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PROJECT REPORT

BARBADOS

BRIDGETOWN SANITARY SEWERAGE SYSTEM PROJECT

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## LOAN TO BARBADOS

### BRIDGETOWN SANITARY SEWERAGE SYSTEM PROJECT

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## I. INTRODUCTION

### A. Loan Application

- 1.01 On January 23, 1975, the Director of the Ministry of Finance and Planning applied to the Bank on behalf of the Government of Barbados for a loan to finance in part the sewerage project for Bridgetown, the capital of the country. In the accompanying feasibility study, total project cost was estimated at some US\$10 million, not including engineering, administration, contingencies and cost escalation, and a loan was contemplated to cover the external component of the project.

### B. Priority

- 1.02 The application indicated the high priority accorded the project by the government. In addition, Barbadian authorities stressed to the programming mission in late March 1975 the special importance of the project for the country and explained several aspects of the institutional set-up that would be employed for implementing the project and the technical cooperation that would be required.

### C. Mission

- 1.03 An analysis and negotiation mission visited Barbados May 6-16, 1975, to study the project's technical, economic, financial, legal and institutional aspects. On the basis of that mission and later updatings, the project's cost estimate was increased to cover changes considered necessary. 1/

### D. Evaluation of Technical Cooperation ATN/SF-1106-BA

- 1.04 The only operation in which the Bank has participated in the Barbadian sanitation sector is the technical cooperation on a contingency basis mentioned 2/, under which the following were carried out: i) studies and designs for the Bridgetown sewerage system and ii) studies on protecting the island's main water source the Belle well. The original agreement was signed October 28, 1971 and amended December 1972. Total cost amounted to the equivalent of US\$317,000, financed as follows:

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1/ See paragraph 3.08 on.

2/ See paragraph 3.08 for the project budget item covering the cost of this technical cooperation operation by the Bank.

(In thousands of US\$)

	<u>IDB</u>	<u>Local</u>	<u>Total</u>
Consultant fees	165.0	-	165.0
Subcontracts	35.0	54.1	89.1
Local personnel	-	19.7	19.7
General services	-	28.0	28.0
Contingencies	10.0	5.2	15.2
Total	<u>210.0</u>	<u>107.0</u>	<u>317.0</u>

Following a selection procedure in accordance with the Bank's policies, the government contracted the services of the firm of Quirk, Lawler and Matusky of Tappan, New York, to carry out studies and designs. The contract was signed October 9, 1972, effective January 4, 1973.

- 1.05 Under the contract, the consultants' draft report must be delivered to the government within 12 months from the effective date. However, difficulties in conducting the required oceanographic studies and government delays in deciding on the location of the treatment plant resulted in a contract extension. The consultants' final report, including final plans and specifications for constructing the proposed Bridgetown sewerage system, was delivered to the government on June 28, 1974.
- 1.06 The Ministry of Health and Welfare was responsible for government supervision of the consultants, through a project manager designated for the purpose. The Operations Department, Division 7 was responsible for the Bank's supervision of operating aspects and the Sanitary Engineering Section of the Project Analysis Department supervised technical aspects. To this end, copies of the reports were submitted by the consultants, a number of interviews were held with them and with government officials at Bank headquarters, and field inspection missions were carried out.
- 1.07 Final disbursement of Bank funds took place August 28, 1974. The government's final report, including a recommendation that the project be submitted to the Bank for financing, was sent to the Bank on October 2, 1974. The results of technical cooperation agreement ATN/SF-1106-BA were satisfactory, despite delays arising during its execution, which are understandable in view of the project's nature. The consultants' plans and specifications conform to high engineering standards in the opinion of the government and Bank experts.

## II. FRAME OF REFERENCE OF THE PROJECT

### A. The Barbadian Sanitation Sector

#### 1. Water

- 2.01 The importance of the area to be served by the project in Bridgetown compared to the rest of the country and the project's relationship to proper utilization of Barbados' limited water supply make it necessary to consider the work in terms of an overall evaluation of the sector.
- 2.02 Barbados' physical characteristics limit the amount of water available for human consumption, agriculture and other uses. The country has an average annual rainfall of 150 cm, subject to considerable regional variations, as well as fluctuations of around 50% in any one region. Some 60% of the total area of only 430 kms<sup>2</sup> is less than 100 m above sea level, with an average annual rainfall of only 110 cm. This rainfall is concentrated in June through November, when heavy and relatively brief rainstorms are frequent. In each decade, there are at least two years of drought and two years of heavy flood-producing rains.
- 2.03 Barbados, whose highest elevation is less than 350 m above sea level, is divided orographically into four basins, three which are made up of permeable limestone formations, with a maximum thickness of 90 m, which overlay impermeable strata that surface only in the northeast basin known as Scotland District. Except for this region, which is incapable of containing aquifers, the permeable geological structure predominating in 85% of the island filters rainwater to form sheetwater strata extending from a little over one meter above sea level to the base of impermeable material underlying the limestone strata. Throughout this area, water has carved fissures and channels for streamwater which, in some places, surfaces in springs. The difference in density between fresh water and sea water prevents the two from mixing, except very near the coast, depending on the sheetwater level of the aquifers.
- 2.04 Barbados' water supply comes from the sheetwater strata, which are fed by rainwater filtering down through the limestone subsoil. An estimated 20% of rainwater filters down, and the remaining 80% drains into the sea. Aquifers are tapped primarily by wells, as indicated in paragraphs 2.07 and 2.11.
- #### 2. Use of water supplies
- 2.05 Several studies since 1947 estimate that Barbados' water supply for human consumption is between 145,000 and 200,000 m<sup>3</sup> a day, depending

primarily on the annual rainfall. It has been determined that about 15,000 m<sup>3</sup> of water a day is unfit for human consumption in its natural form but has some use in agriculture. In the Scotland District, an estimated 30,000 m<sup>3</sup> a day can be collected with some difficulty for human use and some 15,000 m<sup>3</sup> a day for irrigation. In summary, the usable supply in years of high and low rainfall ranges from 175,000 to 230,000 m<sup>3</sup> a day for potable water, and some 30,000 m<sup>3</sup> a day for agriculture. 1/

2.06 Water supplies are currently being used approximately as follows:

a) Public use (Barbados Waterworks Department)	85%
b) Private use in irrigation	10%
c) Sugar mills	5%
Total	100%

3. Barbados' water supply system; operational aspects

2.07 The public water system is under the Barbados Waterworks Department (BWD) 2/. In the last five years, the number of connections to the system has risen from 42,800 to 54,300, or an increase of about 5% a year. This is well over the population growth, of less than 1% a year. Thus the percentage of population with running water has increased, which is also shown by the fact that the approximately 1,200 public water taps has remained constant during the period. 3/

2.08 The average per capita water supply can be considered high despite the fact that it is influenced by factors other than the population itself, such as the use of water by ships and an annual increase of some 10% in the number of tourists visiting the island, which totaled over 230,000 in 1974. The decline in water production, which fell from 457 liters per capita daily (LPCD) in 1972 to 425 LPCD in 1974, can be attributed to the BWD's efforts to avoid waste, particularly by installing 20% more meters. Consequently, the BWD meter installation policy is obviously necessary for conservation.

2.09 BWD production costs, which had remained around US\$0.04 per m<sup>3</sup> up to 1972, have doubled in the last two years, primarily because of the energy crisis.

2.10 Total electric power costs rose from US\$530,000 in 1972 to US\$1,230,000 in 1974. It should be noted that Barbados' electricity rates are subject to fuel cost adjustment clauses, since all electricity is produced in thermal plants. Ninety-seven per cent of the water is produced by pumping, which compounds the problem.

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1/ 10,950,000 m<sup>3</sup> a year, enough to irrigate some 1,000 ha.

2/ See paragraphs 4.03 on of Chapter IV and Appendix A.

3/ Barbados has approximately 60,000 housing units.

- 2.11 The BWD 1/ system comprises the following:

Production: 14 wells and 2 springs.

Storage: 24 reservoirs with a total capacity of 85,300 m<sup>3</sup>, which is 80% of average daily production.

Water lines: approximately 1,000 kms of 3 to 20-inch pipes.

Rectangular or circular wells 1.80 to 3.00 m across are dug by hand to depths of 35 to 75 meters. Most of the larger reservoirs are stone and the smaller ones are steel. The smaller pipes are usually asbestos-cement, and the larger ones are cast iron.

- 2.12 Because of the nature of the sources and the way they are protected and utilized, the water in Barbados is of good quality. Treatment is confined to adding chlorine just before distribution.

#### 4. Water rates

- 2.13 New water rates from which the BWD hopes to cover its operating costs, have been in effect since April 1974. Such rates constitute a necessary updating because of rising costs. They are approximately four times the previous rates, which had been in effect for over 20 years. Revenues in 1974 were 55% higher than in 1973 when the previous rates were in effect. However the rise in energy costs that year neutralized the effect of the new rates, so that they covered only 70% of annual operating costs, not including equipment and installation depreciation. The BWD is convinced that more meters 2/ must be installed for effective billing, while moving ahead in applying new rates.
- 2.14 The new rate structure, which is relatively simple to use, provides charges for the following two basic services:

##### a) Unmetered service

Applies to house service on properties under 2,500 ft<sup>2</sup>, with gardens under 720 ft<sup>2</sup>. An annual charge is made of 40% of the first BD\$150 3/ of property tax and 28% of the remaining tax. The minimum charge is BD\$24 a year. In addition, users must pay BD\$16 a year for each toilet, BD\$8 for each shower and BD\$10.56 for each storage tank under 24 ft<sup>3</sup>. For larger tanks, a charge of BD\$0.48 is made for each additional cubic foot.

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1/ The Canadian International Development Agency (CIDA) granted financing in 1970 to the Government of Barbados in the equivalent of US\$2.6 million to develop the water supply system. Recently (in August 1975) CIDA approved a new loan for US\$3 million to contribute to the expansion of that system.

2/ Appendix A shows that the number of meters rose from 4,900 in 1972 to 6,500 in 1974, or 12% of current connections.

3/ US\$1.00 = BD\$2.00.



b) Metered service

All properties not included in the above classification must be equipped with meters and must pay for the service as follows:

Domestic service: BD\$1.00/1000 gls., plus  
BD\$3.60 quarterly for meter use  
Other services: BD\$1.25/1000 gls., plus  
BD\$6.25 quarterly for the meter

5. Sewage disposal

- 2.15 Barbados has no public sewerage system, so waste disposal must be provided for on the individual property, using latrines, cesspools where subsoil permits, and septic tanks, which are frequently discharged into the storm sewers or simply into the gutters. The rocky nature of the subsoil and the shallow sheetwater level make underground elimination of sewage difficult, particularly in the coastal areas.
- 2.16 The Ministry of Health and Welfare, whose responsibilities include ensuring sanitary disposal of sewage, has been requiring installation of compact sewage treatment plants in hotels, hospitals and larger commercial buildings. At the beginning of 1975, there were 12 such plants in Barbados, with daily capacities of 1500 to 45,000 gls. All of them employ secondary processes, usually discharging into the storm drains or directly into the sea.
- 2.17 Both the most rudimentary forms of sewage disposal and the treatment plants have the problem of handling sludge and other solids, which now are eliminated by specialized commercial services which transport them to selected fields for fertilizer or dump them into the sea.

6. Water studies

- 2.18 Efforts have been made in Barbados to identify, quantify, conserve and in general optimize the use of water supplies, through numerous studies in recent decades. These studies were conducted primarily by the Barbados Waterworks Department under the Ministry of Communications and Works, and the Ministry of Agriculture, Science and Technology, in cooperation with such organizations as PAHO, the OAS, FAO and the IDB, with the participation of consulting firms and individual experts.
- 2.19 Among the most recent investigations are the following:
- a) Studies between 1965 and 1968 by the Barbados Waterworks Department in cooperation with WHO/PAHO to plan expansion of BWD installations.

- b) FAO/IDB study from 1970 to 1973 on the agricultural sector, including irrigation problems.
  - c) Studies in cooperation with the OAS for the Ministry of Agriculture, Science and Technology in 1972, and 1974 by the hydrogeologist Simcha Shiloni, of Israel, on use of water supplies for agriculture in parts of the island.
  - d) Study in 1973 in cooperation with the British Government, by the firm of Wallace Evans and Partners for the Ministry of Communications and Works on storm drains for flooding in the west and south of Barbados, including the Bridgetown area.
  - e) Study completed in 1974 on collection, treatment and elimination of sewage in Bridgetown, by the firm of Quirk, Lawler and Matusky for the Ministry of Health and Welfare, in cooperation with the IDB.
- 2.20 None of the above studies are sufficiently broad to be considered a comprehensive study of water supplies, although all of them provide valuable basic information for the study the government proposes to conduct in the near future, for which it has requested Bank assistance. 1/

B. The Project under the National Development Plan

- 2.21 The current Barbadian National Development Plan, covering April 1973 to March 1977, with a basic budget of BD\$175.6 million, is the fifth public investment program since 1955, and the second since the country's independence in 1966. Major items of resource allocation under the plan are the following:
- |   |            |
|---|------------|
| a) social sectors (education, health and housing)                                       | 41%        |
| b) economic infrastructure (roads, port, airport and water supply)                      | 28%        |
| c) productive sectors   | 13%        |
| d) miscellaneous (public buildings, defense and security, and development institutions) | <u>18%</u> |
|   | 100%       |
- 2.22 Investments in the Bridgetown sewerage project are given priority under the Plan, at an estimated total of BD\$6,464,000. This constitutes about 62% of public health investments, which also include hospitals (25%), garbage disposal (7%) and miscellaneous (6%).

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1/ See paragraph 3.01 and the plan of operations.

- 2.23 The proposed investment for water supplies is BD\$7,415,000, and is budgeted under economic infrastructure because of their importance for Barbadian development. This investment plus those proposed for environmental health and disease prevention, total US\$15,577,000, or 8.9% of the entire Plan.
- 2.24 Although actual investments have not followed the 1973/77 plans, the above distribution of allocations underscores the government's concern for maintaining the population's health. Since 1959, a campaign has been under way to provide low cost sanitary installations for all housing units. The first stage of the campaign was completed in 1965, with 10,000 units installed at an average rate of 1,650 a year. The construction rate rose thereafter to 2,000 and is currently 3,000 units a year.
- 2.25 In its justification for the National Development Plan, the government stated that its vital concern is based on the consideration that health is the basis for the well-being of individuals and their ability to participate in community life. To that end, government policies are to be determined by social needs.

### III. THE PROJECT AND ITS EXECUTION

#### A. Objectives of the Project

3.01 The project has the following two primary objectives:

- a) Improved sanitation conditions in the central area of Bridgetown by the construction of a sanitary sewerage system; and
- b) Preparation of institutional and rate schedule studies for the establishment of an authority to administer the water and sewerage services. 1/

#### B. Description of the Project

##### 1. Sanitary sewerage system

3.02 The proposed sanitary sewerage system will improve sanitary conditions in the downtown area of the city of Bridgetown where most activities and people are concentrated and where the problems of waste and sewage have reached critical proportions and seriously polluted the environment.

3.03 The project would include the following works: (a) a sewage collector system; (b) a sewage treatment plant; and (c) an underwater effluent discharge for the plant. Appendix B shows the location of the project works in Bridgetown and Appendix C gives data on the proposed sewerage system.

