero.

Los déficits de Caja en el período de operación, derivados del repago al BID (el pronóstico del Estado de Resultados es favorable) podrán atenderse por la Municipalidad destinando parte del rubro para nuevas obras, a la amortización del préstamo BID.

c) La ciudad de Santa Cruz1. Administración

En el Comité de Obras Públicas de Santa Cruz, el "Alcantarillado" como "Agua Potable" son Departamentos separados que dependen directamente de la Vice-Presidencia encargada del Departamento Técnico.

El sistema de agua potable recién está operando en forma provisional, aunque regularmente desde fines de 1966. Hasta la fecha, hay poco más de 4.000 conexiones domiciliarias de agua potable. Se ha empezado a cobrar, desde enero de 1967, una tarifa que se espera sea capaz de equilibrar los gastos de operación y mantenimiento.

Una firma de auditores independientes reconocida internacionalmente, desde fines de 1966 está asesorando al Comité en los siguientes servicios:

- a) Implantación de un nuevo sistema contable, que ya está en funcionamiento.
- b) Reorganización de los sistemas de adquisiciones, almacenes y control de haberes.
- c) Auditoría.

El Servicio Civil del Ministerio de Hacienda con el asesoramiento de Técnicos de USAID (Bolivia), está cooperando en la organización de un sistema de administración de personal.

La firma de consultores que ha estudiado el proyecto ha recomendado, sin embargo, que para Santa Cruz se reorganice el sistema de agua potable y alcantarillado sobre la base de un organismo autárquico, local, independiente del Comité de Obras Públicas. Sin embargo dadas las condiciones del país, se ha creído más conveniente la organización de una entidad local con autonomía en el manejo de sus recursos.

2. Información Financiera

El Comité de Obras Públicas de Santa Cruz no produce estados financieros. Presenta sí estados presupuestales que han sido estudiados.

3. Recursos

Los ingresos anuales del Comité son del orden de los Miles US\$ 3,000. La fuente fundamental de ingresos está en los ingresos de las exportaciones de petróleo de The Bolivian Gulf Oil Company, que comenzarán en agosto de 1966.

PRESUFUESTOS DEL COMITE DE OBRAS PUBLICAS (SANTA CRUZ)

		<u>1966 (1)</u>		<u>1967 (2)</u>				<u>1966 (1)</u>		<u>1967 (2)</u>	
		<u>Miles</u>		<u>Miles</u>				<u>Miles</u>		<u>Miles</u>	
		<u>US\$</u>	<u>%</u>	<u>US\$</u>	<u>%</u>			<u>US\$</u>	<u>%</u>	<u>US\$</u>	<u>%</u>
Ingresos Co-						Gastos Co-					
rrrientes	1.456.1	61	2.202.2	72		rrrientes	524.9	22	1.214.8	40	
Operación											
(Ventas,											
Bienes y											
Servicios)	31.3	1	41.7	1		Operación	193.4	8	925.2	30	
Tributa-											
rios (Re-						Transfe-					
galías)	1.080.8	45	1.807.2	59		rencias	327.4	14	285.4	10	
Transfe-											
rencias											
(part.en											
imp.)	344.0	15	353.3	12		Otros	4.1		4.2		
Ingresos											
de Capital	923.4	39	863.0	28		Gastos de					
						Capital	1.871.1	78	1.850.4	60	
Préstamos											
obtenidos	923.4	39	863.0	28		Nuevas const.,					
						etc.	1.732.1	72	1.422.5	46	
						Amortiz.	139.3	6	427.9	14	
TOTAL	2.379.5	100	3.065.2	100		Total	2.396.3	100	3.065.2	100	

(1) Cifras de ejecución presupuestaria.

(2) Cifras de presupuesto.

A través de las cifras se nota en el presupuesto para 1967 un fuerte superávit en las operaciones corrientes que el Comité de Obras Públicas piensa aplicar para financiar gastos de capital (Miles US\$ 987.4). Dicha cifra en 1966 alcanzó a Miles US\$ 931.2.

El Comité de Obras Públicas de Santa Cruz, para el año 1966, contó con un presupuesto de Miles US\$ 2.379.5.

El presupuesto para 1967 del Comité Departamental de Obras Públicas de Santa Cruz es de Miles US\$ 3.065.2, es decir Miles US\$ 685.7 más que en 1966.

4. Capacidad Financiera para Atender las Necesidades del Proyecto

Según el pronóstico de movimiento de fondos que hemos realizado, las necesidades financieras mayores de Santa Cruz en el proyecto han de ser las siguientes:

Necesidades de Fondos del Proyecto

<u>Año</u>	<u>Aporte Local</u>	<u>Necesidades del cash-flow</u>	<u>Total</u>
1	1.200	(108)	1.092
2	1.500	(111)	1.389
3	1.500	(140)	1.360
4	1.000	(158)	842

Creemos que Santa Cruz ha de poder atender adecuadamente las necesidades financieras que se derivan del programa, considerando:

- 1) Que existen las siguientes inversiones ya realizadas que han de afectarse al aporte local:

	<u>Miles US\$</u>
Tubería de hierro fundido adquirido en Brasil	308
Consultorías	185
Inversiones proyecto agua potable	500
Inversiones proyecto alcantarillado	100
Total	<u>1.093</u>

- 2) Que las fuentes propias de financiación en los últimos años han estado cercanas a los Miles US\$ 1.000 y que las inversiones en obras, construcciones, etc., han estado situadas en el orden de los Miles US\$ 1.500.
- 3) Los mayores ingresos que han de derivarse de las operaciones de The Bolivian Gulf Oil Company.

