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AT-542
10 December 1980
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AGENDA

TO: The Board of Executive Directors

FROM: The Secretary

SUBJECT: Barbados. Technical cooperation in the preparation of feasibility studies on sewerage systems for the country's south and west coasts

Attached for your consideration is a plan of operations for providing contingent-recovery technical cooperation to Barbados in the amount of CAN\$1,404,000, to be charged to the Canadian Fund for the Preparation of Development Projects, for the preparation of feasibility studies on sewerage systems for the country's south and west coasts.

Any questions or requests for additional information concerning this operation may be directed to Mr. Edward M. Agostini, Office of the Deputy Operations Manager for Region III, Division 7 (extension 48296). The oral presentation of this plan of operations is tentatively scheduled for December 17.

If there is agreement on this operation in the Committee of the Whole, Management will enter into negotiations with the beneficiary on the pertinent agreement. The relevant resolution will be submitted for approval by the Board of Executive Directors upon conclusion of the negotiations.

Other distribution:

Managers and Advisors
Division Chiefs
Representative in Barbados

INTER-AMERICAN DEVELOPMENT BANK
OPERATIONS DEPARTMENT - REGION III- DIVISION 7
BARBADOS

PLAN OF OPERATIONS FOR TECHNICAL COOPERATION FOR THE PREPARATION OF
FEASIBILITY STUDIES FOR SOUTH AND WEST COAST
SEWERAGE SYSTEMS
(TC-81-01-13-1)

I. SUMMARY OF BASIC INFORMATION

- 1.01 Amount, Type of Bank Financing and Fund: Total project cost equivalent US\$1,400,000; Proposed Bank financing CAN\$1,404,000 contingent recovery from the Bank's Canadian Fund; Local counterpart equivalent US\$200,000. The rate of exchange used for calculating the cost of this project in Canadian dollars is US\$1 = Can\$1.17.
- 1.02 Objective: The objective of the proposed technical cooperation operation is to determine the most feasible alternative sewerage system for the densely developed coastline of the country. All the alternatives to be studied shall include the collection, treatment and final disposal of sewerage from residential, commercial, tourist, industrial, public and other sources along the south and west coasts, as well as the areas of Bridgetown adjacent to the sewerage facilities currently under construction.
- 1.03 Participants: Request made by Ministry of Finance and Planning on behalf of Beneficiary, the Government of Barbados; Executing Agency the Ministry of Health and National Insurance; Project to be executed by consulting firm.
- 1.04 Execution Period: 15 months from the date of the signing of consultancy contract.
- 1.05 Disbursements: To be made within a period of 30 months from the date of signature of Technical Cooperation Agreement; May establish revolving fund of CAN\$140,000.
- 1.06 Bank Responsibility for Supervision: Headquarters, (a) basic responsibility - Operations Department, Region III, Division 7; (b) technical responsibility - Project Analysis Department, Infrastructure Division, Sanitary Engineering Section. Bank's Representation in Barbados responsible for field supervision of project execution in accordance with established norms for such.

- 1.07 Agreement: Agreement to be signed between the Government of Barbados and the Bank.
- 1.08 Project Classification: (a) Sector - Health; (b) Field - Sewerage; (c) Type - Feasibility Studies.

II. BACKGROUND

A. The Project

- 2.01 During the Bank's last Programming Mission to Barbados ^{1/} agreement was reached with the Government regarding a Loan and Technical Cooperation strategy and project pipeline for the 1980-82 period. The agreed upon strategy requires Bank technical cooperation in order to (a) strengthen public sector institutions; (b) assist in the preparation and execution of projects, and (c) general studies in the areas of economic and social development.
- 2.02 Given that tourism is one of the Barbados' main growth sector and a major source of foreign exchange, the Government indicated to the Programming Mission, the importance of improving sewerage disposal methods along the densely populated south and west coasts. Not only would a solution to the coastal sewerage disposal problem assure the adequacy of disposal facilities for tourist developments and ancillaries, but it also would be a substantial health benefit to the indigenous local communities interspersed between the tourist developments. Because of the positive ecological impact of such a project to the coastal areas due to the failure of the present soil absorption methods of disposal in certain locations, and on the ocean reef and other marine life due to marine disposal of untreated effluents in waters close to the shoreline, the project was included in the Bank's pipeline of Technical Cooperation operations.
- 2.03 Accordingly, the Government of Barbados, in April of 1980, requested Bank financing for the purpose of contracting consultants to undertake the necessary studies in order to determine the appropriateness of developing an investment project. In the request, the Government stressed the high priority which it attached to such a project.
- 2.04 In response, the Bank undertook an Orientation Mission for the purpose of appraising the potential scope of work and assisting the Barbadian officials in developing adequate terms of reference for such a consultancy. The mission concluded that the proposed project would not only provide a solution to an important public health problem, but also would substantially enhance the country's tourism development efforts.