3.04 Initially, the collector system will take the sewage of an area of approximately 200 hectares with a population of 37,700 persons. The system includes approximately 19 kilometers of collector pipe ranging from 15 to 90 centimeters in diameter, to which 3,000 homes will be connected at the start. It also has three pressure pipes of 15 to 75 centimeters in diameter, and a total length of 1,860 meters. The sewage contained in the secondary collectors will be pumped through these pipes to the main system. Plans call for using ceramic pipe for the gravity flow lines and cast iron for the pressure tubes. However, the specifications allow these materials to be replaced by others that meet the resistance and useful life requirements while the project is being built if the cost justifies it. Future extensions of the system

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1/ The government has submitted to the Bank an application for a technical cooperation operation to finance a comprehensive study of the island's water resources in order to plan its conservation and use properly. This study will be carried out at the same time as the project. The Bank is considering that application separately through the corresponding plan of operations.

may cover an area approximately twice that of the original and pipelines that can be added to have been designed for any larger future volumes.

- 3.05 The treatment plant has been designed at an initial capacity of 2.4 million gallons per day (MGD) (9.1 million liters per day (MLD)), based on the design population mentioned above. The treatment method selected is a secondary process of activated sludge (stabilization by contact) capable of producing an effluent that meets strict esthetic and sanitary standards and which, consequently, can be discharged into the sea without any harmful effects. The sludge produced in this process will be transported as a slurry to outlying areas for use as fertilizer. It is estimated that during the design period itself and by extending the collector system, an additional 19,500 users can be connected to the system. As a result, the plant design provides for two initial treatment units and a third unit to be built in the future, thereby expanding total capacity to 3.6 MGD (13.6 MLD), large enough to serve a total of 57,200 users.
- 3.06 Although the characteristics of the effluent of the treatment plant normally allow it to be discharged into coastal waters without any harmful effects on health, any breakdown in the plant, however temporary, might produce some undesirable pollution. In view of this, an underwater discharge to release the treated water will be built. It will extend approximately 300 meters from the shoreline and be placed at a depth of some 12 meters. Dilution of the effluent in the sea is one additional safety measure to prevent pollution. It has been proposed to build the underwater discharge of polyethylene pipe and have it work by gravity flow. However, the specifications leave room for replacement of this material by another of similar quality if the cost so justifies.

## 2. Institutional and rate studies

- 3.07 To administer the Bridgetown sewerage system and others built in the future, the government plans to establish an independent authority. This authority will also assume the administrative functions for the water system which are now performed by the Barbados Waterworks Department (BWD). This will require institutional studies of the legal, administrative, financial, operational and rate schedule aspects of the new authority. These studies will be supported by similar studies made recently by PAHO for BWD. In effect, what is proposed is to make this organization independent and to expand its functions. 1/

## C. Cost of the Project

- 3.08 The total cost of the project is estimated at the equivalent of US\$13,662,000 of which 29.4% would be for local expenses and the remaining 70.6% for the external component, broken down as follows:

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1/ See attached plan of operations.

COST OF THE PROJECT 1/

(Equivalent in US\$ thousands)

	Cost in		Sub- total	Costs in		%
	<u>Foreign</u> <u>Direct</u>	<u>Currency</u> <u>Indirect</u>		<u>National</u> <u>Currency</u>	<u>Total</u>	
1. <u>Engineering and Administration</u>	<u>125</u>	<u>118</u>	<u>243</u>	<u>290</u>	<u>533</u>	<u>3.9</u>
1.1 Engineering	125	118	243	145	388	2.8
1.2 Administration	-	-	-	145	145	1.1
2. <u>Direct Costs</u>	<u>4,400</u>	<u>1,650</u>	<u>6,050</u>	<u>1,950</u>	<u>8,000</u>	<u>58.7</u>
2.1 House installations	-	-	-	300	300	2.2
2.2 Collectors	2,000	750	2,750	750	3,500	25.7
2.3 Treatment plant	2,000	750	2,750	750	3,500	25.7
2.4 Underwater discharge	400	150	550	150	700	5.1
3. <u>Financing Charges</u>	<u>519</u>	<u>-</u>	<u>519</u>	<u>-</u>	<u>519</u>	<u>3.8</u>
3.1 Interest and credit commission	422	-	422	-	422	3.1
3.2 Inspection and super- vision	97	-	97	-	97	0.7
4. <u>Concurrent Costs</u>	<u>210</u>	<u>-</u>	<u>210</u>	<u>810</u>	<u>1,020</u>	<u>7.5</u>
4.1 Compensation	-	-	-	810	810	5.9
4.2 Payment to IDB for technical cooperation ATN/1106-SF	210	-	210	-	210	1.6
5. <u>Unassigned</u>	<u>1,940</u>	<u>660</u>	<u>2,600</u>	<u>950</u>	<u>3,550</u>	<u>26.1</u>
5.1 Contingencies	440	160	600	200	800	5.9
5.2 Price escalation	1,500	500	2,000	750	2,750	20.2
TOTALS	<u>7,194</u>	<u>2,428</u>	<u>2/ 9,622</u>	<u>4,000</u>	<u>13,622</u>	<u>100.0</u>
PERCENTAGES	52.8	17.8	70.6	29.4	100.0	

1/ Based on 1975 prices.

2/ See paragraph 3.15.

- 3.09 The engineering and administration costs include the operating costs of the Project Executing Agency for the four-year execution period as well as the payments to the firm of consulting engineers that will work on construction supervision.
- 3.10 The direct construction costs for the sewerage system were calculated by the consultants in mid-1974, using unit and total price quotes obtained from contractors and equipment suppliers. The Project Committee determined that inflation in this construction field in Barbados up to mid-1975 was approximately 17%, a figure consistent with price increases in the United States for projects similar to that proposed for Bridgetown. The figures given in the foregoing cost table were assumed to be valid up to the end of 1975.
- 3.11 The financing charges were based on the terms of the proposed loan as described in paragraph 3.20. It is planned that the loan would be disbursed at the rate of 10% during each of the first two years, 50% in the third year and 30% in the fourth year. All of this is consistent with the execution timetable of the project. 1/
- 3.12 The category of concurrent costs includes, first of all, the compensation that will probably have to be paid for land and easement purchases as well as compensation for removal of individuals living on the land where the treatment plant will be built. Also included is the payment to the Bank for ATN/1106-SF-BA which was granted on a contingent recovery basis for the preparation of the project study.
- 3.13 As concerns the unassigned item, it should be pointed out that the project works are clearly defined in the construction plans and the specifications are prepared and consequently, a 10% figure for the direct cost has been considered sufficient and appropriate as the contingencies item. Furthermore, the Project Committee has estimated the cost escalation at 10% per annum for the period of execution of the proposed works, resulting in a total escalation of US\$2,750,000 as given below:

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1/ See Appendices E and G.

(In US\$ thousands)

<u>Works</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Total</u>
House installations	-	-	-	300	300
Collectors	-	875	1,750	875	3,500
Treatment plant	-	875	1,750	875	3,500
Underwater discharge	-	-	350	350	700
Total, 1975 prices	-	1,750	3,850	2,400	8,000
(Escalation factor)	(0.10)	(0.21)	(0.33)	(0.46)	-
Escalation	-	370	1,270	1,110	2,750

3.14 The direct component of foreign currencies includes the value of the equipment, materials and supplies to be imported, consultants' fees and other expenses that must be paid in foreign currency, including the estimate for contingencies and price escalation. The indirect component of foreign currencies was estimated at US\$2,428,000, which would be for depreciation of construction equipment and for the external component of the cost of certain materials to be bought locally such as aggregates for the concrete mix and the purchase of fuels and lubricants, including contingencies and price escalation.

3.15 The estimated cost in local currency consists fundamentally of wages to local staff. In addition, payments for the house installations and the compensation have been budgeted in local currency.

#### D. Financing Plan

3.16 The project would be financed as indicated in the following table, which shows how the resources of the Bank loan and the local contribution would be used, by investment category:



FINANCING OF THE PROJECT  
(In US\$000 or equivalent)

Investment Category	IDB Loan					Local Contribution			Total	%
	Costs in Foreign Currencies			National currency for local costs	Sub- total	Currency for				
	Direct costs	Indirect costs	Sub- total			External costs	Local costs	Sub- total		
<u>Engineering and Administration</u>										
1 Engineering	125	118	243	-	243	-	145	145	388	2.8
2 Administration	-	-	-	-	-	-	145	145	145	1.1
Total Category 1	125	118	243	-	243	-	290	290	533	3.9
<u>Direct Costs</u>										
1 House installations	-	-	-	-	-	-	300	300	300	2.2
2 Collectors	2,000	750	2,750	200	2,950	-	550	550	3,500	25.7
3 Treatment plant	2,000	750	2,750	-	2,750	-	750	750	3,500	25.7
4 Underwater discharge	400	150	550	-	550	-	150	150	700	5.1
Total Category 2	4,400	1,650	6,050	200	6,250	-	1,750	1,750	8,000	58.7
<u>Financing Charges</u>										
1 Interest	300	-	300	-	300	-	-	-	300	2.2
2 Credit commission	-	-	-	-	-	122	-	122	122	0.9
3 Inspection and supervision	97	-	97	-	97	-	-	-	97	0.7
Total Category 3	397	-	397	-	397	122	-	122	519	3.8
<u>Concurrent Costs</u>										
1 Compensation	-	-	-	-	-	-	810	810	810	5.9
2 Payment, technical cooperation ATN/SF-1106	210	-	210	-	210	-	-	-	210	1.6
Total Category 4	210	-	210	-	210	-	810	810	1,020	7.5
<u>Unassigned</u>										
1 Contingencies	440	160	600	-	600	-	200	200	800	5.9
2 Price escalation	1,500	500	2,000	-	2,000	-	750	750	2,750	20.2
Total Category 5	1,940	660	2,600	-	2,600	-	950	950	3,550	26.1
TOTALS	7,072	2,428	9,500	200	9,700	122	3,800	3,922	13,622	100.0
PERCENTAGES	51.9	17.8	69.7	1.5	71.2	0.8	28.0	28.8	100.0	

1. Source and application of funds

3.17 The source and application of funds are summarized in the following table:

(In US\$000 or equivalent)

	<u>Source</u>		<u>Application</u>		<u>Total</u>	<u>%</u>
	<u>Foreign</u>	<u>Local</u>	<u>Foreign</u>	<u>Local</u>		
IDB (FSO)	9,500	200	9,500 <sup>1/</sup>	200	9,700	71.2
Local contribution	<u>122</u>	<u>3,800</u>	<u>122</u>	<u>3,800</u>	<u>3,922</u>	<u>28.8</u>
Total	<u>9,622</u>	<u>4,000</u>	<u>9,622</u>	<u>4,000</u>	<u>13,622</u>	<u>100.0</u>
Percentages	70.6	29.4	70.6	29.4	100.0	

2. The Bank loan

3.18 The loan would be chargeable to the Fund for Special Operations and would total the equivalent of US\$9.7 million, of which up to the equivalent of US\$200,000 would be disbursed in local currency. Goods and services could be purchased in Barbados and in the other member countries of the Bank with the loan's resources. The resources to be disbursed in foreign currency would finance the purchase of goods and services made through international public bidding (except the engineering services which are not subject to bids), using the margins of preference acceptable to the Bank wherever necessary. These costs would cover expenditures in foreign currency, both direct and indirect. Furthermore, the resources disbursed in East Caribbean dollars would finance part of the cost in local currency for construction contracts awarded through the aforementioned international public bidding system as well as for goods of national origin that could be purchased through public bids restricted to Barbados.

3.19 The loan would finance: i) the foreign currency for the engineering; ii) the foreign currency of the direct cost of construction, except the house installations; iii) the financing charges of the IDB loan, excluding the payments for credit commission during the disbursement period; iv) the payment of ATN/SF-1106-BA; and v) the foreign currency for contingencies and price escalation.

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<sup>1/</sup> Includes the equivalent of US\$2,428,000 estimated as indirect costs in foreign currency.

- 3.20 The Bank loan would be granted to Barbados at an annual interest rate of 2 percent. The repayment would be made over a 35-year period, including a grace period of eight years. The loan would carry a credit commission 1/2 percent per annum on the undisbursed part of the loan and an inspection and supervision fee of one percent on the amount of the loan.

### 3. Local contribution

- 3.21 Barbados would contribute local funding in the equivalent of US\$3,922,000 or 28.8 percent of the estimated total cost. This contribution, to be taken from the national budget, would cover the expenses in national currency of: i) engineering; ii) administration; iii) compensation; iv) direct costs of construction; v) house installations; and vi) some of the unassigned costs. In addition, it would provide the foreign currencies of the credit commission of the Bank loan 1/.

### E. Studies and Designs

- 3.22 The project study was prepared by the consulting firm Quirk, Lawler and Matusky, of Tappan, New York, U.S.A., and is chargeable to technical cooperation ATN/SF-1106-BA. The consultants' work is considered satisfactory. The complete final designs are available and this will make it possible to start the bidding process and execution soon. The approach the consultants followed in preparing the project covered the following major aspects:

#### 1. Collector system

- 3.23 The area of the project study covered all of Bridgetown and the surrounding area toward which the city will expand and where there is a need to build sewage systems within the foreseeable future. The topography of the land led to the delineation of watersheds, among which that of the Constitution River is the most heavily used and which, consequently, takes priority in the sewage system construction. For this reason the decision was made to limit the area of design to this area since, in addition to being defined by the topography of the land, this basin has also been defined as a unit by existing communication links and those projected to the future. The sanitation improvement of nearby watersheds was proposed for future projects.
- 3.24 Within design period of the project, it is believed that the eventual population to be served by the proposed sewer system will result in

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1/ See Appendix D which analyzes the capacity of the national budget to pay the local contribution.

a service volume of approximately 3.6 MGD (13.6 MLD), the maximum capacity of the system. The initial laying of the collectors and the future expansion projects of this system were evaluated jointly and with the possible stages of construction of the treatment plant because both the collector system and the plant itself are related to each other and are equally important in terms of construction costs. The study of alternatives referred to in paragraph 3.33 led to the determination of an optimal initial extension of the collector system and consequently, the initial capacity of the treatment plant.

## 2. Treatment plant

- 3.25 Once the capacity of the treatment plant was determined in consideration of the expected development of the design area up to 1995, and once the possibility of using modular construction in multiples of 1.2 MGD (4.5 MLD) was determined on the basis of two construction stages of the system, an investigation was made of the process that could produce effluent on the desired standards. The critical parameter, from the standpoint of sanitation, is the number of coliform organisms which should not exceed 1,000 per 100 millimeters, according to the recommendations of the Environmental Protection Agency of the United States. Using this figure as the major basis of the analysis, the results of several types of treatment were considered for the following effects:

<u>Treatment</u>	<u>Coliforms/100 ml.</u>	<u>Reduction Factor</u>
None	50,000,000	1
Primary	15,000,000	3.3
Secondary	2,500,000	6.0
Chlorination	2,500 <sup>1/</sup>	1.000
Dilution	1,000	2.5

- 3.26 The reduction factor of coliform bacilli required is 50,000, which could be considered viable without any further treatment than chlorination (1,000) and proper dilution (50). But since this reduction is a function of the length of the underwater discharge and the depth of the outlet, Bridgetown would require a discharge some 1,500 meters long dumping at approximately 20 meters of depth. With these figures, the cost would be higher than that of a treatment plant and there would still be the problem of floating solids which would not be eliminated.