PRONOSTICO DE ESTADO DE RESULTADOS Y DE MOVIMIENTO DE FONDOS DEL PROYECTO

C O C H A B A M B A
(miles US\$)

	1er. Año	2do. Año	3er. Año	4o. Año	5o. Año	6o. Año	7o. Año	8o. Año	9o. Año	10o. Año
<u>Estado de Resultados</u>										
<u>Ingresos</u>										
Ingresos de explotación	153	182	254	246	361	376	391	406	422	437
<u>TOTAL INGRESOS</u>	<u>153</u>	<u>182</u>	<u>254</u>	<u>246</u>	<u>361</u>	<u>376</u>	<u>391</u>	<u>406</u>	<u>422</u>	<u>437</u>
<u>Gastos</u>										
Ac. Mant. y Admin.	80	100	120	150	163	169	176	183	190	198
Depreciación	-	10	20	50	96	96	96	96	96	96
Intereses	-	7	10	50	113	107	102	96	91	86
<u>TOTAL DE GASTOS</u>	<u>80</u>	<u>117</u>	<u>150</u>	<u>250</u>	<u>372</u>	<u>372</u>	<u>374</u>	<u>375</u>	<u>377</u>	<u>380</u>
<u>RESULTADOS</u>	<u>73</u>	<u>65</u>	<u>104</u>	<u>(4)</u>	<u>(11)</u>	<u>4</u>	<u>17</u>	<u>31</u>	<u>45</u>	<u>57</u>
<u>Estado de Movimiento de Fondos</u>										
<u>Resultados</u>	73	65	104	(4)	(11)	4	17	31	45	57
Depreciación	-	10	20	50	96	96	96	96	96	96
Costo BID	1.500	1.000	800	500	-	-	-	-	-	-
Costo local	250	250	250	250	-	-	-	-	-	-
<u>TOTAL DE INGRESOS</u>	<u>1.823</u>	<u>1.325</u>	<u>1.174</u>	<u>796</u>	<u>85</u>	<u>100</u>	<u>113</u>	<u>127</u>	<u>141</u>	<u>153</u>
<u>Gastos</u>										
Construcción e Ingeniería	1.650	1.160	933	681	-	-	-	-	-	-
Atención Técnica	5	5	3	2	-	-	-	-	-	-
Control BID	10	10	10	8	-	-	-	-	-	-
Costo de trabajo inicial	38	7	18	(2)	-	-	-	-	-	-
Intereses período constr.	34	60	83	60	-	-	-	-	-	-
Asignación de compromiso	13	8	3	1	-	-	-	-	-	-
<u>TOTAL</u>	<u>1.750</u>	<u>1.250</u>	<u>1.050</u>	<u>750</u>						
Costo de trabajo	-	-	-	-	29	4	4	4	4	4
Capitalización BID	-	-	-	-	180	180	180	180	180	180
<u>TOTAL DE EGRESOS</u>	<u>1.750</u>	<u>1.250</u>	<u>1.050</u>	<u>750</u>	<u>209</u>	<u>184</u>	<u>184</u>	<u>184</u>	<u>184</u>	<u>184</u>
<u>Saldo</u>	<u>73</u>	<u>75</u>	<u>124</u>	<u>46</u>	<u>(124)</u>	<u>(84)</u>	<u>(71)</u>	<u>(57)</u>	<u>(43)</u>	<u>(31)</u>
<u>Saldo ACUMULADO</u>	<u>73</u>	<u>148</u>	<u>272</u>	<u>318</u>	<u>194</u>	<u>110</u>	<u>39</u>	<u>(18)</u>	<u>(61)</u>	<u>(92)</u>

PRONOSTICO DE ESTADO DE RESULTADOS Y MOVIMIENTO DE FONDOS DEL PROYECTO

P O T O S I
(miles US\$)

	1er. Año	2do. Año	3er. Año	4o. Año	5o. Año	6o. Año	7o. Año	8o. Año	9o. Año	10o. Año
<u>Resultados</u>										
Costos de explotación	8	42	100	141	157	160	163	166	170	173
	8	42	100	141	157	160	163	166	170	173
Mant. y Admin.	25	30	35	40	50	55	60	65	70	75
Explotación	-	3	7	15	37	37	37	37	37	37
Industria	-	2	6	19	41	40	37	35	33	31
DE GASTOS	25	35	48	74	128	132	134	137	140	143
INGRESOS	(17)	7	52	67	29	28	29	29	30	30
<u>Movimiento de Fondos</u>										
Costos	(17)	7	52	67	29	28	29	29	30	30
Explotación	-	3	7	15	37	37	37	37	37	37
Costo BID	350	400	300	350	-	-	-	-	-	-
Local	210	70	80	80	-	-	-	-	-	-
INGRESOS	543	480	439	512	66	65	66	66	67	67
Explotación e Ingeniería	536	443	334	394	-	-	-	-	-	-
Industria Técnica	4	4	4	3	-	-	-	-	-	-
BID	4	4	3	3	-	-	-	-	-	-
Trabajo inicial	2	8	14	10	-	-	-	-	-	-
Costos durante construc.	8	7	23	20	-	-	-	-	-	-
Costo de compromiso	6	4	2	-	-	-	-	-	-	-
Local	560	470	380	430	-	-	-	-	-	-
Costo de trabajo	-	-	-	-	4	1	1	1	1	1
Explotación BID	-	-	-	-	66	66	66	66	66	66
INGRESOS	560	470	380	430	70	67	67	67	67	67
	(17)	10	59	82	(4)	(2)	(1)	(1)	-	-
CUMULADO	(17)	(7)	52	134	130	128	127	126	126	126

PRONOSTICO DE ESTADO DE RESULTADOS Y DE MOVIMIENTO DE FONDOS DE LOS PROYECTOS
SANTA CRUZ (AGUA Y ALCANTARILLADO)
(miles US\$)