^{1/} Programming Mission undertaken in December, 1979.

- 2.05 Subsequently, the Government and the Bank negotiated the magnitude of the scope of work and parameters for the studies to be financed by the proposed operation.

B. Beneficiary and Executing Agency

- 2.06 The beneficiary of the proposed operation will be the Government of Barbados and the executing agency will be the Ministry of Health and National Insurance. The Ministry is divided into two major parts, the technical sections and the administrative sections. The technical units include the (i) Environmental Engineering Services, (ii) Environmental Health Services, (iii) Medical Care Services, and (iv) National Insurance Program. The Environmental Engineering Service functions as the country's environmental protection agency with responsibility for: (i) processing applications and plans for all development projects; (ii) enforcement and consultation concerning sewerage and industrial waste treatment and disposal facilities; (iii) planning and designing waste treatment and disposal facilities; (iv) monitoring and controlling marine and ground water pollution; (v) consultation regarding oil and marine pollution; (vi) monitoring air pollution and industrial hygiene, (vii) advising the Sanitation Service Authority; and (viii) controlling swimming pool construction and maintenance.
- 2.07 To execute the Bridgetown Sewerage Project 1/, the Ministry created a Project Execution Unit answerable directly to the Ministry's Permanent Secretary. Additionally, through a Technical Cooperation Project 2/, an autonomous national water and sewerage authority was created to have under its jurisdiction the production and distribution of potable water in Barbados, as well as the administration of the Bridgetown Sewerage System, and any other public sewerage system which may be constructed in the future. The new authority will absorb and be operating the Barbados Water Department 3/ by January, 1981, and absorb and administer the Bridgetown Sewerage System within four months after its completion which should be in late 1981.
- 2.08 Thus, the proposed technical cooperation will be carried out by the Bridgetown Sewerage Project Executing Unit until such time as it is transferred to the Barbados Water and Sewerage Authority, at which time, the technical cooperation operation will also be transferred to the Authority. Since the same local counterpart staff will remain with the technical cooperation, no detrimental impact is foreseen as a result of such transfer.

1/ Financed with Loans 440/SF and 440-A/SF; See paragraph 2.

2/ ATN/SF-1398-BA

3/ Currently, within the Ministry of Communication and Works, it is responsible for all Barbados water production and supply.

C. IDB Participation in the Health Sector

- 2.09 The Government of Barbados has, as part of its overall development strategy, emphasized improving the country's health delivery and sanitation systems. In this regard, the IDB has been the major source of external financing, having provided (i) Technical Cooperation financing for development of the National Health Service and National Pharmaceutical and Drug Plan 1/; (ii) a loan for the construction of five community health clinics; 2/, (iii) Technical Cooperation for Studies and designs for a sewerage system in Bridgetown 3/; (iv) a loan 4/ and supplementary loan 5/ for the construction of a sewerage system for downtown Bridgetown; and (v) Technical Cooperation for the creation of a National Water and Sewerage Authority 6/.
- 2.10 It should be noted that the only sewerage project in the country was financed by the IDB and is currently under execution. As such, an evaluation is presented below.

D. Evaluation of Previous Project

- 2.11 The objective of the Bridgetown Sewerage Project is to improve sanitation in the central area of the capitol city through the construction of a sanitary sewerage system, which consists of (i) a collection system (sewers); (ii) a treatment plant; and, (iii) an underwater effluent discharge (ocean outfall).
- 2.12 At the time of the original loan approval in 1975, the total estimated cost of the project was US\$13,622,000, of which the Bank provided US\$9.7 million. Although contracts were awarded for the sanitary sewers and the ocean outfall, the Borrower's decision to relocate the sewage treatment plant and the inadequacy of soils studies prior to redesigning resulted in the need to again design the plant for the

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- 1/ ATN/SF-1633-BA for US\$236,000 approved March 9, 1978, has been successfully terminated and its recommendations are being implemented.
- 2/ Loan 577/SF-BA for US\$3.3 million approved April 1979, construction contracts have been awarded for 3 clinics to date.
- 3/ ATN/SF-1106-BA for US\$210,000 approved in 1971 and finally signed after amendments in 1973. Consultant's studies for construction of Bridgetown Sewerage System submitted in 1974.
- 4/ Loan 440-SF-BA for US\$9.7 million approved in October, 1975 for construction of Bridgetown Sewerage System.
- 5/ Loan 440-A/SF-BA for US\$2.56 million supplemental financing for Bridgetown project.
- 6/ ATN/SF-1398-BA for US\$100,000 approved in October, 1975 for institutional and tariff studies and creation of national water and sewerage authority.

soils conditions at the new location. As a result, the estimated cost of the project increased to US\$19,916,000, or US\$6.2 million more than the 1975 original estimate on which the Bank's loan was based. In April, 1979 the Bank approved a supplemental loan of US\$2,560,000 to partially finance the increased costs of the project.