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<sup>1/</sup> Acceptable using less strict standards than those of EPA.

- 3.27 Having seen the need to build a treatment plant, it was decided to use a secondary process since the primary treatment alone eliminates only 70 percent of the solids and has little effect on reducing coliform bacilli. The secondary process eliminates 95 percent of the suspended solids and 95 percent of existing coliform organisms in the waterwasters. The cost of the secondary treatment plant is only 20 to 30 percent higher than that of a primary plant. Among the several secondary treatment alternatives, the process of stabilization by contact was selected since it does not require as much treatment tank space, thereby reducing the construction costs. These costs are 15 percent lower than those for similar processes. Space limitations in the area of Bridgetown ruled out stabilization ponds although they would probably require an initially lower investment.
- 3.28 These same space limitations restricted the selection of a plant site to four areas, three of which were rejected since they were in the way of port expansion works and neighboring industrial development. The site chosen, known as Emmerton Land, is located next to the area served by the sewer system in a low area which facilitates the flow of the collector water into the plant. It is a short distance from the coast and the discharging of the effluent into the ocean is thereby simplified.

### 3. Underwater discharge

- 3.29 The location of the underwater discharge was an important factor in selecting the site of the treatment plant. Consideration was given to three possible areas where the plant effluent could reach the shoreline. Two of these sites were located north of the port installation, in the area where the port will be expanded. Consequently, a point located on Carlisle Bay to the southeast of the port was selected, at a relatively short distance from the treatment plant sites where it will not interfere with the aforementioned expansion work.
- 3.30 The discharge has been designed to operate by gravity flow with a maximum design volume of 13.6 million liters per day, which is estimated to occur in 1995. Initially the discharge will be no more than approximately 50 percent of this figure. The length of discharge pipe and the depth at which the discharge diffusers will be installed were determined on the basis of soundings of the bay floor and a study of ocean currents.
- 3.31 Consideration has been given to using the plant effluent for agriculture either by using it to recharge aquifers or in an irrigation system that would cover an initial area of only some 250 hectares. Technically it is feasible to recycle wastewater that has been

treated as in the proposed system but economic reasons rule against it as long as there are other cheaper sources of water for irrigation. The pipe and pumping system alone to the closest possible place where the water could be used would have an initial cost 60 percent higher than the proposed underwater discharge. Furthermore, it would be cheaper to operate the discharge because it will operate by gravity flow.

- 3.32 It is not expected that the water studies to be conducted on this matter will lead to conclusions other than those given above but they will provide more precise information about the cost of recycling waste-water, an operation that probably will be necessary by the end of the project design period (1995), which is when currently-identified water reserves will be exhausted.

#### 4. Comparison of alternatives

- 3.33 The project as a whole is relatively expensive, primarily because of its size, but the studies made by the consultants and confirmed by Bank technicians show that in all aspects of the project the most economic solution has been adopted. On one hand, the treatment process (activated sludge) requires facilities only 27 percent more expensive than those of a primary treatment plant and on the other, the size of the project and its modular design, to accommodate future expansion up to maximum capacity, also provide the most economical alternative 1/. The following table is a comparison of alternatives.

	<u>Alternatives</u>		
	<u>1 <u>2/</u></u>	<u>2</u>	<u>3</u>
Initial Capacity (connections)	3,000	2,250	1,500
Future expansion (connections)	<u>2,000</u>	<u>2,750</u>	<u>3,500</u>
Final capacity (connections)	5,000	5,000	5,000
Initial cost (US\$000) <u>3/</u>	8,000	7,250	6,500
Cost of expansions (US\$000) <u>4/</u>	<u>4,000</u>	<u>5,500</u>	<u>7,000</u>
Total cost (US\$000)	12,000	12,750	13,500

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1/ See paragraphs 6.22 to 6.26 of this report.

2/ Alternative adopted.

3/ 1975 prices.

4/ 1985 prices.

F. Execution of the Project

1. Scheduling and timetable

- 3.34 Appendix E shows a condensed diagram of project execution over the four-year period starting from the date of signature of the eventual loan contract.
- 3.35 It is believed that the conditions prior to eligibility of the loan for disbursement can be met in 12 months. This is compatible with the timetable of execution of works. The Project Executing Agency would be organized prior to the signing of the loan contract and consequently that activity is not included in the execution diagram. It would be important to give priority to the contracting of the consulting firm that would cooperate in project supervision in order to move ahead with the paperwork for execution of the works.
- 3.36 During the six months following signature of the contract, the consultants who will participate in both the institutional and the comprehensive water studies, which should be carried out simultaneously with the construction of the sewer system, should be hired. The first study is important for the organization of the agency that will administer the sewer system once it is in operation. The water study is very important for the construction of the underwater discharge. For this reason, questions concerning the use of wastewater for agricultural purposes should be covered in the first stage of the water study, as contemplated in the respective plan of operations. <sup>1/</sup> The construction of the underwater discharge depends on the water study's confirmation of the basic design of that discharge system. Although it is not very likely that the designs will have to be revised, if this is the case the execution timetable includes adequate time to do it.
- 3.37 The construction of the treatment plant will require coordination between the execution of the civil works and the purchase and installations of the electromechanical equipment. The solution to this problem is not complicated because of the large amount of time estimated for the construction. A period of six months has been set aside for preliminary operations during which the tests and necessary changes will be made so that the plant functions properly.

2. Expropriations, easements and compensation

- 3.38 Most of the sewerage system collectors will be built along public routes and as a result this item presents no major difficulties in

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<sup>1/</sup> See paragraph 4.01 of the respective plan of operations.

obtaining a right of way. A treatment plant will be built on a site, part of which is partially privately owned and occupied by housing units that will have to be vacated. The government has started action to acquire the land and to transfer the occupants of the areas affected by the plant construction. Generally speaking, these housing units are of a semi-mobile type (chattel houses) which makes this preliminary job easier. Following Bank practice in similar situations such problems must be solved before the works are started. 2/ The investment for this item is included in the local contribution under the category of current costs. In addition, it is recommended that the Health Services Act of 1949 be amended to allow the Ministry of Health and Welfare to establish easements on private property for the purposes of laying the sewer pipe and performing the corresponding maintenance work. 2/

### 3. House installations

- 3.39 The costs of the project include the construction of approximately 3,000 house connections and the adaptation of inside installations so that all existing building along the sewerage system can be hooked up to it. Although at this time relatively few empty buildings stand in the way of the system, according to Bank policy, a suitable mechanism (a revolving fund) will have to be established to make loans to low-income people to pay for the inside installations that connect the housing units to the public system. In addition, measures should be taken to achieve optimum use of this system by proper regulations 3/, which require all people living in the area to hook up to the system. 4/

### 4. Acquisition of goods and services

- 3.40 The principal works of the project shall be awarded through an international public bidding competition following the procedure already prepared and negotiated between the Bank and the government. 5/
- 3.41 According to the execution timetable for this project, the bids shall be carried out as follows:

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1/ See clause 1(i) of the Recommendations.

2/ See clause 4 of the Recommendations.

3/ See clause 2 of the Recommendations.

4/ See clause 5 (ii) of the Recommendations.

5/ A copy of the bidding procedure is attached as Appendix F.



Second Year:

Collectors	US\$3,500,000	
Treatment plant	<u>3,500,000</u>	US\$7,000,000

Third Year

Underwater discharge	<u>700,000</u>	
Estimated total to award	<u>US\$7,700,000</u>	<u>1/</u>

- 3.42 The consultants who designed the Bridgetown sewer system prepared all necessary bid documents which are subject to final review and approval by the Bank.

5. Works by force account

- 3.43 Considering the difficulty of contracting some of the work involved in the project, plans call for carrying out some works by force account 2/ in the following manner:

House installations	US\$300,000
Relocation of households	<u>350,000</u>
Total	<u>US\$650,000</u>

- 3.44 Both items will be covered by the local contribution. The first is under the category of direct costs and the second under the compensation item when those affected prefer to have the government take complete responsibility for the work of relocating them instead of being paid in cash. The estimate is for the extreme case in which all of those affected prefer the government to take responsibility owing to the relatively simplified nature of the work mentioned, the Project Executing Unit is not expected to have any difficulties in having the work done by force account.

6. Investment schedule

- 3.45 Appendix F shows the investment schedule planned for the programming of the project. The investments financed by the resources of the proposed loan assume the establishment of a revolving fund of US\$970,000 during the first year and its replenishment through justifying documents in later years.

Considering the usual lag between the making of the investment and its justification to the Bank, the category of direct costs shows an

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1/ Does not include price escalation.  
2/ See clause 8(k) of the resolution.  
3/ Does not include cost escalation.

apparent discrepancy in pari-passu funding. However, the total pari-passu of the project, which is approximately 70%-30%, should be maintained over the entire execution period.

#### 7. Project Executing Agency

- 3.46 The government has established a Project Executing Agency which will be responsible for supervising the project. This agency is attached to the Ministry of Health and Welfare and will depend directly on the Permanent Secretary so as to have sufficient authority and independence of action. In matters pertaining to technical cooperation, the agency will maintain liaison with the BWD and the Ministry of Agriculture, Science and Technology. The interministerial coordination shall be exercised by the Ministry of Finance and Planning.
- 3.47 The Executing Agency will be staffed with enough people and other elements 1/ needed to manage the technical and administrative aspects of the project itself. It will have the advisory service and cooperation of a firm of consulting engineers, as indicated below.

#### 8. Consulting engineers

- 3.48 Before the first disbursement of the Bank loan is made, 2/ the government will engage the services of a consulting firm to advise the Executing Agency on carrying out its activities. The activities in which the consultants will participate include the following: a) review of designs and bidding documents; b) selection of contractors; c) evaluation of bid offers; d) preparation of execution programs; e) technical supervision of the works, including analysis, tests and other checks; f) quantification of amounts and payments to contractors; g) initial operation of the system; h) preparation of operational and maintenance manuals; and i) other activities in which the Executing Agency needs technical assistance.

#### 9. IDB inspection and supervision

- 3.49 The Bank may supervise execution of the project in several ways. Of these the Project Committee recommends entrusting the functions of inspection and supervision to the Sector Specialist in Engineering already appointed for the port expansion works of Bridgetown (loan 277/OC-BA) who at certain times may have the help of a Sanitary Works Specialist residing in another member country. This recommendation is consistent with the hiring of local professionals to work with the Sector Specialist, if necessary.

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1/ See clause 8(c)(i) of the resolution.

2/ See clause 8(c)(ii) of the resolution.

10. Capacity of contractors and suppliers

- 3.50 Barbados has no construction firms capable of executing the entire project, although there are some who could execute part of the works as subcontractors. However, when international bids are called for, no difficulty in obtaining proposals from responsible firms is expected. The size and importance of the project will probably attract suitable contractors from several member countries of the Bank. Although the project has some degree of specialization, no difficulties are expected in obtaining the materials and equipment needed to carry it out. Most of this equipment will have to be imported.

11. Auditing

- 3.51 Within 120 days following the close of each fiscal year, the borrower must present to the Bank through the Project Executing Agency and then through the authority established to administer the water and sewerage service, beginning with the fiscal year ending December 31, 1976 and for the rest of the life of the loan, the financial statements of the project and of that authority audited by a firm of certified public accountants.

G. Operation of the Project

1. Costs of operation

- 3.52 The government intends to establish an authority that will assume the functions now performed by the Barbados Waterworks Department and will also take responsibility for operating the Bridgetown Sewerage System and any other sewerage system built in the future. This institutional solution has been selected from among the several alternatives studied since it is the most efficient way to administer the new service because it uses human and physical resources now available within the BWD.
- 3.53 The operating costs of the sewerage system will be lower with this proposed organization. The estimates of the direct annual operating costs of the system are summarized below:

Wages and salaries	US\$100,000
Energy and supplies	250,000
Depreciation	<u>277,000</u>
Annual total	<u><u>US\$627,000</u></u>

- 3.54 Based on the initial capacity of the system (9,100 cubic meters per day), the annual volume to be collected, treated and discharged will be approximately 3.3 million cubic meters at a unit cost of US\$0.19 per cubic meter (US\$0.72 per 1,000 gallons).

## 2. Financing alternatives

- 3.55 The planning of the project included a financial study which will be the groundwork for the rate studies to be conducted later on. This study identified the following sources of income to finance the operation:
- a) An ad valorem tax on the properties improved directly by the system. In 1974 these properties had an assessment value for tax purposes equal to US\$37.5 million. The consultants noted that a 1 percent tax per annum on that assessment would yield income of approximately US\$375,000.
  - b) A charge for use of water which will be higher than that actually handled in the sewerage system since there are certain volumes that do not enter it. Making the conservative assumption that these volumes are equal, a charge of approximately US\$0.075 per cubic meter would be needed in addition to the abovementioned ad valorem tax to complete the financing of the operation, including costs for depreciation.
- 3.56 If the cost computation leaves out depreciation, the operating and maintenance costs drop to US\$350,000 per year, the cost per cubic meter falls to US\$0.106 and the financial burden borne by the users declines in proportion. Considering the nature of the project, an intermediate alternative will probably be suitable. This would be an attempt to have the income from service rates cover the operating and maintenance cost of the system and to the extent possible, depreciation. 1/
- 3.57 The rate study that is part of the technical cooperation to be conducted simultaneously with the construction activities will determine the final method of financing the operation of the system.

## 3. Maintenance of the system

- 3.58 Paragraph 3.48 mentions that one of the duties of the consulting engineers is to give advisory service in the preparation of operational and maintenance manuals for the system. These manuals will be presented to the Bank one year before completion of the construction work.
- 3.59 For the Bank to maintain proper follow-up with regard to maintenance of the system, during the first ten years of operations there will be a requirement to present annual reports containing information about such maintenance. 2/

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1/ See clause 8(g) of the resolution.

2/ See clause 3 of the Recommendations.

#### IV. INSTITUTIONAL AND FINANCIAL ANALYSIS

##### A. Borrower and Executing Agency

###### 1. Borrower

4.01 The borrower would be the Government of Barbados.

###### 2. Executing agency

4.02 The Project Execution Unit, which has been established by the government in the Ministry of Health and Welfare, would be responsible for supervising the construction of sewerage systems. Later, the government would establish an autonomous authority that would be responsible for the present functions of the Barbados Waterworks Department (BWD) and administration of the new sewerage service. This new authority would be created two years from the date of the loan contract and be organized in accordance with the recommendations in the institutional study to be conducted under the project. 1/

###### 3. Barbados Waterworks Department

###### i) Organization

4.03 By an 1895 law, the government established the Waterworks Department, which is now under the Ministry of Communications and Works. Because of its specialized duties, the BWD has always had a certain independence in its operations. However, since it is under the Ministry, the Department is subject to government personnel administration regulations (hiring, replacements, salaries, etc.). In other areas, such as budgets, procurement, bookkeeping and accounting, the department must comply with the regulations established in the financial laws administered by the Ministry of Finance and Planning.

4.04 The current BWD organization chart is contained in Appendix H. The department is under a Chief Engineer, who directly supervises the following divisions: 1) administration; 2) engineering, construction and distribution; 3) mechanical engineering and water supplies.