	1er. Año	2do. Año	3er. Año	4o. Año	5o. Año	6o. Año	7o. Año	8o. Año	9o. Año	10o. Año
<u>Resultados</u>										
Agua	120	195	288	370	429	449	469	489	509	529
Alcantarillado	68	49	57	98	115	64	64	64	64	64
INGRESOS	188	244	345	468	544	513	533	553	573	593
Int. y Adm.	80	120	150	180	200	220	240	260	280	300
ciación	-	30	80	170	220	220	220	220	220	220
s	-	13	55	130	173	163	155	147	137	131
EGRESOS	80	163	285	480	593	603	615	627	637	651
OS	108	881	60	(12)	(49)	(90)	(82)	(74)	(64)	(58)
<u>Movimiento de Fondos</u>										
os	108	81	60	(12)	(49)	(90)	(82)	(74)	(64)	(58)
ciación	-	30	80	170	220	220	220	220	220	220
BID	2.050	1.600	1.500	650	-	-	-	-	-	-
local	1.200	1.500	1.500	1.000	-	-	-	-	-	-
INGRESOS	3.358	3.211	3.140	1.808	171	130	138	146	156	162
e Ingeniería	3.109	2.969	2.857	1.568	-	-	-	-	-	-
ia Técnica	9	9	7	5	-	-	-	-	-	-
BID	18	17	17	6	-	-	-	-	-	-
de trabajo inicial	47	14	25	31	-	-	-	-	-	-
s período constr.	46	79	88	39	-	-	-	-	-	-
de compromiso	21	12	6	1	-	-	-	-	-	-
	3.250	3.100	3.000	1.650						
de trabajo					19	(8)	5	5	5	5
ciación BID					276	276	276	276	276	276
EGRESOS	3.250	3.100	3.000	1.650	295	268	281	281	281	281
	108	111	140	158	(124)	(138)	(143)	(135)	(125)	(119)
UMULADO	108	219	359	517	393	255	112	(23)	(148)	(267)

INFORME ECONOMICOPROYECTO DE PRESTAMO PARA AGUA POTABLE Y ALCANTARILLADO EN
COCHABAMBA, POTOSI Y SANTA CRUZ DE LA SIERRAAntecedentes

Bolivia tiene una población estimada en 4.5 millones de habitantes ^{1/} de la cual se considera a 1.4 millones como población urbana. Las ciudades de Cochabamba, Santa Cruz de la Sierra y Potosí tienen alrededor de 300.000 habitantes, cifra que representa poco más del 20% de la población urbana del país.

Las condiciones socio-económicas generales de vida son bastante desfavorables. El PIB por persona del país se calculaba en sólo US\$ 112 ^{2/} en 1966, aunque los centros urbanos, especialmente La Paz, registran una cifra superior al promedio. La tasa de alfabetismo es una de las más bajas en Latinoamérica, alcanzando solamente el 37% en 1964. Así también, en 1961-63 la dieta promedio contenía 1810 calorías y 47.3 gramos de proteínas diarias, cifras que son inferiores en cerca del 30% a los mínimos señalados por la FAO.

Según otros índices nacionales, la tasa de mortalidad era de 98 por 1.000 nacidos vivos y la expectativa de vida era de solamente 50 años en 1966. La mortalidad infantil ha disminuído notablemente pero aún sigue siendo una de las más altas de Latinoamérica.

Se destaca el hecho que apenas 14.5% de la población total, y 45.5% de la urbana estaba servida por sistemas de agua por tubería en 1964. Esto explica, en gran parte, que las enfermedades asociadas a condiciones de saneamiento ambiental poco satisfactorias influyan fuertemente sobre la tasa de mortalidad. Entre ellas sobresalen las relacionadas con la insuficiencia o mala calidad del agua: el 15.2% de las enfermedades registradas en los diversos Departamentos del país tienen como causa posible la poca disponibilidad y la mala calidad del agua potable.

La Secretaría Nacional de Planificación y Coordinación, considera que las inversiones en agua potable y alcantarillado son de fundamental importancia dentro del desarrollo del país. El Plan Nacional de Desarrollo preparado por esta entidad, pretende realizar una inversión de US\$ 538.5 millones en un plazo de tres a cuatro años, en donde se incluye una partida de US\$ 49.2 millones para proyectos sociales, lo que equivale al 8.4% del total. La parte destinada a agua potable y alcantarillado cubre la mitad de los proyectos sociales, de los cuales US\$ 8.2 millones serán invertidos durante el año de 1967. Actualmente se encuentran en ejecución obras de agua potable en la ciudad de Oruro y, se ha aprobado financiamiento del BID para 60 poblaciones rurales. Además, se ha comenzado a construir el sistema de agua y alcantarillado de Santa Cruz, cuya continuación hasta terminar la primera fase del programa forma parte del proyecto en consideración.

- ^{1/} Ya que no se ha efectuado un censo desde 1950, las informaciones disponibles difieren en cuanto al número de habitantes. La Secretaría de Planificación da esta cifra, la Dirección de Estadística 3.5 millones.
- ^{2/} Basado en el dato de población de Planificación; de acuerdo al de Estadística sería de US\$ 150 per cápita.

Con estudios terminados y con financiamiento comprometido para agua potable se encuentran las ciudades de La Paz, Sucre, y la captación de agua potable para Pando, Beni y Oruro. En una etapa inmediatamente posterior, el Plan indicaba se considerarían proyectos para Cochabamba y Potosí, que estaban terminando los estudios correspondientes al redactarse el Plan. Estos estudios se encuentran terminados actualmente, y fueron utilizados como base para el presente proyecto. Adicionalmente, se estudian algunos proyectos menores en Beni y Pando.

Las tres ciudades

Las tres ciudades afectadas por el proyecto muestran características muy diferentes. En primer lugar, la ciudad de Cochabamba se encuentra ubicada en un valle en el corazón de Bolivia, con potencialidad eminentemente agrícola. Potosí en el altiplano, es un productor fundamentalmente de productos mineros y en especial del estaño. Finalmente, la ciudad de Santa Cruz de la Sierra se encuentra en los llanos orientales de Bolivia, en donde las actividades principales son la agricultura tropical y la extracción de petróleo. Las dos primeras ciudades son centros de gran tradición, mientras que Santa Cruz de la Sierra es una población que ha ganado importancia recientemente por la amplia gama de actividades industriales y agropecuarias, así como la explotación del petróleo y el gas.