- 2.13 Undoubtedly because this was the first such project in the country, substantial delays in its execution were evident. Thus, one year in addition to the allotted six months were needed to comply with all the conditions precedent to the first disbursement. This was primarily due to difficulties in preparing a relocation plan for individuals to be displaced by the project. While the events which led to the project's redesign were largely unforeseen and unforeseeable, 1/ the technical capacity of the executing unit, despite services of supervisory consultants, was not sufficient to adequately control the project within the original parameters.
- 2.14 It should be noted, however, that subsequent to the project's reformulation, its execution has progressed normally and all contractual conditions have been adequately complied with. As of September 31, 1980, approximately 55% of the loan resources had been disbursed and over 50% of the physical works completed. The current status of the three sub-projects are as follows: (i) Sanitary sewers - approximately 6 miles or over 40% of the sewer lines have been laid and nearly 90% of these lines have been tested and accepted; (ii) Sewerage treatment facilities - these consist primarily of a treatment plant and pumping stations. The treatment plant is nearly completion with the finishing work and installation of machinery and equipment currently underway. A pumping station was resited due to unfavorable soil conditions which will require the complete use of sheet pilings for its construction. This change is not expected to delay the overall execution period; (iii) Ocean outfall - construction of the outfall was completed in August, 1979 and the certificate of inspection and acceptance issued by the supervisory engineers in December, 1979.
- 2.15 Since part of the overall project consisted of the creation of a National Water and Sewerage Authority it is expected that an entity of this nature will enhance the technical and administrative functions because of its design and strong governmental support 2/.

1/ This according to document PR-688-5 upon which the supplemental loan is based.

2/ This entity was officially created in October, 1980 and it will become operational within one year.

III. OBJECTIVES

- 3.01 The objective of the proposed technical cooperation operation is to determine the most feasible alternative sewerage system for the densely developed coastline of the country. The alternatives to be studied shall all include the collection, treatment and final disposal of sewerage from residential, commercial, tourist, industrial, public and other sources along the south and west coasts, as well as the areas of Bridgetown adjacent to the sewerage facilities currently under construction.

IV. DESCRIPTION

- 4.01 The proposed operation would be undertaken by a consulting engineering firm with considerable knowledge in the technical, economic and financial aspects of sewerage collection, treatment and disposal systems. Additionally, the consultants should have knowledge and experience in the appropriateness and applicability of such systems to an island ecosystem such as Barbados.
- 4.02 The study will encompass the following areas of Barbados:
1. A stretch of approximately 15 kilometers of western coastline between Brighton and Speightstown extending 200 to 500 meters inland.
 2. A stretch of approximately 10 kilometers along the southern coast between Needham's Point and Oistins, extending about 500 meters inland.
 3. The populated areas surrounding central Bridgetown which will not be covered by the sewerage system currently under construction.
- 4.03 In accordance with the above mentioned objective of the proposed operation, the work to be performed by the consultants will consist of the following general categories of activities 1/:
1. Conduct feasibility studies and present recommendations for the collection, treatment and disposal of sewerage in the South Coast, West Coast and Greater Bridgetown areas.
 2. Prepare and present preliminary engineering designs and cost estimates for the sewerage of the study areas.
- 4.04 To perform the above studies will require a total of 108 consultant months during an execution period of 15 months 2/. The consulting firm who would undertake the studies would provide the following expertise:

1/ See Annex 1 for detailed consultancy Terms of Reference.

2/ See Annex 3 for a project execution schedule.