4.05 The BWD staff numbers a little over 1,000. Of these, 300 are permanent and the rest are temporary.

###### ii) PAHO technical cooperation

4.06 In May 1971, the government signed a technical assistance agreement with the Pan American Health Organization (PAHO), which was in

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1/ See attached plan of operations.

effect up to December 31, 1973. The technical assistance furnished the BWD by PAHO covered the following areas: structural organization, laws and regulations, billing, bookkeeping procedures, meter reading and collection, procurement and storage, personnel and revenue studies.

4.07 In its August 1974 report, PAHO states that, while all measures and recommendations suggested were not implemented entirely, a considerable improvement was made in the following aspects of the department's technical and administrative operations:

- a) administrative reorganization; the BWD organizational structure has been modified by establishing an administrative division responsible for direction and supervision of accounting, personnel, business operations, meter control, billing, collecting, procurement, storage and office services;
- b) the Parliament changed some aspects of the original BWD law (1895 Waterworks Act) giving the department greater authority, particularly in establishing water rate increases and expanding meter use;
- c) billing and collections were improved;
- d) progress was made in keeping accounting up to date under the system prescribed by the government.

iii) Financial administration

4.08 The BWD is under the Ministry of Communications and Works, and its budget therefore comes from that Ministry. Financial administration is under a manager, who is in charge of the various sections, such as the business section, central bookkeeping and others. This organizational scheme is recent and was put into effect in accordance with PAHO recommendations. The business section bills for services. Metered service is billed quarterly by hand, so that substantial improvements are required. Billing for fixed rate service is based primarily on the government's periodic valuation of estimated property income. This billing is done quarterly using the computer of the Data Processing Department of the Ministry of Finance and Planning, and the system is giving good results.

Billing for miscellaneous services (plumbing) covers charges to users for new installations, pipe repair, meter installation, etc., and is done monthly by hand, using bookkeeping equipment to record the bills. All service receipts must be deposited in the treasury account to the order of the Government General Accountant.

4.09 The central accounting section keeps the BWD books in accordance with the 1964 law on financial regulations and accounting. Bookkeeping is of the budget type, which consists in processing and recording expense vouchers. Financial data are issued in monthly budget reports, which are sent to the Ministry of Finance and Planning.

4.10 BWD operations are periodically reviewed by the Government's General Auditor, who reports directly to the Parliament. Due to staff limitations, the General Auditor's office is unable, in practice, to review accounts with the frequency and depth required. 1/

iv) Comments on BWD administrative and financial organization

4.11 With PAHO technical assistance, the BWD has improved some aspects of its administrative and financial organization. Despite the progress made, the department must complete mechanization of its billing system, increase meter installation, make the collection system more effective, and develop a satisfactory accounting and financial data system.

4.12 With the institutional technical assistance proposed in the attached Plan of Operations, the department hopes to receive specific recommendations on administrative and financial aspects that must be taken into consideration in organizing and putting into operation the new authority that will be responsible for administering water supplies and sewerage.

v) BWD budget execution

4.13 The BWD income and cost statement in Appendix 1 shows that it has historically operated at a deficit. Operating deficits and new capital investments are financed by the national government budget. The rise in income and expenditures shows the following trend:

(In thousands of US\$)

	<u>Real income</u>	<u>%</u>	<u>Real costs</u>	<u>%</u>	<u>Surplus (deficit)</u>
1971/72 <u>2/</u>	1,017	100	1,785	100	(768)
1972/73	1,095	108	1,745	98	(650)
1973/74	1,398	137	2,488	139	(1,090)
1974/75	2,168	213	3,162	177	(994)
	<u>Budget</u>				
1975/76	2,603	256	3,303	185	(700)

1/ See paragraph 3.51 of Chapter III.

2/ Base year equals 100.

Note that starting in 1974, the percentage of income has risen more than costs with respect to the base year, resulting in a decrease in the annual deficit. This is due to the establishment of new rates, effective April 1, 1974. Real costs do not include depreciation, according to BWD bookkeeping practice.

vi) BWD statement of accounts receivable

- 4.14 Available data for analysis of accounts receivable are limited. However, the following tables give the amounts collected and age of overdue accounts as of March 31, 1975, for billings in the nine months from April 1 to December 31, 1974, for sales of water and other services. The water accounts are classified into fixed rates and metered rates, while the miscellaneous accounts are for connections and plumbing services charged to users for new installations, pipe repair, meter, etc. This data is obtained from records other than the account books, since the BWD keeps books on sales and services at the time of collection not at the time of billing.

<u>Class of accounts</u>	<u>No. of accounts</u>	<u>Amounts</u>	
		<u>US\$ thousands</u>	<u>%</u>
<b>A. <u>Water-Fixed Rates</u></b>			
1. Accounts billed in 9 months (from 4/1/74 to 12/31/74)	n. a.	<u>447.6</u>	<u>100.0</u>
2. Accounts collected as of 3/31/75	n. a.	<u>289.1</u>	<u>64.6</u>
3. Accounts in arrears as of 3/31/75	<u>16,370</u>	<u>158.5</u>	<u>35.4</u>
3 months	<u>11,742</u>	<u>90.5</u>	<u>20.2</u>
6 months	<u>3,224</u>	<u>42.4</u>	<u>9.5</u>
9 months	<u>1,404</u>	<u>25.6</u>	<u>5.7</u>
<b>B. <u>Water-Metered Rates</u></b>			
1. Accounts billed in 9 months (from 4/1/74 to 12/31/74)	n. a.	<u>419.6</u>	<u>100.0</u>
2. Accounts collected as of 3/31/75	n. a.	<u>361.5</u>	<u>86.2</u>
3. Accounts in arrears as of 3/31/75	<u>1,594</u>	<u>58.1</u>	<u>13.8</u>
3 months	<u>895</u>	<u>19.7</u>	<u>4.7</u>
6 months	<u>438</u>	<u>29.9</u>	<u>7.1</u>
9 months	<u>261</u>	<u>8.5</u>	<u>2.0</u>
<b>C. <u>Miscellaneous Accounts (Plumbing)</u></b>			
1. Accounts billed in 9 months (from 4/1/74 to 12/31/74)	n. a.	<u>565.0</u>	<u>100.0</u>
2. Accounts collected as of 3/31/75	n. a.	<u>418.0</u>	<u>74.0</u>
3. Accounts in arrears as of 3/31/75	<u>2,586</u>	<u>147.0</u>	<u>26.0</u>
3 months	<u>1,080</u>	<u>74.0</u>	<u>13.1</u>
6 months	<u>734</u>	<u>14.0</u>	<u>2.5</u>
9 months	<u>772</u>	<u>59.0</u>	<u>10.4</u>



The above table shows that fixed rate water accounts amounted to US\$447.6 thousand in the nine months from 4/1/74 to 12/31/74, or 52% of total billings for water sales in that period. The remaining 48% represented metered rate sales, which amounted to US\$419.6 thousand.

Fixed rate water accounts show the longest delays in collection, with 35.4% of billings in arrears, while 13.8% of metered rate water accounts are in arrears. Note that, while 35.4% of billings in arrears is a high percentage, most of the overdue accounts (52%) are under three months. On the other hand, fixed rate overdue billings are the most numerous, numbering 16,370 at an average of US\$9.68 each, compared to 2,586 overdue metered rate accounts, averaging US\$36.45 each. This characteristic of numerous small accounts probably indicates a need to change the collection systems for this category of users so as to speed up collection of accounts. The BWD now collects for its services through the four collection offices located in Pine, Bridgetown, Oistings, and Folkstone. One of the objectives of the technical cooperation operation proposed under this project is to study establishment of a uniform billing system for all services, develop better procedures for collection and cut off of service for delinquent accounts, and prepare a program for collecting accounts receivable from users. 1/

Miscellaneous accounts for connections and plumbing also show a high percentage of overdue billings - 26% in the nine-month period. The number of overdue accounts for this item was 2,586, averaging US\$56.84 each. It is believed that users frequently question the BWD's right to collect these charges and that collection is less than energetic. This situation should also be corrected as a result of the proposed technical cooperation operation.

The following table gives a complete statement of overdue accounts as of 3/31/75, which completes available data on BWD billing and collections. This additional data show that miscellaneous accounts (connections and plumbing) constituted 59.2% of arrears in the amount of US\$347.5 thousand. Next in importance are the fixed rate water accounts comprising 29.3% of the total, in the amount of US\$188.0 thousand, and the metered rate water accounts with the remaining 16.5% in the amount of US\$105.7 thousand:

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1/ See paragraphs 6 and 7 of Chapter IV - A of the technical cooperation plan of operations.

Overdue Accounts Receivable as of March 31, 1975

	<u>No. of accounts</u>	<u>% of accounts</u>	<u>Amount in thousands of US\$</u>	<u>% of amounts</u>
<u>Water-Fixed Rates</u>	<u>17,768</u>	100	<u>188.0</u>	100
3 months	11,742	66	90.5	48
6 months	3,224	18	42.0	22
9 months	1,404	8	26.0	14
12 months and over	1,398	9	29.5	16
<u>Water-Meterd Rates</u>	<u>1,963</u>	100	<u>105.7</u>	100
3 months	895	46	19.7	19
6 months	438	22	29.9	28
9 months	261	13	8.5	8
12 months and over	369	19	47.6	45
<u>Miscellaneous Accounts</u>				
<u>(Plumbing)</u>	<u>23,239</u>	100	<u>347.5</u>	100
3 months	1,080	5	74.0	21
6 months	734	3	14.0	4
9 months	772	3	59.0	17
12 months and over	20,653	89	200.5	58

## V. FINANCIAL PROJECTIONS

### A. Water System: Basic Assumptions

- 5.01 Estimated water production for the ten fiscal years beginning 1976/1977 is 26 million gallons a day for the first year, increasing with few exceptions one million gallons a day per year thereafter. This estimate follows the BWD's historical rising trend. The Department's experience indicates that 15% of water production is lost due to leaks, broken pipes and other causes. Expected receipts for water sales in FY 1975/1976 divided by expected net production gives an income of US\$0.051 per m<sup>3</sup> (see Table I of Appendix J). Income projection has been estimated on the basis of this unit income. The income estimate for connections, plumbing and miscellaneous is based on experience in recent years.
- 5.02 The cost per m<sup>3</sup> of net water production is obtained by dividing total expenses by the total m<sup>3</sup> produced (see Table I). These costs have varied from US\$0.078 for FY 1974/1975 to US\$0.076 for the current fiscal year, excluding depreciation. Cost estimates have been based on a cost of US\$0.08 per m<sup>3</sup>, not including depreciation. Based on BWD data, fixed asset investments have been established from 1966 on, and an average 2.8% depreciation rate has been applied to them. Costs of connections, plumbing and miscellaneous are also based on historical experience.
- 5.03 Local investments needed to expand the water mains system, drill new aquifer wells, construct new reservoirs, etc., have been estimated by the BWD.

### B. Sewerage System: Basic Assumptions

- 5.04 The consultants' estimate, which does not include depreciation, has been found acceptable by the Bank's experts. A depreciation estimate has been added to the projections. The project costs, investment schedule, and financial expenditures utilized are those established in this report. 1/

### C. Projections of Results

- 5.05 Tables II, III and IV of Appendix J give projections of results for the water and sewerage system, along with consolidated projections for both services. The tables show deficits in the projections for both the water service and the new sewerage service. In the first

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1/ See Table VI of Appendix J.

case, the deficit is a result of rates that do not cover the system's administrative, operating and maintenance costs, much less depreciation. The sewerage system's expected income covers those costs, but only part of the depreciation.

- 5.06 The technical cooperation operation contemplated for the new authority to be organized for administration of the water and sewerage services includes a rate study to establish conditions for the authority to become self-sufficient.

D. Sensitivity Analysis of the Projection of Results from the Rate Increase

- 5.07 It was thought desirable to analyze the possible impact of a gradual rate increase to cover:

- a) First alternative - Administrative, operating, maintenance and depreciation costs.
- b) Second alternative - Administrative, operating and maintenance costs, excluding depreciation.

- 5.08 Since income currently covers about two thirds of costs, it is assumed that annual increments will be made to avoid a sharp increase that might cause negative reactions from users. The analysis shows that costs would be totally absorbed with an average rate of US\$0.09 to US\$0.095 per m<sup>3</sup>, a 73% increase over current average rates. Costs excluding depreciation would be covered with a rate of US\$0.07 to US\$0.075, a 36% increase over current average rates. Table V of Appendix J shows the financial impact of these increases.

E. Statement of Source and Application of Funds

- 5.09 The statement of source and application of funds for the water and sewerage authority to be established (see Table VI of Appendix J) is based on the following assumptions: the government will provide works built with funds from the Bank loan and the local counterpart for the sewerage project as a capital contribution to the authority. It will also provide funds to continue expanding the water system at the same rate. The government will also cover the authority's operating deficits for as long as they occur. The foregoing indicates that the authority cannot be responsible for the Bank project's financial costs, which must be covered by the Barbadian Government.

## VI. SOCIOECONOMIC EVALUATION

### A. Sewerage Requirements

#### 1. Initial service area

- 6.01 According to the Housing Census of 1970, there were approximately 59,400 dwellings in Barbados, the human fecal waste from which was disposed of by the following methods:

Latrines	71%
Toilets	27%
Other means	<u>2%</u>
	<u>100%</u>

Some 74% of the toilets were located in the area of Bridgetown and its environs.

- 6.02 The central area of Bridgetown to be serviced by the proposed sewerage system can be subdivided as follows: a) docking zones for coast-wise shipping vessels (careenage); 1/ b) commercial district, with its narrow, winding streets; and c) outlying residential areas, which are a combination of middle-class permanent structures (built principally of stone) and rudimentary wooden structures, or chattel houses, usually built on temporary foundations. The area to be served covers approximately 200 hectares, equivalent to 43% of the central area of Bridgetown. 2/

#### 2. Problems of congestion in Bridgetown

- 6.03 Among the factors that contribute to the predominant role that Bridgetown plays in all aspects of the national life are the following:
- a) a population density of 605 inhabitants per square kilometer in the country;
  - b) a highway network of three kilometers per square kilometer;
  - c) a maximum distance of 29 kilometers between Bridgetown and any other point;
  - d) maximum bus fares of US\$0.35;

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1/ The expansion of the port of Bridgetown, which is being carried out with financial aid from the Bank, will in the future make it possible to accommodate vessels of smaller draft.

2/ See paragraph 6.12.

- e) a 9% annual increase in the number of automobiles, and a 2% annual increase in the number of buses and trucks in the country;
  - f) the effect of the tourist industry.
- 6.04 The move of the residential population toward the suburbs has been offset by the people who go into Bridgetown daily and spend the greater part of their working hours there, maintaining the level of pressure on public services.
- 6.05 The number of residents in the central area of Bridgetown fell from 11,000 in 1960 to 8,900 in 1970, but the number of vehicles has grown to approximately 17,000 automobiles on a daily average.
3. Potential users of the sewerage system
- 6.06 Social security statistics for 1971/1972 showed that there were 25,740 employees in the area to be served initially by the proposed sewerage system; of them, 23,240 remained at their jobs for the full working day. In addition, the area has 15 schools with a total of 6,000 students, which adds up to a transient population of 29,240 persons.
- 6.07 The 1970 Census and the Physical Development Plan of Barbados estimate that transient population at 28,500 persons, and the population survey carried out specifically for the sewerage project put the number at 25,500. This figure, when added to the 4,600 permanent residents of the area, gives an approximate total of 30,100 as initial users of the proposed sewer system, without including the staff and patients of Queen Elizabeth Hospital, which increase the total by some 2,000 persons.
4. Population projections to 1995
- 6.08 The Town and Country Planning Office estimates that in the next 20 years there will be no increase in either the number of residents or the student population in the area under consideration, but that the number of people who work in it will grow by between 4,500 and 7,600 persons, depending on the improvements made on the area's road system.
- 6.09 According to the previous estimates, the number of people served will grow from approximately 30,100 to between 34,600 and 37,700 by 1995. The corresponding growth rates would be of 0.64% annually and 1.03% annually in each case, as compared to the annual growth rate of Barbados as a whole, which has averaged 0.37% between 1960 and 1973.
- 6.10 The projected road improvements (Spine Road and Inner Ring Road) will tend to improve land utilization in the metropolitan area of Bridgetown by decentralizing non-essential activities. The road plan goes

hand in hand with other measures of urban development in the city, such as port improvements, the establishment of industrial parks and the proposed sewerage project.