Cochabamba

La ciudad de Cochabamba se encuentra en uno de los valles centrales del país, a una altitud promedio de 2.500 metros sobre el nivel del mar. El clima y la precipitación pluvial favorables han convertido al valle en una zona agrícola, que constituye actualmente una importante fuente de abastecimiento para otras regiones del país. Está estratégicamente ubicada y tiene buenas conexiones por ferrocarril, carretera y línea aérea con otros centros poblados del país. Con la reciente inauguración de la planta eléctrica de Corani, se dispone de cantidades suficientes de energía para uso industrial y comercial.

Cochabamba es la segunda ciudad de Bolivia, con una población de 135 mil habitantes en 1966 y con un área de 2.870 hectáreas. El crecimiento de la población se estima en 2.5% anual, por lo que en 1980 llegaría a alrededor de 190 mil y en 1990 superaría la cifra de 250 mil habitantes.

El servicio de agua potable de la ciudad es insuficiente para cubrir las necesidades, pues se calcula que hasta enero de 1967 había menos de diez mil conexiones en el sistema de la municipalidad, y se estima, que una tercera parte del rendimiento de agua se perdía en el sistema de distribución. Gran parte de la población compra agua de vendedores ambulantes. El sistema público y los pozos privados cubren solamente el 60% de la población y la calidad del agua es muy deficiente, en especial en los pozos de propiedad privada, que proveen aproximadamente el 12.5% de las casas.

Una encuesta realizada en esta ciudad, que cubrió 450 familias, señala que el consumo de agua muestra una elasticidad ingreso positiva. Apunta además, que el promedio anual de ingreso disponible per cápita en la ciudad es aproximadamente US\$ 110.

Potosí

La ciudad de Potosí está ubicada en una ladera de la Cordillera de los Frailes a una altitud de 4.000 metros y se encuentra asentada en un área de 470 hectáreas.

De acuerdo con un censo realizado en 1965, la población ascendía a 63.500 habitantes distribuidos en 13.500 familias y 6.900 casas. En el período 1950-1965, el aumento de la población fue de 17.700 personas, o sea, un incremento anual del 2.2% a pesar de una emigración de 8.200 personas en el mismo período. Se estima que en 1980 su población superaría a los 85.000 habitantes y a los 100.000 en 1990.

La ciudad se encuentra comunicada con otras partes del país por vía aérea, férrea y carreteras, y tiene las conexiones apropiadas de ferrocarril con el exterior, en especial hacia Argentina y Chile. Cabe mencionar, además, que existe en el BID un proyecto en avanzado estado de estudio para el financiamiento de la construcción de una carretera en territorio argentino hasta la frontera boliviana, que incrementaría el intercambio entre esta ciudad y el país vecino.

Existen en la localidad, ciertas industrias de artículos de consumo que emplean aproximadamente 650 personas; sin embargo, el verdadero sustento de la población se deriva casi exclusivamente de la explotación del estaño. Las reservas de explotación rentables se calculan en 2.6 millones de toneladas con un contenido medio de estaño de 0.8%. Aunque sólo una tercera parte de esta cifra son reservas probadas, se estima suficiente para una vida de 6-8 años.

El costo de producción (US\$ 0.85 por libra), más el elevado costo de transporte (US\$ 0.65 por libra), de acuerdo con información proporcionada, limitan las reservas económicamente explotables. Con la futura instalación de una fundición en la ciudad de Oruro se podría reducir en 50% los gastos de transporte, ya que actualmente se exporta el mineral en bruto a Inglaterra y a Estados Unidos. Suponiendo un costo competitivo de fundición del metal, esto permitiría la explotación del mineral en otras zonas cercanas asegurando así una mayor actividad económica por un período largo de tiempo.

Las minas tienen fuentes propias de abastecimiento y disposición del agua. En la ciudad de Potosí, el sistema de servicio de agua potable es insuficiente e ineficiente, ya que el aprovisionamiento no es continuo y la red de distribución de agua cubre el 66% de la superficie edificada y aproximadamente el 55% de la población. La red del servicio de alcantarillado cubre una proporción aún menor, de aproximadamente el 10.5% para recolección pluvial y el 30% de la sanitaria. El ingreso disponible por persona se calcula en alrededor de US\$ 105.

Santa Cruz de la Sierra

El Departamento de Santa Cruz se encuentra ubicado en la parte oriental de Bolivia, siendo el más extenso, con el 29% del territorio nacional y con fronteras con Paraguay y Brasil. Su clima es subtropical y la altitud media es de 400 metros sobre el nivel del mar. Su capital, Santa Cruz de la

Sierra, con una población actual estimada en 100.000 habitantes, ha crecido muy rápidamente (3.5% anual) y se proyecta que en 1980 podrá alcanzar a 160.000 habitantes, llegando a cerca de 225.000 en 1990. El ritmo de crecimiento demográfico registrado es el resultado, no solamente del crecimiento natural de la población, sino también de una fuerte inmigración proveniente de otras regiones del país. Se estima que la importancia agropecuaria y petrolera en las cercanías de Santa Cruz, y en especial su dinamismo actual, harán posible un incremento continuo de la población a esa misma tasa.

El desarrollo económico de la zona, y por tanto de sus ciudades, está muy ligado a la producción agropecuaria, especialmente de los cultivos de caña de azúcar, yuca, arroz, y a la actividad ganadera. En cuanto a su importancia industrial, la elaboración de azúcar nacional se realiza en tres ingenios en las proximidades de la ciudad. Existen, además, aserraderos, una cervecería y otras industrias de menor importancia. Los yacimientos petroleros de Camiri y Carada se encuentran en este Departamento.