	<u>Man/Months</u>
-Senior Sanitary Engineer/Project Director (1)	15
-Senior Sanitary Engineer/Collection Works (1)	12
-Senior Sanitary Engineer/Wastewater Treatment (1)	12
-Senior Sanitary Engineer/Sewage and Sludge Disposal (1)	12
-Senior Civil Engineer (1)	9
-Soil Mechanics Engineer (1)	3
-Geologist (1)	3
-Hydrologist/Surface and Ground Water (1)	3
-Irrigation Engineer (1)	3
-Chemist (1)	6
-Microbiologist (1)	6
-Marine Biologist (1)	3
-Oceanographer (1)	3
-Coastal Engineer (1)	3
-Ecologist (1)	3
-Computer Sciences Technician (1)	3
-Senior Economist (1)	6
-Senior Financial Analyst (1)	3
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- 4.05 To assist the consulting firm in carrying out the studies, the Executing Agency will provide the necessary office space, administrative, and logistic support to effectively execute the project. Additionally, the following local counterpart staff will be assigned by the Executing Agency to work directly with the consulting firm throughout the project execution period:

	<u>Man/Months</u>
-Civil or Sanitary Engineer (1)	15
-Statistician (1)	12
-Technical Asistant (3)	36
-Land Surveyor (3)	12
-Chainmen (6)	24
-Draftsmen (3)	24
-Secretary (2)	24
-Economic Survey Personnel (10)	10
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V. BUDGET

- 5.01 The total cost of the proposed technical cooperation operation is estimated to be the equivalent of US\$1,400,000, of which the Bank would finance CAN\$1,404,000, which is the equivalent of US\$1,200,000 (86%); and the Beneficiary would finance the equivalent of US\$200,000 (14%).
- 5.02 The following is a general allocation of the operation's budget by category 1/:

(CAN\$ Equivalents)
1 US\$ = CAN\$1.17

	<u>IDB</u>	<u>BENEFICIARY</u>	<u>TOTALS</u>
1. <u>Consulting Firm</u>	1,203,193	-	1,203,193
1.1 Fees & Overhead	890,663	-	
1.2 Equipment	46,800	-	
1.9 Soils Tests	23,400	-	
2.5 Business Travel	242,330	-	
6. <u>General Support</u>	17,550	202,293	219,843
6.1 Office facilities	-	17,550	
6.4 Supplies	-	5,850	
6.5 Computer Services	11,700	-	
6.6 Support Personnel	-	161,343	
6.7 Publications	5,850	-	
6.8 Communications	-	5,850	
6.9 Local Travel	-	11,700	
98 <u>Contingencies</u>	183,257	31,707	214,964
TOTALS	1,404,000	234,000	1,638,000
	=====	=====	=====
Percentages	86%	14%	100%

- 5.03 The Bank's contribution of up to CAN\$1,404,000 would be provided on a contingent recovery basis from the Bank's Canadian Fund for Project Preparation. Thus, if the Beneficiary subsequently obtains a loan from

1/ See Annex 2 for a detailed budget.

the Bank or some other external source to finance the eventual project based on the proposed technical cooperation operation, the Bank would be reimbursed the amount of its contribution. If however, no project results, the operation would be nonreimbursable.

VI. JUSTIFICATION

- 6.01 The primary justification for the proposed operation is its anticipated improvement in the country's sanitation standard which will result in improved health conditions in general, and an infrastructure which can accommodate dense tourist development.
- 6.02 Presently, Barbados has no public sewerage system ^{1/}. The traditional method of waste water and excreta disposal along the coastal strip has been either by the use of privy pits, septic tanks or sewage absorption wells. Water from baths and kitchen sinks is generally discharged into open drains which enter the public storm drains and eventually are disposed into the sea.
- 6.03 With the tremendous increase in development along the coastal strip, its close proximity to the sea, and its high density, the surface area available for using soil absorption methods has been seriously restricted given the high water table in certain areas (about 3 feet below ground level). Thus, the traditional soil absorption methods of waste water and excreta disposal has failed in some recent building developments, resulting in pollution of the ground water. These conditions are not only odorous, offensive and unsightly, but pose a threat to the health of the area population. The problem is exacerbated by the disposal of large quantities of grease from restaurants which coats the surface area of the soil, thus stopping the absorption process.
- 6.04 In addition to the above mentioned on-shore problem, a recent marine ecology study indicates that the coral reefs, mulluses, shell fish and marine vegetable life along the coastal strip are being seriously damaged by sewage disposal from the coast. Also, detergents, grease and other effluents being discharged into the sea are wrecking grievous damage to the marine environment and ecosystem.
- 6.05 Up to 1960, Barbados' economy and employment were primarily dependent on sugar and the little tourism that developed was closely linked to the country's British Commonwealth relationship. The decade of the sixties brought an influx of tourist to the island thus making tourism

^{1/} The Bridgetown Sewerage project is expected to be completed in late 1981.

and important dynamic factor in the economy. This was due to a variety of natural factors such as climate and beaches, combined with the Government's decision to develop the tourism potential and the ability to maintain political stability.