- 6.11 The principal effect of the road project will be to attract warehouses and factories to the fringes of the city, leaving the downtown area for office buildings and stores. The net impact of these changes will be an increase in the transient population of the central area, since there is a greater worker density in office buildings and stores than in warehouses and similar buildings.
- 6.12 On the basis of the foregoing data, the population survey of the seven sectors into which the initial area of the sewerage project were divided breaks down the population to be served in 1995 as follows:

<u>Sector</u>	<u>Percentage of Area</u>	<u>Resident and Transient Population</u>	<u>Density of Use (Persons per Acre)</u>
A	6	2,500	90 <u>1/</u>
B	7	7,700	222 <u>1/</u>
C	8	4,300	100 <u>1/</u>
D	7	2,500	71
E	16	5,600	70
F	24	8,000	65
G	32	7,100	44
	<u>100</u>	<u>37,700</u>	<u>75</u>

5. Size of the project

- 6.13 The following table depicts the situation of water supply and sewage disposal services in 1970, for Barbados and for the two parishes in which the metropolitan area of Bridgetown lies:

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1/ Areas subject to greater sanitary deterioration if the project is not carried out. See map in Appendix B.

	<u>Barbados</u>	<u>St. Michael 1/</u>	<u>Christ Church</u>
Number of dwellings:	59,400	26,300	9,200
Water supply:	<u>100</u>	<u>100</u>	<u>100</u>
In the home	40	49	51
On property	21	20	18
Public facilities	37	29	28
Others	2	2	3
Sewage disposal:	<u>100</u>	<u>100</u>	<u>100</u>
Toilets	27	30	42
Latrines	71	69	55
Others	2	1	3

- 6.14 The total number of water supply connections has increased from 42,800 in 1970 to 54,300 in 1974, and the average water production of 90 MLD in 1970 has grown to 105 MLD in 1974. In the same period there were no significant changes in the figures for sewage disposal.
- 6.15 Past figures for water consumption can be considered high, having reached 457 liters per capita daily (LPCD) in 1972. Even though that consumption does not give an accurate picture of domestic consumption, in that it includes the water consumed in hotels and port facilities, it has been established that part of the water earmarked for use in dwellings is used for irrigation purposes. The study made by the Barbados Waterworks Department with the collaboration of PAHO in 1968, whose recommendations have been adopted as long-range sectoral policy, suggests an average usage of 340 LPCD; to this end, it proposes measures such as wider use of meters and the adoption of differential rates. The proposed figure is based on the specific usages of 45 LPCD to 70 LPCD for public facilities, 180 LPCD for general domestic use and 455 LPCD for hotels and upper class dwellings in the southern and western areas of the island, not included in the area of the project.
- 6.16 The proposed average usage of 340 LPCD includes possible losses in the distribution system and other sources that do not form part of the sanitary sewer system, such as the water utilized for sprinkling gardens and cleaning streets. For this reason, the estimated volume for the sewerage project is 227 LPCD, or 67% of the proposed usage. The total estimated volume as a basic input to the system would then be approximately 8.56 MLD, based on the estimated 1995 population for the initial service area and without including water derived from infiltration.

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1/ Includes the area of the project.



- 6.17 As explained in Chapter III of this report, the initial service area is subject to physical growth, it being estimated that the total number of consumers will eventually reach 57,200. Based on the average usage of 227 LPCD, this increase will raise the total to approximately 12.98 MLD. The initial and final capacities adopted by the treatment plant are respectively 9.1 MLD and 13.6 MLD, which gives a margin of 5% to absorb infiltrations into the system.
- 6.18 The water collection system has been designed taking into account the maximum expected volumes, on the basis of population density as broken down earlier in paragraph 6.12 and the infiltrations corresponding to the respective diameters as well as extensions of branch lines in the future. The drainage system has been designed for the maximum projected volume of 13.6 MLD.
- 6.19 In every instance consideration has been given to the maximum volumes that might occur at any moment in the operation of the system, and, in the case of the treatment plant, the least expensive process within the adopted quality standards was decided upon.

B. Project Benefits

1. Existing conditions

- 6.20 The initial area to be served by the project has approximately 3,900 sanitary units (latrines and water closets) to service the 30,100 people that make up the resident and transient population today; that is, a ratio of approximately one to eight. Of those units, 3,000 are toilets that, in the best of cases, empty into septic tanks that must be cleaned out every five years. The 900 existing latrines empty into cesspools 12 to 18 feet deep, which must also be cleaned periodically or replaced by new cesspools. It should be noted that the rocky subsoil makes their construction and use more difficult. The problem is further complicated by the high level of the underground water, which is found at an average depth of six feet and places limits on the subsoil's absorption capacity.
- 6.21 The public sanitary services, while hygienic in appearance, tend to be in operation only part of the day, either because of the abovementioned absorption limitations or because they are awaiting the cleaning crews from the Ministry of Health and Welfare to remove solid matter. The buildings that have septic tanks or compact treatment plants usually empty waste matter into cesspools of a very limited capacity, as stated earlier, or into storm drainage systems. On many streets it flows through the gutters, creating a disagreeable atmosphere for both eyes and nose. This situation, a potential public health hazard, is kept under control through the efforts of the authorities. At any moment, however, a disastrous situation might occur, since several areas of Bridgetown are prone to flooding, especially those near the Constitution River.

## 2. Alternatives and restrictions

- 6.22 The waste disposal systems currently used in Barbados seem to operate satisfactorily outside Bridgetown. The construction campaign for minimum sanitary facilities referred to previously resulted in the installation of 24,700 units in 1972, of which 95% operated satisfactorily. Nevertheless, in Bridgetown, where the population concentration requires disposal of waste matter through the subsoil, that form of sanitation has become inoperative because of the area's geological and topographic conditions.
- 6.23 Although a high percentage of sewage is liquid matter, there are some 200 to 300 parts per million of solids, whose separation and disposal is the basic function of the treatment processes, for which septic tanks are a rudimentary form. In each case, they require a method for eliminating the liquid effluent, generally subject to the absorption capacity of the subsoil, and a procedure for the periodic collection and disposal of the solids accumulated in the tank. In the case of Bridgetown, the limiting factor is the absorption capacity of the subsoil.
- 6.24 Given the preceding facts, it is of no use to make a comparative analysis of the results of replacing the proposed sewerage system with one based on the use of septic tanks, when considering that the latter would provide only a very rudimentary primary treatment. In addition, the construction of septic tanks emptying into cesspools is impossible in Bridgetown, given the high level of underground water. For these reasons, the system of collectors should be constructed in any event, as it would also take care of the need to construct the final drainage for the system.

## 3. Feasibility of the project

- 6.25 Studies made by the consultants and verified by the technicians of the Bank show that the secondary treatment process adopted in the most economical of the comparable alternatives in terms of quality of effluent. The size of the project in its initial phase has been limited to servicing the area of Bridgetown in greatest need. It would not be desirable to reduce the initial expansion of the sewerage network to an even smaller area, because the investments in the treatment plant and drainage system would not be reduced notably and the per capita cost would increase. A greater expansion of the network would, on the other hand, reduce the per capita cost, because it includes installations (especially the treatment plant and drainage system) whose capacity has been gauged in accordance with the ultimate capacity of the system and will not be fully utilized initially. Nevertheless, the project would increase the cost and commit additional funds that the country needs to invest in other sectors, under the National Development Plan.

- 6.26 It is considered that the sanitary improvements in the central area of Bridgetown will have a very wide impact, as they will benefit not only the direct users but all the residents of the country as well. By eliminating the focal point of environmental pollution (the area to be improved) there will be a positive effect on the entire coast. The size of Barbados and its high population density make it necessary to consider important development projects in terms of their over-all effects instead of merely their direct benefits.
- 6.27 In addition to its effect on environmental health, the project under study is in line with the important programs of urban improvement, in that it will contribute to the elimination of slums, the conservation of water resources, and the improved utilization of water in the area to be served.

C. The Beneficiaries of the Project

1. Direct and indirect beneficiaries

- 6.28 The initial beneficiaries of the project can be grouped in the following categories:
- a) 4,600 residents in the areas to be served.
  - b) 25,500 employees and students who work or study in the area.
  - c) An undetermined number of people who make daily trips to the downtown area of Bridgetown where the most important centers of the nation are located.
- 6.29 The group of residents does not include affluent people, because there are no first-class dwellings in the zone. Likewise, the second and third groups include representatives of all the income levels of Barbados. In turn, consumers from those two groups will receive the benefits of the system at the expense of property owners in the area to be serviced, who will carry the greater part of the financial burden.

2. Distribution of income

- 6.30 The Bank estimated a per capita GDP of US\$620.8 (1970 dollars) for 1973, similar to the average for Latin America (US\$616). But since the country's economy has a 71% dependency on imports, the cost of living is comparatively high, and imported inflation has also been increasingly evident in recent years.
- 6.31 There is considerable disparity in income distribution in Barbados, as seen in the following table of typical annual salaries, expressed in Barbados dollars:

Store clerks	2,000	to	2,700
Construction workers	3,000	to	3,750
Supervisors	4,800	to	9,600
Executives	9,600	to	36,000
Government employees	10,400	to	18,000
Engineers	12,000	to	18,000
Doctors and dentists	30,000	to	50,000

6.32 The census taken in 1970 shows that although 76% of the country's dwellings are built of wood, 72% of them had between two and four bedrooms, that an average of 3.96 persons lives in each house, and that 73% of them were owner-occupied.

6.33 As for the location of the project's treatment plant on the grounds of Emmerton, a study has been made for the relocation of people who live on part of those grounds, who are representative of the residential areas within the service area of the sewerage system.

6.34 Emmerton has a total area of 25 acres and has 418 houses, in which 1,523 persons live. Its central core of five acres has 149 houses and 565 inhabitants. Family incomes are distributed as follows:

	<u>Total Area</u> (%)	<u>Central Core</u> (%)
<u>Weekly income</u>		
Under US\$12.50	38	49
US\$12.50 to US\$25.00	34	29
US\$26.00 to US\$50.00	18	16
More than US\$50.00	10	6
	<u>100</u>	<u>100</u>

6.35 Studies done in collaboration with PAHO for the expansion of the services of the BWD, mentioned earlier in paragraph 2.19 (a), indicate that to recover the required investments it will be necessary to charge rates equivalent to 18 days' wages per year for those who earn around US\$25.00 weekly. The recommendations of PAHO, which date back to 1960, show that payment for water service should not exceed 12 days' wages per year. Obviously, in the case of most property owners the charges for the service would fall well below that mark.

6.36 The rate study for the water supply and sewerage systems, which will be carried out in accordance with the institutional planning of the administrative authority of both systems, should take into account that the goals of each are complementary and that the objective should be the financial self-sufficiency of the joint operation of both systems, in keeping with ability to pay of low-income families.

## VII. JUSTIFICATION OF THE PROJECT

### A. Technical Feasibility

- 7.01 The project has been conceived to eliminate the focal point of environmental pollution, which is now the central area of Bridgetown. The parameters selected for its scope are rational and the designs have been prepared in accordance with acceptable engineering standards.
- 7.02 The technical capacity of the Government of Barbados to undertake the project, by means of an Executing Unit assigned to the Ministry of Health and Welfare, will be strengthened by contracting a consulting firm that will actively participate in the supervision of the work being done. 1/
- 7.03 The availability of materials and equipment for the work and of construction firms is limited in Barbados; but no difficulty is foreseen in contracting goods and services by means of international bidding.
- 7.04 The program drawn up for the execution of the project is realistic and its achievement within the projected time period can be considered technically feasible. In spite of the relatively high cost of the project, the consideration of other technical alternatives has led to the conclusion that this is the most economical approach.
- 7.05 Institutional and rate studies undertaken before the creation of the authority that will be in charge of administering the system, as well as the establishment of that authority far enough in advance of the completion of the works of the project, assure that there will be no insurmountable problems in its operation.

### B. Financial Feasibility

- 7.06 Because the provision of the local contribution required for the execution of the project and the resources to cover eventual operating deficits of the new entity will be the responsibility of the government, and because of the small impact (3.6% as an average) that they would have on the government's current revenue, it is felt that there will be no difficulty in meeting annual commitments. 2/
- 7.07 The proposed project would be financially feasible if the following additional conditions are fulfilled:

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1/ See clause 8(c)(ii) of the resolution.

2/ See Table IV of Appendix D.

- (a) creation by the government of an autonomous authority that would take over the present functions of the BWD and those of the sewerage system and to which all the assets of the Department would be transferred as a capital contribution. 1/
- (b) Government transfer to the new autonomous authority of the works built with the resources of the Bank loan and the local contribution, in the form of capital contribution. 2/
- (c) Timely establishment by the borrower of rates that will allow the new authority to cover all expenses of the sewerage system, including those related to administration, operation, maintenance and, insofar as possible, depreciation.
- (d) Borrower coverage of the costs for the operating deficit of the new authority until it achieves financial self-sufficiency. 3/

C. Socioeconomic Feasibility

- 7.08 Existing pressures on the present sanitary facilities of downtown Bridgetown are a consequence of its economic development and rapid urbanization. The situation has reached a saturation point, its effects being apparent as a threat to health, an obstacle to urban development and a public nuisance. The change from the present system, made up of hundreds of latrines and septic tanks, to a public sewerage system is justified for the reasons cited.
- 7.09 The considerable investment that the project will require, even when divided into stages, and its relatively high cost of operation have a disproportionate relation to the possible operating revenue, as often occurs in public services of this nature. The overall benefits of the project should not be measured, however, only in terms of the number of direct users. Given the size of the country and the importance that Bridgetown has over the rest of the island, the scope of the project is more national than municipal or regional in nature. The elimination of a sanitary and environmental hazard located in a critical area will result in benefits for the general public. This is the main justification for the proposed investment.
- 7.10 The solutions adopted insofar as concerns the treatment process, location of the treatment plant and other aspects of the project, will contribute favorably to improving the sanitary conditions of the coast urban life and the environment in general. All the residents of Barbados will be benefited, as will its visitors, for the project will have an indirect effect on tourist and economic activities that are vital for the country.

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1/ See clause 8(e) of the resolution.

2/ See clause 8(g) of the resolution.

3/ See clause 8(h) of the resolution.