A pesar de su creciente importancia económica, la ciudad está poco comunicada con el resto del país. Por tierra solamente se encuentra en buen estado la carretera a Cochabamba y unas carreteras de poca extensión hacia el interior del Departamento. Por vía aérea existen conexiones con otras ciudades del país y del extranjero y cuenta con ferrocarril a Argentina y Brasil. Su posición geográfica le da una alta importancia dentro del marco de la integración regional.

Hasta el año 1964, la ciudad de Santa Cruz no tenía sistema alguno de alcantarillado y actualmente el servicio cubre una pequeña parte. Esto provoca, adicionalmente de las molestias conocidas, el peligro de contaminación de las aguas subterráneas, de donde se extrae nuevamente para su uso. Esto presenta una especial importancia en las zonas centrales, en donde la densidad de población es de 240 habitantes por hectárea, contra el promedio de 70 habitantes por hectárea.

No existen datos efectivos del consumo de agua, pero se estima que apenas un 30% de la población cuenta con estos servicios. Por otra parte, el ingreso disponible per cápita se estima en alrededor de US\$ 120.

Los Proyectos

Los proyectos para Cochabamba, Potosí y Santa Cruz comprenden la ampliación y el mejoramiento de los sistemas de agua potable existentes en esas ciudades y, en Santa Cruz, también el alcantarillado. Su ejecución permitiría proporcionar y mejorar considerablemente la calidad del servicio de agua a cerca de 365 mil personas en 1980. Debe subrayarse que esto significa suministrar agua potable a cerca de 220 mil personas que, de mantenerse los sistemas en el estado actual, en 1980 no tendrían acceso a este servicio. En el caso del alcantarillado este aumento es aún más significativo, ya que casi la totalidad de las 92 mil personas que serían atendidas por dicho servicio representan un aumento neto sobre la reducida capacidad del sistema actual. De esta suerte, la ejecución de los proyectos beneficiaría directamente a alrededor del 7% de la población total del país, y más del 20% de la urbana, estimada para ese año.

Queda claro que los resultados de los proyectos en consideración serían conducentes a una marcada mejoría en la salud de la población, al afectar en una forma significativa las condiciones responsables de un componente importante de los índices de morbilidad y mortalidad que se observan en el país.

Por otro lado, se debe anotar que la falta de agua y de desagüe, o el servicio con medios propios, pueden constituir un costo fuerte para ciertos tipos de industria. En algunos casos pueden ser razón suficiente para eliminar posibilidades de inversión, o para forzar una ubicación fuera del mercado local. Como se vió anteriormente, Cochabamba, Potosí y Santa Cruz presentan un gran potencial económico. Sin embargo, las deficiencias en los servicios que se han anotado, en alguna medida, han impedido un mayor flujo de inversiones. Como consecuencia del mejoramiento y la ampliación de los servicios municipales, y el ahorro que esto significaría a los inversionistas privados, es posible que un buen número de ellos se interesen en ampliar sus empresas, o en establecer nuevas industrias en estas tres ciudades, lo que conllevaría beneficios de ingreso y empleo para las poblaciones respectivas.

Movilización de recursos

El préstamo disfrutaría de una movilización significativa de recursos en las ciudades beneficiadas. En Santa Cruz de la Sierra, el 50% del costo total de la construcción del servicio de alcantarillado sería aportado por la municipalidad y una menor proporción para el abastecimiento de agua. Estos desembolsos previstos dependen, en especial, de la capacidad económica y de la fuente de recursos de que dispone la zona. El Departamento de Santa Cruz cuenta con ingresos provenientes de regalías por la explotación de yacimientos de petróleo, los que se estimaban que ascenderían a US\$ 1.8 millones en 1967. Incluyendo la deuda pública, el Comité de Obras Públicas de la ciudad podrá disponer de US\$ 3.1 millones en este año. El aporte total de Santa Cruz al proyecto sería de US\$ 4.3 millones, dividido en un período de cuatro años que dura la construcción.

Los recursos disponibles se utilizan por este Comité para mejorar los servicios públicos de la capital departamental, tales como son la pavimentación, el drenaje, etc. que actualmente se encuentran en las primeras etapas de construcción. Según su presupuesto para 1967, el 60% de los egresos serían de capital, como los mencionados, y el 40% restante corrientes.

Se estima que los ingresos por las tarifas de agua ascenderían a US\$ 129 mil dólares y las de alcantarillado a US\$ 115 mil dólares durante el primer año después de terminada la construcción. Estos ingresos previstos siguen una tendencia creciente conforme aumentaría el número de casas beneficiadas por los servicios.

Se recomienda la aplicación de la alternativa 4 sobre el rendimiento de las tarifas en los préstamos para servicios públicos, en vista del ingreso limitado por persona en la ciudad. Los recursos resultantes de las tarifas de agua serían suficientes para cubrir los gastos administrativos y de operación y mantenimiento del sistema, los ingresos de la deuda del BID y la amortización de la misma.

Ya que la población de Santa Cruz tendrá que cubrir un fuerte aumento en las tarifas de agua potable, se considera que la capacidad de pago disponible para cubrir gastos relacionados con el proyecto de alcantarillado es reducida por lo que se recomienda que se utilice la alternativa número 5. Los ingresos totales provenientes de los usuarios del alcantarillado permitirían cubrir los gastos de administración, operación y mantenimiento, y los intereses de la deuda del BID.

Por ser un centro eminentemente agrícola, la municipalidad de Cochabamba tiene ingresos fiscales relativamente modestos. Se estima que el Comité de Obras Públicas dispondrá de US\$ 1.6 millones en 1967. En estas condiciones la ciudad contribuiría con el 30% del costo total del proyecto, lo que equivale a un total de US\$ 1.6 millones durante los cuatro años de ejecución. Sin embargo, el nivel del ingreso familiar muestra que las tarifas podrían captar recursos suficientes para cubrir los gastos de administración, de operación y mantenimiento, los intereses sobre la deuda del BID y su amortización.