D. Justification for the Use of the FSO

- 7.11 The Bank has had a general policy of considering sewerage system projects as eligible for financing with resources from the FSO; even in the larger countries of Latin America, especially when those projects are aimed at eliminating potentially dangerous sanitary conditions.
- 7.12 The project under consideration has a high social content. It raises the health levels of a small country, where there is no system for collecting, treating and eliminating sewerage as a means of disposing of human waste, although 97% of the public is supplied with drinking water.

E. Recommendations of CEPCLIES

- 7.13 In its review of the programs of Barbados in November 1974, CEPCLIES called attention to that country's needs and problems and, within that context, suggested that international lending agencies place emphasis on projects that would foster growth, leaving analysis of specific operations to bilateral agreements reached through program missions from those agencies. As concerns the sewerage system project of Bridgetown, CEPCLIES took note of the observations arising from a study made by the OAS, expressing concern about a possible decision to empty great volumes of sewage into the sea, adversely affecting the island's water reserves. The problem is of an economic, rather than a technical, nature, since there is no great sanitary risk in reusing water from the sewer, once treated, for agricultural purposes or recharging aquifers. Studies done indicate that the displacement system alone, in order to utilize the effluent from the plant in one of these ways, would have an initial cost 60% higher than that of the proposed drainage system. In addition, this system would operate by means of gravity, while the other alternatives would require pumping.

OPERACION DEL "BARBADOS WATERWORKS DEPARTMENT"

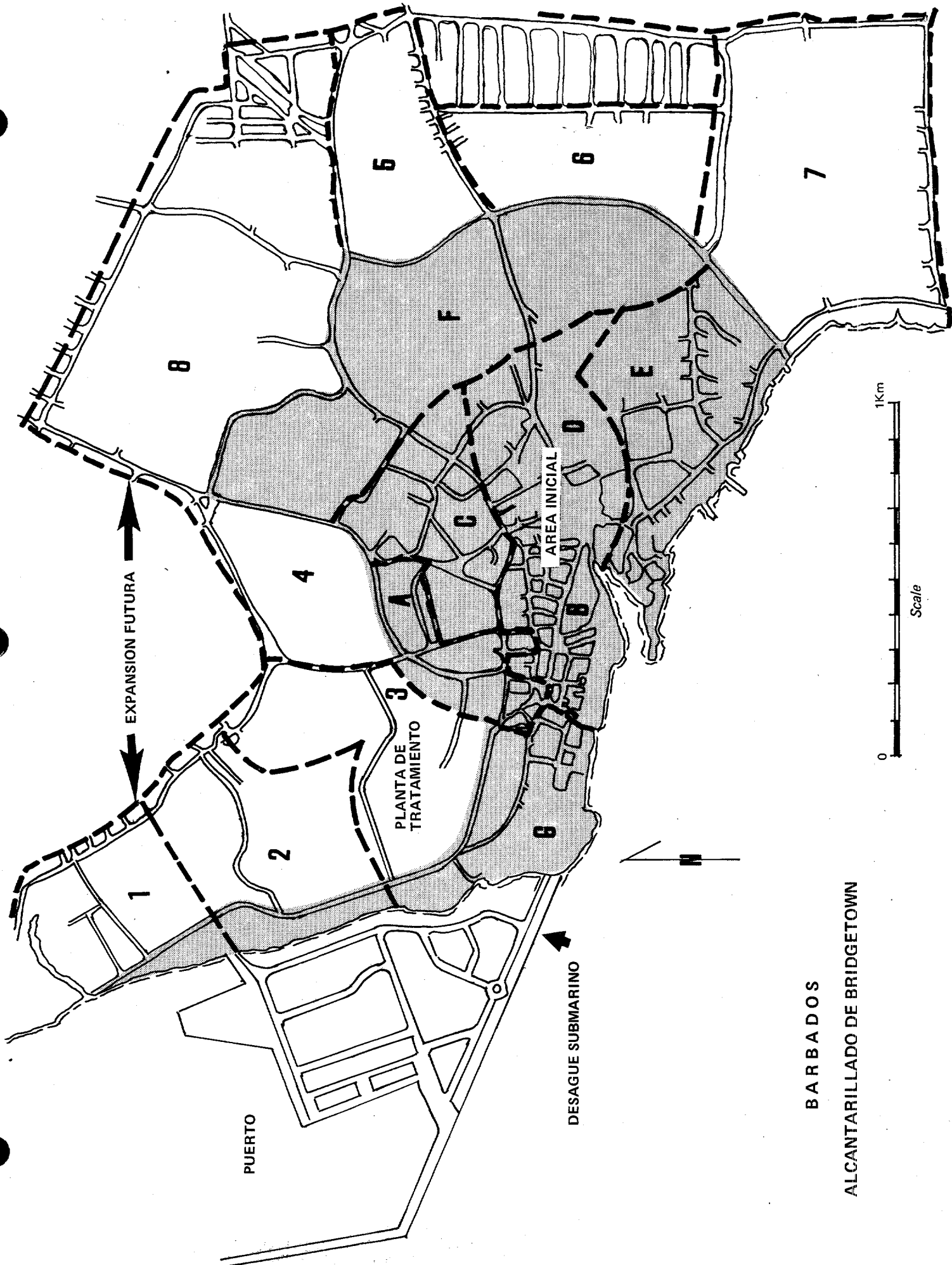
		<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>
Conexiones	- Número	42.800	46.200	49.700	52.200	54.300
	Aumento (%)	6,3	7,9	7,6	5,0	4,0
Medidores	- Número	4.200	4.300	4.900	5.400	6.500
	Aumento (%)	0	2,4	14,0	10,3	20,4
de Medidores		9,8	9,3	9,9	10,3	12,0
Producción Media Diaria (m3)		90.000	101.000	111.000	107.000	105.000
Producción Anual (1.000 m3)		<u>32.850</u>	<u>38.865</u>	<u>40.515</u>	<u>39.055</u>	<u>38.325</u>
Medido (1.000 m3)		8.100	8.670	9.280	8.980	9.680
Medición (1.000 m3)		24.750	30.195	31.235	30.075	28.645
Costo Anual <u>1/</u> (BD\$1.000)		2.577	3.466	3.440	4.908	6.293
Costo Unitario <u>2/</u> (BD\$/m3)		0.078	0.090	0.084	0.126	0.164
<u>3/</u> (US\$/m3)		0.039	0.045	0.042	0.063	0.082
Población Total de Barbados		240.000	242.000	243.000	245.000	247.000
Población Media (lpcd)		375	417	457	437	425

No incluye Depreciación.

Basado en producción anual.

US\$1.00 = BD\$2.00





BARBADOS

ALCANTARILLADO DE BRIDGETOWN

BARBADOS - ALCANTARILLADO DE BRIDGETOWN

CARACTERISTICAS DEL PROYECTO 1/

1. Datos Básicos

Area de Diseño: La zona central baja de Bridgetown, adyacente al río Constitution, hasta la cota de 12 m.s.n.m. aproximadamente.

Período de Diseño: 1995

Area Inicial: 200 Ha.

Area Futura: 400 Ha.

2. Sistema de Colectores

Caudal Medio: 60 gpcd (227 lpcd)

Infiltración por Pulgada de Diámetro: 200 gpd/milla

(por cm. de Diámetro: 185 lpd/km)

Caudal Máximo: 2.5 x Caudal Medio

Velocidad Máxima: 2 fps (0.60 mps)

Tuberías Gravedad: 6" a 36" (15 cm. a 90 cm): 62.300 ft (19.000 m)

Tuberías Presión: 6" a 30" (15 cm a 75 cm): 6.100 ft (1.860 m)

Total Tuberías 68.400 20.860

Pozos de Inspección: 315 unidades

Conexiones Domiciliarias: 3.000

Estaciones de Bombeo:

No. 1	-	250 gpm - 24' (16 lps - 7.30 m)
No. 2	-	250 gpm - 24' (16 lps - 7.30 m)
River Road	-	1.250 gpm - 20' (80 lps - 6.10 m)

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1/ Todos los datos se dan en USGallons (3.785 lts).

3. Planta de Tratamiento

Capacidad Inicial : 2.4 MGD (9.1 MLD)  
Capacidad Final : 3.6 MGD (13.6 MLD)  
Caudal Máximo : 2.5 x Caudal Medio  
Agua a Tratar :

Coliformes :	50 x 10 <sup>6</sup> /100 ml
DBO :	200 mg/l
Sólidos suspendidos:	250 mg/l
Sólidos totales:	500 mg/l

Proceso Secundario de Fangos Activados.

Instalación Inicial: 2 Unidades

Instalación Final : 3 Unidades

Etapas: Desmenuzamiento, sedimentación, aireación, digestión, cloración.

Calidad del Efluyente:

Coliformes :	1.000/100 ml
DBO :	20 mg/l
Sólidos suspendidos:	12.5 mg/l
Sólidos totales:	25.0 mg/l

4. Desagüe Submarino

Longitud :	1.000 ft (305 m)
Diámetro :	28 in (71 cm)
Número de difusores:	20
Diámetro de " :	3 in (7.5 cm)

Presentamos a continuación un estado comparativo de ingresos, gastos e inversiones de capital del G

GOBIERNO DE BARBADOS

Presupuesto y Ejecución Presupuestaria para 5 años

[illegible]

Este Cuadro I de ejecución presupuestaria fue preparado en base a información proporcionada por el Ministerio de Finanzas y Planeamiento. Incluye derechos de aduana, impuestos directos, derechos y licencias e ingresos de departamentos del Gobierno. Los gastos presupuestarios son clasificados en corrientes y no corrientes. Entre los primeros se incluyen "gastos de personal" (salarios y otros emolumentos) que representan alrededor del 40% de los gastos presupuestarios y "otros gastos" necesarios para la administración, como comunicaciones, servicios, mantenimiento, etc. Los gastos no corrientes incluyen muebles, útiles y equipos cuyo valor no es significativo.

Las inversiones de capital representan aquellas erogaciones que involucran desembolsos en proyectos de desarrollo nacional, generalmente para infraestructura, como construcción de caminos, puentes, edificios públicos, etc.

Crecimiento de los ingresos, gastos e inversiones

	<u>Ingresos</u>		<u>Gastos</u>		<u>Inversiones de Capital</u>	
	<u>Presupuesto</u>	<u>Real</u>	<u>Presupuesto</u>	<u>Real</u>	<u>Presupuesto</u>	<u>Real</u>
1971/72 <u>1/</u>	100	100	100	100	100	100
1972/73	98	108	109	113	105	101
1973/74	124	126	142	155	141	147
1974/75	151	162 <u>2/</u>	164	175 <u>2/</u>	149	175
1975/76	175	-	187	-	178	-

1/ Año base igual a 100

2/ Ultima estimación disponible

La comparación indica que los gastos han crecido proporcionalmente más que los ingresos. Las inversiones de capital son financiadas a través de préstamos internos o externos a ser negociados, así como de préstamos de agencias internacionales de desarrollo.

Deuda pública

La deuda pública del Gobierno ha crecido en la siguiente forma:

	<u>US\$ millones</u>	<u>%</u>
Al 1o. abril 1972	35,8	100
Al 1o. abril 1973	41,5	116
Al 1o. abril 1974	50,6	141
Al 1o. abril 1975	59,5	166

Aproximadamente, un tercio de la deuda pública es de financiación externa y dos tercios de financiación interna.

Servicio de la deuda

La comparación del servicio de la deuda con los ingresos reales muestra las siguientes relaciones:

	Ingresos reales US\$ miles	Servicio de la deuda ^ US\$ miles	%
1971/72	51.113	3.240	6,3
1972/73	55.380	4.414	7,9
1973/74	64.382	6.055	9,4
1974/75	82.724 <u>1/</u>	7.441 <u>1/</u>	9,0
1975/76	85.487	11.384 <u>2/</u>	13,3

1/ Estimados

2/ Presupuesto

El servicio de la deuda pareciera mantenerse dentro de límites razonables, respecto a los ingresos aunque con tendencia a aumentar.

Presupuesto del ejercicio 1975/76

El presupuesto de recursos y gastos para el ejercicio comenzado el 1o. de abril 1975, a terminar el 31 de marzo de 1976 muestra las siguientes cifras:

	US\$ miles
Ingresos	85.487
Egresos	<u>92.857</u>
(Déficit)	(7.370)

Las estimaciones no indican cómo se financiará el déficit presupuestario, pero es tradicional que el ejercicio termine con superávit ya sea aumentando los ingresos o comprimiendo los gastos, o ambos a la vez.

El estimado de inversiones de capital para el ejercicio 1975/76 es el siguiente:

	(US\$ miles)
Servicios públicos generales	3.949
Defensa y seguridad	108
Educación	3.865
Salud	679
Vivienda	4.581
Otros servicios sociales	282
Servicios económicos	<u>14.389</u>
	27.853

APENDICE D

-4-

que se proyecta financiar en la siguiente forma:

Fondo canadiense de ayuda externa	532
Instituciones financieras internacionales	1.580
Instituciones financieras regionales	2.957
Fondo Bienestar Obrero	800
Préstamo locales	<u>3.875</u>
	9.744
Préstamos a obtenerse	<u>18.111</u>
	<u>27.855</u>

El rubro "servicios económicos" incluye una partida de US\$1.189.000 para desarrollo y protección de recursos de agua y reemplazo y ampliación de cañerías maestras.

Gastos de funcionamiento del Ministerio de Comunicaciones y Obras en relación con el Gobierno Central.

Como puede observarse en el Cuadro II, la participación de los gastos del Ministerio con respecto a los gastos e ingresos del Gobierno, no ha experimentado variaciones significativas en los ejercicios analizados, según aparece de la siguiente comparación:

(en miles de US\$)

	<u>1971/72</u>	<u>1972/73</u>	<u>1973/74</u>	<u>1974/75</u>
<u>Gobierno Central</u>				
Ingresos	51.113	55.380	64.382	82.724
Gastos	46.313	52.526	71.992	80.858
<u>Ministerio</u> <u>Comunicaciones y Obras</u>				
Gastos	5.453	5.803	7.385	9.035
<u>Porcentajes del</u> <u>Gobierno Central</u>	%	%	%	%
Sobre ingresos	10,6	10,4	11,4	10,9
Sobre gastos	11,8	11,0	10,2	11,1

Las inversiones de capital del Ministerio han seguido la siguiente evolución:

Miles de US\$

<u>Inversiones Reales</u>	<u>Inversiones de Capital</u>	<u>%</u>
1971/72 <u>1/</u>	2.632	100
1972/73	2.418	92
1973/74	1.980	75
1974/75	2.165	82
<u>Presupuesto</u>		
1975/76	3.748	142

1/ Año base

Las inversiones muestran una disminución en los ejercicios subsiguientes a 1971/72. El presupuesto estimado para 1975/76 se incrementa por la inclusión de una fuerte partida para construcción de caminos.

#### Comentarios sobre ejecución presupuestaria

La ejecución presupuestaria del Gobierno muestra normalmente superávit de ingresos sobre egresos, aunque las estimaciones originales arrojen déficit. Excepción a esta tendencia ha sido el ejercicio 1973/74, cuya explicación parecería ser los mayores costos de combustibles que Barbados importa y aumentos salariales. Todos los gastos recurrentes y no recurrentes son cubiertos por los ingresos ordinarios obtenidos de impuestos directos, derechos aduaneros, ingresos de departamentos del Gobierno, licencias, multas, etc.

Las inversiones de capital son financiadas con fondos obtenidos a través de préstamos internos, de instituciones financieras internacionales, de instituciones internacionales de desarrollo y de fondos de jubilaciones. Como norma la programación de inversiones excede generalmente a la capacidad de obtener financiación para las mismas.