La municipalidad de Potosí, aún con posibilidades más modestas, ya que depende únicamente de la actividad minera que está pasando por una época muy difícil, contribuiría con sólo el 17% del costo total del proyecto. Este monto ascendería a US\$ 0.3 millones para realizarse en cuatro años, comparado con US\$ 0.3 millones disponibles para el Comité de Obras Públicas en 1967. Las tarifas, se estima, podrán captar recursos suficientes para cubrir los mismos conceptos de egresos de agua que en Santa Cruz y Cochabamba, por lo que es recomendable la aplicación uniforme de la alternativa 4 sobre ingresos de las tarifas de servicios públicos antes señaladas, para el agua potable de las tres ciudades.

La inversión total, en los cuatro años de ejecución de los proyectos, sería de US\$ 17.3 millones, que representarían un promedio de US\$ 4.3 millones anuales. Esta última cifra equivale al 4.3% de la formación bruta de capital en el país, en 1965, y una cantidad de mucha mayor importancia para las poblaciones beneficiadas.

Tarifas

Los ingresos estimados en este informe para los diferentes proyectos de agua serían el resultado de recaudaciones promedio por familia beneficiada que representan un 3% de sus ingresos disponibles, equivalente a una tarifa promedio de alrededor de US\$ 0.06 por metro cúbico de uso domiciliario. A esto se le sumaría el ingreso por uso comercial e industrial, a una tarifa de US\$ 0.10 por metro cúbico. Cabe subrayar que ambas tarifas estarían dentro de las normas establecidas para países con condiciones socio-económicas como Bolivia, como se puede constatar observando que, en ciudades de hasta 30.000 habitantes en Perú, por ejemplo, se cobra US\$ 0.04 por metro cúbico de consumo domiciliario y US\$ 0.11 por el de consumo industrial y comercial.

Con relación al servicio de alcantarillado sanitario, se estimó que los usuarios pagarían el equivalente de US\$ 25 por el derecho de conexión, recomendándose que se les permitiera hacerlo en cuotas mensuales durante un año y, además, una cuota de US\$ 6 anual a cada conexión por el derecho de uso. Esta cifra se considera razonable, en vista de que no sobrepasaría el

1% del ingreso familiar disponible en la región de Santa Cruz. Se estimaron ingresos adicionales atribuibles a este proyecto, al suponerse una imposición fiscal de la municipalidad de US\$ 0.04 anuales por metro lineal de frente de los predios servidos con el alcantarillado pluvial.

Si bien los sistemas de tarifas propuestas guardan relación con la capacidad de pago de los usuarios, se observan dos problemas importantes en el planteamiento de los informes de los consultores. En primer lugar, en dos de los casos esos informes proyectan incrementos muy fuertes sobre los pagos que se hacen en el presente por el servicio. En Cochabamba y Potosí la tarifa actual es de alrededor de US\$ 1.25 por año por conexión, sirviéndose entre 1-1/2 y 2 familias por conexión como promedio. Con el sistema que proponen, ésta subiría a cerca de US\$ 25 al año. Se considera que el salto directo de un nivel al otro es demasiado fuerte para que sea aceptado sin problemas por la población. Por lo tanto se recomienda un aumento gradual de las tarifas entre esos niveles durante el período de construcción de las obras, llegando a su nivel final al completarse las mismas en el cuarto año del proyecto.

En segundo lugar, los consultores proponen un elevado cargo por derecho de conexión para el proyecto de agua potable en Potosí (US\$ 35), mientras que no se lo hace para Cochabamba ni Santa Cruz. Se considera más adecuado uniformar el tipo de recaudación a través de tarifas por el servicio de agua, método por el cual los usuarios de Potosí están en condiciones de cubrir los mismos costos cubiertos en Cochabamba y Santa Cruz.

Se estima que una estructura progresiva de las tarifas domiciliarias permitiría recaudar un mayor volumen de recursos, lo que a su vez permitiría servir a una mayor proporción de la población que lo que se podría con una tarifa uniforme. Esto sería posible, principalmente, porque la incidencia de la tarifa sobre las familias con ingresos bajos sería menor, por lo que podrían realizar los pagos requeridos. A este efecto, las tres ciudades precisan de asistencia técnica para llevar a cabo los estudios que se requieren para determinar sistemas de tarifas adecuados a las necesidades de financiamiento de los proyectos y a la capacidad de pago de los diferentes grupos de usuarios.

Por otra parte se debe apuntar la reducida capacidad de financiamiento de los usuarios para cubrir las necesidades adicionales de inversión en la vivienda (cuarto aparte para el sanitario, accesorios, cañerías, etc.) que resultan de la conexión de los servicios. Es posible que una cantidad sustancial de usuarios potenciales, especialmente del servicio de alcantarillado, no lleguen a conectarse al sistema por falta de recursos para cubrir estas necesidades. Para obviar ese problema se recomienda que se ponga a su disposición un fondo cuyos recursos puedan ser utilizados para mejoras domiciliarias relacionadas con el mejor uso del agua y el alcantarillado.

Consideraciones finales

El financiamiento del BID, US\$ 11.0 millones de los recursos del Fondo para Operaciones Especiales, cubriría el 50% de la inversión en el proyecto de alcantarillado y el 75% de los de agua potable. El préstamo está planteado en términos que resultan adecuados a la función primordialmente

social de los proyectos, a su calidad de servicio público, y a las necesidades de términos de amortización, consistentes con su vida útil. Además, la distribución de recursos propuesta ayudaría a mantener la situación general de balanza de pagos del país.

De los US\$ 11.0 millones del préstamo del BID, US\$ 9.7 millones serían desembolsados en dólares, lo cual es suficiente para cubrir el costo directo en divisas estimado para el proyecto, así como una parte de las importaciones indirectas o inducidas por su ejecución. Ya que los pagos de amortizaciones e intereses se harían en moneda local, la operación no tendría efectos negativos directos sobre la situación de balanza de pagos.

En vista de los beneficios apuntados que se obtendrían de la ejecución de los proyectos, y la adecuacidad de su financiamiento a las necesidades del país, se concluye que, desde el punto de vista de su desarrollo económico y social, se justifica su ejecución.

INFORME JURIDICO SOBRE PRESTAMO A LA REPUBLICA DE BOLIVIA
PARA AGUA POTABLE Y ALCANTARILLADO EN TRES CIUDADES

I. El prestatario

(a) Generalidades

El prestatario será la República de Bolivia. El préstamo tiene por objeto mejorar y ampliar los sistemas de agua potable existentes en las ciudades de Cochabamba, Potosí y Santa Cruz; y en esta última, además, el sistema de alcantarillado.

De conformidad con lo establecido en el artículo 96, inciso 6 de la Constitución Política promulgada el 3 de febrero de 1967, corresponde al Presidente de la República "Administrar las rentas nacionales y decretar su inversión por intermedio del respectivo ministerio, con arreglo a las leyes y con estricta sujeción al presupuesto".

El Poder Ejecutivo lo ejerce el Presidente de la República conjuntamente con los Ministros de Estado (Art. 85).

(b) Disposiciones relacionadas con la contratación de empréstitos

De conformidad con lo establecido en el artículo 59, inciso 5 de la citada Constitución, el Poder Legislativo debe "autorizar y aprobar la contratación de empréstitos que comprometan las rentas generales de la nación, así como los contratos relativos a la explotación de las riquezas nacionales".

La redacción de ese precepto de la nueva Constitución ha obligado a analizar la norma mencionada para determinar si se trata de dos actos distintos, el de autorizar primero y el de aprobar después, o si sería suficiente con uno solo de ellos como requería el antiguo texto constitucional que sólo hablaba de "autorizar".

Tal como ha sido ya analizado por este Departamento en informe relacionado con préstamo destinado a la misma República para financiar parcialmente el sistema de agua en 59 pequeñas ciudades de 150 a 10.000 habitantes, el artículo constitucional que se menciona debe interpretarse en el sentido de que la exigencia constitucional es no sólo la de autorizar, sino también la de aprobar la contratación en referencia; vale decir, dos actos jurídicos en vez de uno solo.

II. El organismo ejecutor

(a) Características generales

Se ha propuesto como organismo ejecutor a la Corporación de Aguas y Alcantarillado (CORPAGUAS) creada por Decreto Supremo número 07942 de 8 de marzo de 1967.

Se trata de una entidad descentralizada, bajo la supervigilancia del Ministerio de Salud Pública, con personería jurídica, patrimonio y atribuciones señaladas en su ley constitutiva, con domicilio legal en la ciudad de La Paz (Art. 1). Dentro de las atribuciones señaladas por la ley están las de dictar la política general del abastecimiento de agua potable, la construcción de redes de alcantarillado pluvial, el estudio y construcción de los sistemas de abastecimiento de agua potable y sistemas de desagüe de aguas servidas en localidades que carezcan de estos servicios (Art. 2).

(b) Organización administrativa

CORPAGUAS está dirigida por un Consejo de Administración formado por un presidente y cuatro representantes con derecho a voz y voto procedentes de las siguientes entidades: Ministerio de Salud Pública; Ministerio de Obras Públicas; Secretaría de Planificación y Coordinación; y Corporación Boliviana de Fomento. Cuando el proyecto corresponda a una jurisdicción determinada, además, un representante del Gobierno local.

Al Consejo de Administración le corresponde aprobar y adjudicar todos los contratos que la entidad debe celebrar (Art. 7, inciso d). La representación de la entidad corresponde a su Presidente (Art. 10).

(c) Capacidad para ejecutar el proyecto

De conformidad con lo expuesto puede afirmarse que CORPAGUAS tiene capacidad legal para actuar como organismo executor del proyecto y que esa actividad está dentro de sus objetivos fijados por ley. Por disposición del artículo 3, inciso a) está autorizada esta entidad para "celebrar contratos y convenios adoptando las medidas que estime necesarias". Está sujeta a la fiscalización de la Contraloría General de la República (Art. 155 de la Constitución).

(d) Tarifas

El artículo 3 del Decreto de creación de CORPAGUAS le confiere autorización para "e) fijar normas para establecer tasas y tarifas de los servicios a su cargo y revisar las que se encuentran en vigencia".

(e) Procedimiento de licitaciones públicas

De acuerdo con lo establecido en el inciso c) del artículo 7 CORPAGUAS tiene la facultad de "convocar a licitaciones públicas para la ejecución de obras de agua potable y alcantarillado y para la adquisición de materiales y equipo".

(f) Aporte local

Se considera que el proyecto asciende en conjunto a US\$17.255.000; de los cuales US\$6.210.000 serán aporte local.

La capacidad del deudor, siendo la República, no puede ponerse en duda para cumplir con la obligación de sufragar ese aporte local.

III. Conclusiones

1. El deudor está plenamente capacitado para contraer el préstamo y firmar el contrato respectivo.
2. Previamente a la firma del contrato, el Congreso Nacional deberá autorizar el contrato y una vez que sea firmado deberá someterse a aprobación o ratificación del Congreso para su validez.

Reference: Bolivia. Loan to the Republic of Bolivia
(Water supply for three cities) (Doc. PR-255)

Appended is a summary of the Bank's operations in Bolivia as of
September 30, 1967.

November 15, 1967

BOLIVIA

1. As of September 30, 1967, the IDB had authorized 22 loans to the Republic of Bolivia, three of which have been completely disbursed. Following is a summary of the status of the loans as of that date.