La deuda pública del Gobierno ha mantenido el mismo ritmo de crecimiento de los ingresos, mientras los servicios de la deuda se mantienen dentro de límites razonables.



El crecimiento de los gastos de funcionamiento del Ministerio de Comunicaciones y Obras es levemente inferior porcentualmente a los del Gobierno Central y su participación sobre los gastos e ingresos del Gobierno se mantiene invariable.

En el estado de origen y aplicación de fondos para el sector de saneamiento (Cuadro III) se muestra el esfuerzo financiero del Gobierno para capitalizar al BWD así como para atender los intereses y amortización del eventual préstamo del Banco y absorber los déficit de operación de dicha empresa.

Asimismo, en el Cuadro IV se analiza la capacidad del Gobierno para financiar el aporte local y los gastos financieros del proyecto de alcantarillado, las inversiones necesarias para la expansión del sistema de agua y los déficit estimados de explotación de los sistemas de agua potable y alcantarillado. Se ha partido de la premisa de que la nueva empresa de agua y alcantarillado continuará arrojando déficit de explotación, lo cual podría ser disminuido gradualmente a través de la aplicación de nuevas tarifas. Los ingresos ordinarios del Gobierno, estimados en US\$85,5 millones en el presupuesto para el ejercicio 1975/76 en ejecución, se redujeron conservadoramente a US\$83 millones y se mantuvieron constantes a través de todo el período analizado. Es de notar que históricamente la ejecución real del presupuesto de ingresos ordinarios superó a los cálculos presupuestarios. La relación porcentual del total de aportes del Gobierno a la nueva empresa de agua y alcantarillado y los ingresos del Gobierno se mantiene dentro de los niveles históricos, salvo en el ejercicio 1977/78 que demandará un esfuerzo adicional debido al aporte local al proyecto de alcantarillado. Dadas las bases conservadoras con que se ha hecho el cálculo, estimamos que el Gobierno de Barbados, siempre y cuando dé prioridad al financiamiento de este proyecto, podría hacer frente al aporte local requerido.

# CUADRO II

## MINISTERIO DE COMUNICACIONES Y OBRAS

APENDICE

Presupuesto de funcionamiento  
Clasificación por departamentos y objeto del gasto

En miles de US\$

	1971/72		1972/73		1973/74		1974/75	
	Presupuesto	Real	Presupuesto	Real	Presupuesto	Real	Presupuesto	Estimado
<b>Ón General</b>								
os personal	2.457	2.161	1.329	1.296	1.748	1.648	3.654	3.462
gos	1.592	1.324	2.744	2.436	3.244	3.138	1.636	2.260
recurrentes	160	110	319	258	349	15	196	32
	4.209	3.595	4.392	3.990	5.341	4.800	5.486	5.754
<b>de Agua</b>								
os	427	683	426	616	607	1.018	1.369	975
gos	1.053	1.050	1.236	1.104	1.610	1.436	1.061	2.172
recurrentes	57	52	25	25	34	34	16	15
	1.537	1.785	1.686	1.745	2.251	2.488	2.446	3.162
<b>ción Eléctrica</b>								
os	49	45	51	40	69	60	75	67
gos	20	17	24	21	41	24	49	34
recurrentes	13	11	7	8	-	13	1	18
	82	73	82	69	110	97	125	119
isterio	5.828	5.453	6.160	5.803	7.703	7.385	8.057	9.035
<b>de Capital</b>	3.370	2.632	2.950	2.418	3.660	1.980	3.795	2.165

tos personales - comprende sueldos y salarios de personal, seguro nacional y otras remuneraciones.

rgos - comprende gastos corrientes como comunicaciones, energía eléctrica, materiales, gastos mantenimiento etc.

o recurrentes - comprende muebles y útiles de oficina y equipos cuyo valor no es significativo.

**CUADRO III**  
**FINANCIAMIENTO DEL SECTOR AGUA POTABLE Y**  
**ALCANTARILLADO POR EL GOBIERNO DE BARBADOS**  
**Estado de Origen y Aplicación de Fondos**

**APENDICE I**

	<u>1975/76</u>	<u>1976/77</u>	<u>1977/78</u>	<u>1978/79</u>	<u>1979/80</u>	<u>1980/81</u>	<u>1981/82</u>	<u>1982/83</u>	<u>1983/84</u>	<u>1984/85</u>
<b>Presupuesto en curso</b>										
<b>de Fondos</b>										
BID	-	970	970	4.850	2.910	-	-	-	-	-
		970	970	4.850	2.910					
<b>ón de Fondos de Capital:</b>										
to BID	-	1.550	2.740	5.730	3.602	-	-	-	-	-
iones de capital para										
ión sistema de agua	1.189	1.200	1.185	1.200	1.200	2.200	1.500	1.500	1.500	1.500
s préstamo BID	-	-	-	-	-	196	196	196	196	192
ción préstamo BID	-	-	-	-	-	-	-	-	-	306
n del Déficit de opera-										
la Empresa de Agua y										
rellado	700	823	854	895	978	963	1.002	1.039	1.103	1.139
	1.889	3.573	4.779	7.825	5.780	3.359	2.698	2.735	2.799	3.137
<b>t (Déficit)</b>	(1.889)	(2.603)	(3.809)	(2.975)	(.2.870)	(3.359)	(2.698)	(2.735)	(2.799)	(3.137)

## CUADRO IV

## APENDICE D

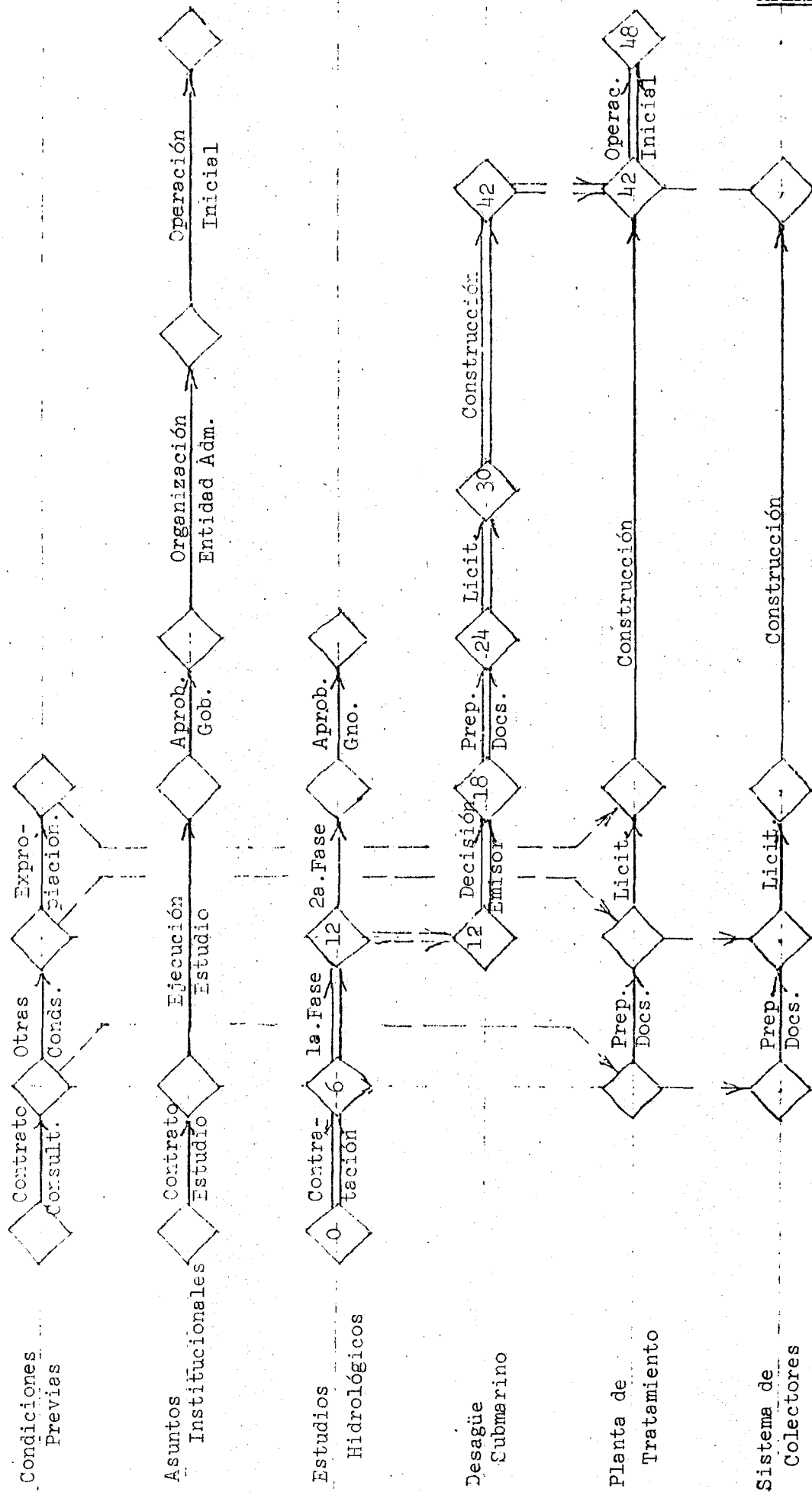
Capacidad del Gobierno para financiar el costo  
del proyecto de alcantarillado

( en miles de US\$ )

Déficit Explota- ción	Inversiones de Capital p/ expansión sist.agua ptble.	Aporte local Proyecto Al- cantarillado	Gastos Financieros Proyecto BID a cargo del Gobierno	Total	Ingresos del Gobierno
768	1.018	-	-	1.786	51.113
650	985	-	-	1.635	55.380
1.090	968	-	-	2.058	64.382
imado 994	1.211	-	-	2.205	82.724
supuesto 700	1.189	-	-	1.889	85.487
s					
823	1.200	580	-	2.603	83.000
854	1.185	1.770	-	3.809	83.000
895	1.200	880	-	2.975	83.000
978	1.200	692	-	2.870	83.000
963 <u>1/</u>	2.200	-	196	3.359	83.000
1.002	1.500	-	196	2.698	83.000
1.039	1.500	-	196	2.735	83.000
1.103	1.500	-	196	2.799	83.000
1.139	1.500	-	498	3.137	83.000
1.134	1.500	-	492	3.126	83.000

de 1980/81 comprende el sistema de agua y alcantarillado.

# DIAGRAMA DE EJECUCION



APENDICE E

MESES

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12

24

36

48

TENDERS PROCEDURES

IDB RESOURCES - SANITARY SEWERAGE BRIDGETOWN PROJECT

These procedures shall be followed in awarding contracts for the construction of the works and for the procurement by the Borrower of materials for use in the Project whenever the value of such contracts or equipment acquisitions are expected to exceed the equivalent of twenty-five thousand United States dollars (US\$25,000) and when any part of the resources of the Bank are to be used for such purpose.

I. TENDERS COMMITTEE

- A. A special Tenders Committee shall be established and shall be comprised of the persons:

- (a) the Chief Supply Officer (Chairman),
- (b) the Crown Solicitor or Deputy Crown Solicitor,
- (c) a representative of the Ministry of Finance and Planning,
- (d) the Officer-in-Charge of the Project Execution Office,
- (e) a Civil Engineer.

- B. The Special Tenders Committee shall have the duties set forth herein.

Voting shall be by a majority of all members.

II. PREQUALIFICATIONS OF CONTRACTORS

- A. Potential contractors will be prequalified following the system described.
- B. Documents to be used in connection with the prequalification of contractors will be prepared and presented to the Bank for approval.
- C. A Register of eligible prospective contractors will be maintained by the Special Tenders Committee.
- D. Such Register will be opened by placing notices in at least two (2) newspapers of general circulation in Barbados inviting interested contractors to apply for registration. Copies of notices will be sent at the same time to all embassies or consulates of the member countries of the Bank as well as those either located in Barbados or in the nearest country.

- E. The notices shall contain all relevant information necessary to enable a prospective contractor to apply for inclusion in the Register, including a brief description of the project and the participation of the Bank in the financing.
- F. The Tenders Committee shall review the qualifications of prospective contractors, which review will be forwarded through the Officer-in-Charge of the Project Execution Office to the Bank for comment and clearance.
- G. Thereafter the Tenders Committee will notify each contractor of the results of the review, within thirty (30) days of receipt of applications.
- H. Rejected contractors may request reconsideration of applications which shall be treated as new requests.
- I. The Register shall be closed not more than 30 days prior to the date it is anticipated invitations to tender will be sent to prospective contractors, provided however that 90 days prior to such date of closing, notice of the intention to close the Register will be published following the procedures set forth in (D) and (E) above. Such notice shall also indicate the date of the proposed invitations to tender as well as specifying the works to be undertaken.

Applications received prior to 30 days before anticipated invitation to tender shall be treated as in (F) and (G). All others shall be returned.

- J. The Register shall be re-opened no later than 30 days following award of previous contract or 30 days following determination that all tenders are to be rejected, until all works have been contracted. The procedure for re-opening shall follow A to I above.

### III. CALL FOR BIDS

- A. Invitations shall be sent to all contractors on Register with description of works to be tendered indicating where and when bidding documents, specifications, etc. may be obtained and time and place tenders will be opened.
- B. The period for presentation of tenders shall be not less than 45 days from date of invitation to tender.
- C. Prior to the issue of invitations to tender, bidding documents, final engineering plans, specifications and cost estimates pertaining to the installation to be constructed along with the text of the contract proposed to be entered into with the successful tenderer shall have been approved by the Bank.

- D. Tenders, together with evidence of surety, shall be submitted in sealed envelopes and shall be treated pursuant to Section 143 of the Financial Rules.
- E. (1) On the date and at the place set for opening of tenders, which place shall be open to all persons who have submitted tenders, the Chairman and the other member by whom a key is kept pursuant to D(1) shall unlock the box and remove and open the tenders found therein.
- (2) The Chairman shall announce the tenders received from contractors on the Register and other tenders shall be rejected.
- (3) The Chairman and other Members of the Committee shall initial the tenders received from contractors on the Register and shall cause a note to be taken of the number of such tenders and such further information as the Committee may require.
- F. Tenders eligible for consideration shall be evaluated by the Project Execution Office and returned to the Tenders Committee with recommendation for the decision of the Committee. The lowest eligible tender shall normally be recommended for award.
- G. The tender recommended for award together with a report, analysing all tenders shall be submitted to the Minister for his review. Upon receipt of approval by the Minister, the Officer-in-Charge of the Project Execution Office shall submit the tender proposed for award as well as the analysis report to the Bank for its comments and clearance.
- H. Subsequent to the acceptance by the Bank of the report and concurrence with the proposed award, the Officer in Charge of the Project Execution Office shall prepare the necessary documentation for the authorization of award to the successful tenderer.
- I. In every contract awarded under these procedures, a clause shall be inserted providing that the contract may be cancelled in cases where there is evidence that -
- (a) the contractor or his agent has offered or given to any person any gift or consideration of any kind as an inducement or reward for doing or omitting to do, any act in relation to the obtaining or execution of the contract;
- (b) the contractor has shown favour or disfavour to any person in relation to the contract;



- (c) the contractor or his agent in relation to any contract with the Borrower has committed an offence under the Prevention of Corruption Act, 1929.
- J. When a tender has been accepted written notice of its acceptance shall be given to the person who submitted the tender and he shall by the said notice, be required to enter into a formal contract with the Borrower. A formal contract shall be prepared and shall be in such form and shall contain such terms, conditions and provisions as may be considered necessary, which the Bank shall have approved prior to signing thereof. Copies of the notice to the successful tenderer shall be sent to all persons who submitted tenders.