BOLIVIA - In thousands of dollars

	<u>SPECIAL FUND</u>		<u>TF</u>	<u>CD</u>	<u>TOTAL</u>	
	<u>Total</u>	<u>Bank parti-</u>	<u>Total</u>	<u>Total</u>	<u>Total</u>	<u>Partici-</u>
	<u>loans</u>	<u>cipations</u>	<u>loans</u>	<u>loans</u>	<u>loans</u>	<u>pations</u>
Amount of loans <u>1/</u>	51,560	--	14,600	1,500	67,660	--
(-) Undis- bursed balance	<u>26,313</u>	<u>--</u>	<u>6,865</u>	<u>1,500</u>	<u>34,678</u>	<u>--</u>
Disbursed	25,247	--	7,735	--	32,982	--
(-) Paid by borrowers	<u>5,485</u>	<u>--</u>	<u>486</u>	<u>--</u>	<u>5,971</u>	<u>--</u>
Outstanding	<u>19,762</u>	<u>--</u>	<u>7,249</u>	<u>--</u>	<u>27,011</u>	<u>--</u>

1/ Net of cancellations.

2. FUND FOR SPECIAL OPERATIONS - In millions of dollars - Net

<u>Date of approval</u>	<u>Loan</u>	<u>Borrower</u>	<u>Purpose</u>	<u>Amount</u>	<u>Disbursed</u>	<u>Undisbursed</u>
2/24/61	1	CBF	Over-all	10.0	10.0	-
7/14/61	9	COMIBOL	Rehabilitation National Mines	4.5	4.5	-
12/28/62	29	Banco Agrícola	Agricultural credit	2.6	0.3	2.3
2/14/63	30	COMIBOL	Rehabilitation National Mines	4.9	4.9	-
10/31/63	35	Republic of Bolivia	Agricultural credit	1.1	0.3	0.8
7/23/64	41	Republic of Bolivia	Electric power	3.5	2.9	0.6
12/21/65	76	University of San Simón	Higher education	0.5	-	0.5
12/21/65	77	University of Oruro	Higher education	0.4	0.1	0.3
12/21/65	78	University René Moreno	Higher education	0.4	-	0.4
2/10/65	86	COMIBOL	Rehabilitation National Mines	2.5	0.9	1.6
6/23/66	99	Fábrica Nacio- nal de Cemento <u>1/</u>	Factory expansion	-	-	-
6/23/66	100	Banco Indus- trial	Over-all	1.0	0.1	0.9
8/24/66	109	Rep. of Bolivia	Preinvestment	2.1	0.4	1.7
11/10/66	120	CBF	Over-all	10.8	1.0	9.8
7/27/67	151	CONAVI	Housing	5.5	-	5.5
8/17/67	154	Rep. of Bolivia	Water supply	<u>1.8</u>	<u>-</u>	<u>1.8</u>
				<u>51.6</u> <u>2/</u>	<u>25.4</u>	<u>26.2</u> <u>2/</u>

1/ Cancelled in June 1967.

2/ Net of cancellations.

TRUST FUND - In millions of dollars

<u>Date of approval</u>	<u>Loan</u>	<u>Borrower</u>	<u>Purpose</u>	<u>Amount</u>	<u>Disbursed</u>	<u>Undisbursed</u>
12/28/62	51	CBF	Settlement	6.5	3.6	2.9
3/21/63	61	CONAVI	Housing	4.0	3.1	0.9
10/31/63	67	Rep. of Bolivia	Rural development	0.4	0.4	-
5/7/64	78	Rep. of Bolivia	Higher education	0.3	0.1	0.2
3/4/65	104	Rep. of Bolivia	Water supply	2.6	0.5	2.1
5/20/65	111	University of San Andrés	Higher education	<u>0.7</u>	<u>0.1</u>	<u>0.6</u>
				<u>14.5</u>	<u>7.8</u>	<u>6.7</u>

CANADIAN FUND - In millions of dollars

11/10/66	6	CBF	Over-all	1.5	-	1.5
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3. The public sector received 20 of the 22 loans granted to Bolivia. Three have been fully disbursed: a) the first over-all loan to the Corporación Boliviana de Fomento (1/SF-BO), and b) the loans granted to the Corporación Minera de Bolivia (9/SF-BO and 30/SF-BO) corresponding to the first and second phases of rehabilitation of the national mines. The contracts for two loans have not yet been signed (151/SF-BO and 154/SF-BO).

Following is a brief commentary on the loans in which difficulties have arisen.

Execution of the loan to the Banco Agrícola for agricultural credit (29/SF-BO), in connection with the project for the settlement of approximately 8,000 families, has been progressing slowly because of the borrower's problems relating to the margin of interest.

Disbursements are also proceeding slowly under loan 35/SF-BO to the Republic of Bolivia, for which the executive agency is, as for the foregoing loan, the Banco Agrícola de Bolivia. In addition, delays have occurred in the settlement program (51/TF-BO) on which the progress of this loan depends.

The Regional Representative is determining whether technical assistance to the Banco Agrícola could help to accelerate execution of the loan.

Loan 51/TF-B0 to the Corporación Boliviana de Fomento for the settlement of 8,000 colonists is being reviewed with a view to a more realistic definition of its objectives, by reducing the extension of its disbursement period to the maximum reasonable level; 2,825 colonists had been settled as of June 30, 1967.

On loan 67/TF-B0 to the Republic of Bolivia for the improvement and integration of existing rural development bases and the establishment of three new bases, administrative-accounting questions had arisen that are being satisfactorily resolved through corrective measures adopted by the borrower. This loan is 92% disbursed.

On loans 76/SF-B0 and 78/SF-B0 to San Simón University and Gabriel René Moreno University, respectively, some of the conditions precedent to the first disbursement have not yet been fulfilled. It should be noted, however, that the reports required for fulfillment of those conditions are now being received more rapidly, and both loans are therefore expected to qualify for the first disbursement during the current quarter.

4. One of the two loans to the private sector, loan 99/SF-B0 to the Fábrica Nacional de Cemento, was canceled at the request of the borrower, which has found other sources of financing more in keeping with its objectives.