#### IV. ACQUISITION OF GOODS, MATERIAL AND EQUIPMENT

The procedures for the acquisition of goods, materials and equipment shall follow those set forth herein, except that prequalification need not be required, in which case notice of invitation to tender shall be published and sent to embassies and consulates as set forth in II(D) containing full specification of the goods, etc. and other information set forth in III(A). Rules III(B) to I shall also be followed.

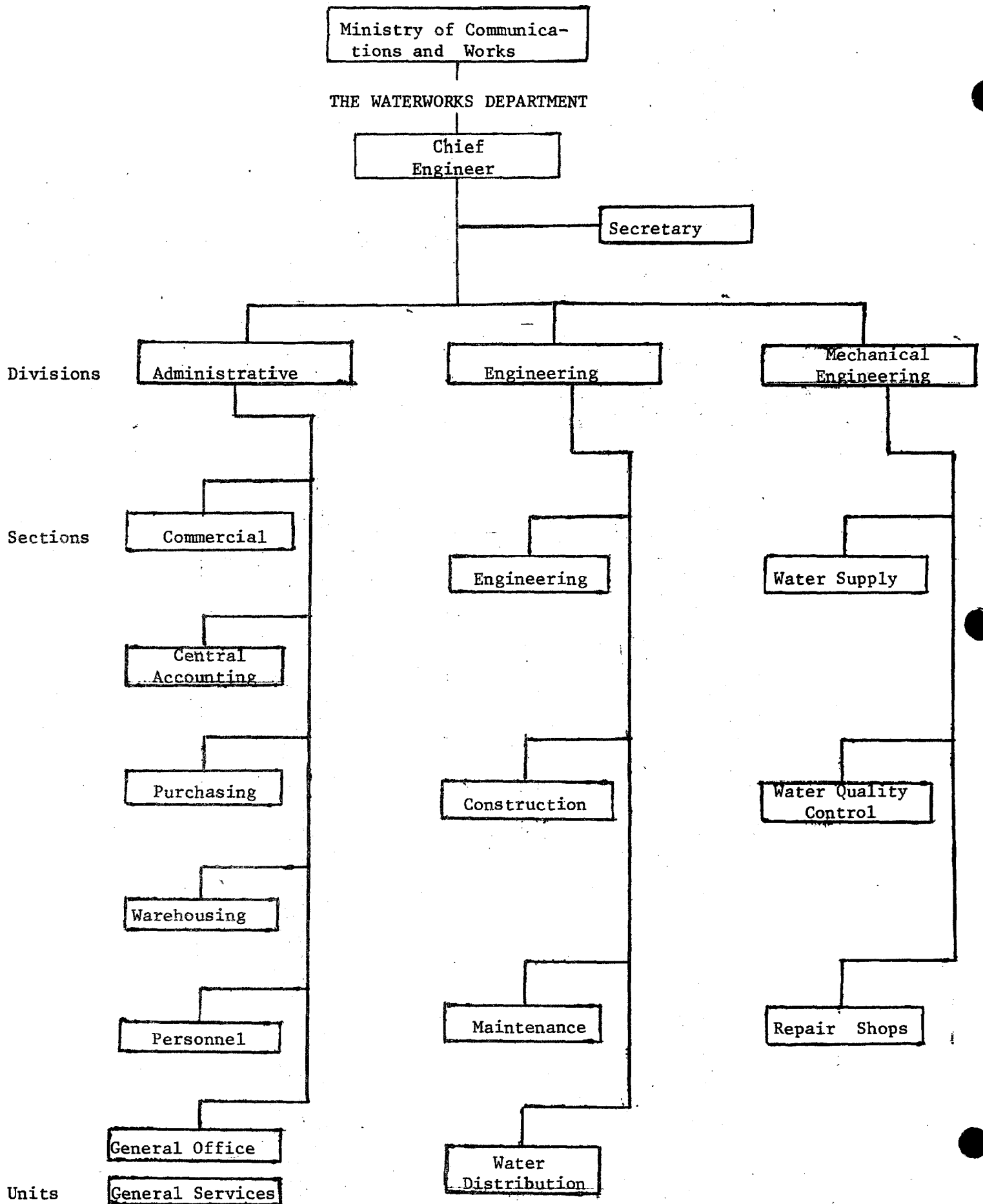
#### V. SPECIAL CONDITIONS

- A. Whenever the goods and services to be acquired are totally or partially to be financed with the resources of the Bank Loan, the procedures and specific tender requirements shall permit free participation of bidders in or from member countries of the Bank eligible to participate in tenders with respect to the acquisition of services, machinery, equipment and other materials for the Project and for the awarding of construction contracts. Consequently such procedures and/or specific requirements shall not contain any condition which may impede or restrict the participation of such bidders.
- B. Tenders may be limited to national entities only when the sole source of financing is the Borrower's local contribution.
- C. Tenders will be presented with an indication of the origin of all goods. At the same time tenders should indicate the origin and costs of any technical services from outside Barbados. In the case of construction firms, evidence shall be presented that such firms are from an eligible country.

CALENDARIO DE INVERSIONES

(en miles de US\$)

	<u>TOTALES</u>			<u>Año 1</u>		<u>Año 2</u>		<u>Año 3</u>		<u>Año 4</u>	
	BID	LOC.	TOTAL	BID	LOC	BID	LOC	BID	LOC	BID	LOC
ería y Admón.	243	290	533	3	50	80	80	80	80	80	
Directos	6.250	1.750	8.000	-	-	400	1.150	3.550	300	2.300	3
Financieros	397	122	519	27	50	60	40	120	20	190	
Concurrentes	210	810	1.020	210	330	-	300	-	180	-	
ignación Especial	2.600	960	3.550	730	150	430	200	1.100	300	340	3
IALES	9.700	3.922	13.622	970	580	970	1.770	4.850	880	2.910	6
	9.700	3.922	13.622	1.550		2.740		5.730		3.602	
S	(71,2)	(28,8)	(100,0)	(11,4)		(20,1)		(42,1)		(26,4)	



RESUMEN DE ESTADO DE INGRESOS Y GASTOS  
(en miles de US\$)

	1971/72				1972/73				1973/74				1974/75				1/ Estimado	
	Presupuesto	%	Real	%	Presupuesto	%	Real	%	Presupuesto	%	Real	%	Presupuesto	%				
	100	813	100	1.017	100	966	100	1.095	100	1.150	100	1.398	100	1.500	100	2.168	100	
tes	182 7	1.480 57	170 5	1.733 52	172 3	1.661 25	157 2	1.720 25	193 3	2.217 34	176 2	2.454 34	162 1	2.430 16	145 1	3.147 15	12	-
	189	1.537	175	1.785	175	1.686	159	1.745	196	2.251	178	2.488	163	2.446	146	3.162	12	
	89	(724)	75	(768)	75	(720)	59	(650)	96	(1.101)	78	(1.090)	63	(946)	46	(994)	2	
e		1.262		1.018		906		985		1.000		968		1.241		1.211		

1/ Última estimación disponible

9 se muestra estado detallado de ingresos y gastos e inversiones de capital del Departamento de Agua del Ministerio de Comunicaciones

CUADRO I

PROYECCIONES FINANCIERAS

COSTOS DE PRODUCCION DE AGUA

	1971/72	1972/73	1973/74	1974/75 Estimado	1975/76 Presupuesto
(1) Producción agua (miles m <sup>3</sup> anuales)	38.865	40.515	39.055	39.822	43.141
(2) Pérdidas (estimado 15% de (1) )	-5.830	-6.077	-5.858	-5.973	-6.473
(3) Producción neta (1-2) (miles m <sup>3</sup> )	33.035	34.438	33.197	33.849	36.668
(4) Ingresos por venta de agua (miles US\$)	563	678	720	1.650	1.860
(5) Gastos produc.distribución y adminis- tración (miles US\$)	1.500	1.471	2.066	2.653	2.794
(6) Depreciación (miles US\$)	389	414	441	476	515
(7) Ingresos por m <sup>3</sup> (4 ÷ 3)	US\$ 0.017	0.02	0.022	0.049	0.051
(8) Costo por m <sup>3</sup> (5 ÷ 3)	US\$ 0.045	0.043	0.062	0.078	0.076
(9) Depreciación por m <sup>3</sup> (6 ÷ 3)	US\$ 0.012	0.012	0.013	0.014	0.014
(10) Costo total por m <sup>3</sup> (8 + 9)	US\$ 0.057	0.055	0.075	0.092	0.09

APENDICE J

**CUADRO II**  
**PROYECCION DE RESULTADOS**

**Servicio de Agua**  
**(en miles de US\$)**

	1975/76 Presupuesto En curso	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Producción de agua (miles m <sup>3</sup> )	43.141	43.141	44.800	46.460	49.778	51.438	53.097	54.756	56.416	58.075
Pérdida (miles m <sup>3</sup> )	6.473	6.473	6.719	6.969	7.469	7.715	7.964	8.210	8.464	8.710
	36.668	36.668	38.081	39.491	42.309	43.723	45.132	46.546	47.951	49.365
Venta de agua	1/ 1.860	1.860	1.942	2.014	2.157	2.230	2.302	2.374	2.445	2.518
Conexiones, misceláneos	743	750	750	750	750	750	750	750	750	750
Costos en miles US\$	2.603	2.610	2.692	2.764	2.907	2.980	3.052	3.124	3.195	3.268
Producción, distribución, mantenimiento 2/	2.794	2.933	3.046	3.159	3.385	3.498	3.610	3.723	3.836	3.949
Depreciación	509	500	500	500	500	500	500	500	500	500
	515	562	606	653	700	774	817	859	902	945
Costos	3.818	3.995	4.152	4.312	4.585	4.772	4.927	5.082	5.238	5.394
Deficit	(1.215)	(1.385)	(1.460)	(1.548)	(1.678)	(1.792)	(1.875)	(1.958)	(2.043)	(2.126)

1/ US\$0.051 por m<sup>3</sup>

2/ US\$0.08 por m<sup>3</sup>

**CUADRO III**  
**PROYECCION DE RESULTADOS**  
**Sistema de Alcantarillado**  
 (en miles de US\$)

	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
<b>Ingresos</b>										
Tarifas ad valorem de la propiedad	-	-	-	-	187	187	189	190	192	195
Tarifa vinculada al consumo de agua	-	-	-	-	193	194	196	198	200	202
Ingresos por conexiones domiciliarias	-	-	-	-	25	25	25	-	-	-
	-	-	-	-	405	406	410	398	392	397
<b>Egresos</b>										
Gastos de operación, administración, mantenimiento y energía <sup>1/</sup>	-	-	-	-	350	350	350	350	350	350
Depreciación	-	-	-	-	277	277	277	277	277	277
	-	-	-	-	627	627	627	627	627	627
<b>Superávit (Déficit)</b>	-	-	-	-	(222)	(221)	(217)	(239)	(235)	(230)

<sup>1/</sup> Basado en operación del sistema a toda su capacidad.

CUADRO IV  
Proyecciones de Resultados - Consolidado  
Servicio de Agua y Alcantarillado  
(en miles de US\$)

	1975/76 Presupuesto en curso	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
to. Agua	2.603	2.610	2.692	2.764	2.907	2.980	3.052	3.124	3.195	3.268
to. Alcantarillado	-	-	-	-	-	405	406	410	388	392
os:	2.603	2.610	2.692	2.764	2.907	3.385	3.458	3.534	3.583	3.660
	515	562	606	653	700	1.051	1.094	1.136	1.179	1.222
. Agua	3.303	3.433	3.546	3.659	3.885	3.998	4.110	4.223	4.336	4.449
. Alcantarillado	-	-	-	-	-	350	350	350	350	350
. Egresos	3.818	3.995	4.152	4.312	4.585	5.399	5.554	5.709	5.865	6.021
Deficit)	(1.215)	(1.385)	(1.460)	(1.548)	(1.678)	(2.014)	(2.096)	(2.175)	(2.282)	(2.361)



CUADRO V  
DEPARTAMENTO DE AGUA  
Análisis de Sensibilidad

	<u>1976/77</u>	<u>1977/78</u>	<u>1978/79</u>	<u>1979/80</u>	<u>1980/81</u>	<u>1981/82</u>	<u>1982/83</u>	<u>1983/84</u>	<u>1984/85</u>	
<u>Proyección básica</u>										
Ingresos Servicio Agua (Calculados a la tarifa actual de US\$0.051 por m <sup>3</sup> )	2.610	2.692	2.764	2.907	2.980	3.052	3.124	3.195	3.268	
Resultados Serv. Agua con depreciación	(1.385)	(1.460)	(1.546)	(1.678)	(1.792)	(1.875)	(1.958)	(2.043)	(2.126)	
Resultados Servicio Agua sin depreciación	(823)	(854)	(895)	(978)	(963)	(1.002)	(1.039)	(1.103)	(1.139)	
<u>Primera alternativa:</u>										
Aumento gradual de las tarifas hasta cubrir total costos de operación y depreciación	US\$0.055	0.06	0.065	0.07	0.075	0.08	0.085	0.09	0.095	
Resultados (Disminución del déficit)	(1.228) 11%	(1.117) 23%	(998) 35%	(874) 48%	(743) 58%	(567) 70%	(376) 80%	(172) 91%	46 -	
<u>Segunda alternativa</u>										
Aumento gradual de las tarifas hasta cubrir el total de los costos de operación solamente	(667)	(511)	(343)	(173)	31					
Disminución del déficit	19%	40%	62%	82%						

**CUADRO VI**  
**Servicio de Agua y Alcantarillado**  
Estado de Origen y Aplicación de Fondos  
(en miles de US\$)

Presupuesto en curso      1975/76      1976/77      1977/78      1978/79      1979/80      1980/81      1981/82      1982/83      1983/84      1984/85      1985/86

I Fuentes de Fondos

Superavit (Déficit)	(1.215)	(1.385)	(1.460)	(1.546)	(1.578)	(2.014)	(2.096)	(2.175)	(2.282)	(2.361)	(2.402)
Depreciación	515	562	606	653	700	1.051	1.094	1.136	1.179	1.222	1.268
Aportes de capital del Gobierno:											
Fondos BID	-	970	970	4.850	2.910	-	-	-	-	-	-
Contribución local, Proy. Alcant.	-	580	1.770	880	692	-	-	-	-	-	-
Aporte para expansión sistema de agua	1.189	1.200	1.185	1.200	1.200	2.200	1.500	1.500	1.500	1.500	1.500
Déficit de Explotación	700	823	854	895	978	963	1.002	1.039	1.103	1.139	1.134
	1.189	2.750	3.925	6.930	4.802	2.200	1.500	1.500	1.500	1.500	1.500

II Aplicación de Fondos

Proyecto FID	-	1.550	2.740	5.730	3.602	-	-	-	-	-	-
Inversiones y conservación del sistema de agua	1.189	1.200	1.185	1.200	1.200	2.200	1.500	1.500	1.500	1.500	1.500
	1.189	2.750	3.925	6.930	4.802	2.200	1.500	1.500	1.500	1.500	1.500