- 6.06 While tourism in other Caribbean countries has suffered from economic recession and political and economic unrest, it has prospered in Barbados, providing rapidly increasing shares of domestic product, employment and foreign exchange earnings. Tourist arrivals were 317,000 in 1978, more than twice the number of 1970 and the share of tourism in GDP reached 11.6% compared to 8.7% in 1970. Direct employment in tourism is estimated at about 6,700 with an additional 6,000-7,000 service jobs catering mainly to tourism. Thus, the total employment in tourism represents about 15% of the labor force. Gross foreign exchange earnings from tourism has also risen rapidly, reaching US\$128.5 million in 1978. Tourism has important linkages to other sectors of the economy, particularly construction activities that benefit from building of hotel and tourism related infrastructure, and provides a potentially important market for domestic food production and other consumer goods as well as handicrafts.
- 6.07 The strip of coastal area along the southern and western coast of Barbados is characterized by its highly dense development of tourist facilities interspersed with some residential areas. This coastal strip contains some of the most popular beaches in the Caribbean and is vital to the tourist industry, and therefore economy, of Barbados. Presently, the area contains over 100 hotels and guest houses with approximately 2,500 hotel rooms, and over 80 restaurants.
- 6.08 In recent years, the larger office buildings, hotels and other commercial establishments along the coastal strip have been encouraged to install activated sludge treatment plants. The liquid effluent from most of these private treatment plants are discharged into the ocean. With proper maintenance and operation these plants are capable of producing an effluent of secondary quality. However, in most cases, the plants are poorly operated and result in very little treatment being achieved prior to discharge.
- 6.09 In light of the above, it is apparent that in order to protect the country's ground water sources, maintain its general health standards, and complement the continued growth in the economy's major source of foreign exchange, solutions must be developed for the collection, treatment and disposal of sewerage along the densely developed coastal strip.

VII. DISBURSEMENTS

- 7.01 All disbursements would be made within a period not to exceed 30 months from the date of the signature of the Technical Cooperation Agreement

and as the Beneficiary justifies, with appropriate documentation, the expenses charged to the Bank's contribution. The counterpart funds will be disbursed simultaneously with the Bank's contribution.

- 7.02 At the Beneficiary's request, the Bank could establish a revolving fund in the equivalent of CAN\$140,000. The Bank would replenish this fund in its entirety or in part as the resources are utilized and upon submission of appropriate documentation detailing the expenses chargeable to the Bank's contribution.
- 7.03 The Technical Cooperation Agreement to be signed with the beneficiary would stipulate that the final disbursement of the Bank's contribution of not less than 10% of the total amount of the services contract signed by the beneficiary with a consulting firm will be contingent upon the acceptance by the beneficiary and the Bank of the final report stipulated in paragraph 8.01.
- 7.04 The agreement to be signed with the beneficiary shall stipulate that as soon as the services defined in this plan of operations are completed, any remaining uncommitted funds on the project will be cancelled automatically.

VIII. REPORTS

- 8.01 The Technical Cooperation Agreement to be signed with the beneficiary and the contract to be signed between the executing agency and the consulting firm will stipulate that the firm will be required to submit the following reports to the executing agency and to the Bank with a specified number of copies.
 - (a) Work Program (five copies): Within 15 days after the commencement of work, setting out the nature and intended timing of each component of all the activities to be undertaken.
 - (b) Bimestrial Report (five copies): Within 15 days after the end of each bimester, a concise and precise report stipulating the progress of work for each component making comparisons to the work program.
 - (c) Draft Final Report (five copies): Upon completion of the studies, a draft final report of the alternatives studied and the recommended alternative.
 - (d) Final Report (five copies): Within 30 days from receipt of comments on the draft final report, a Final Report and an Executive Summary incorporating relevant modifications which the Beneficiary and/or the Bank may suggest.

- 8.02 Within 60 days from the date of receiving the final report, the executing agency will submit to the Bank an evaluation report on the results of the Technical Cooperation and the extent to which its objectives have been accomplished. The Bank, however, retains the right to request additional information necessary to clarify or complement the reports submitted by the executing agency or the consulting firm.
- 8.03 Within 90 days from the date of the final disbursement the Ministry of Health and National Insurance shall submit to the Bank a statement of the expenses charged to the Bank's contribution and the local contribution. The statement should be certified by auditors acceptable to the Bank.

IX. SUPERVISION

- 9.01 The Technical Cooperation Agreement will stipulate that the Bank may exercise supervision over the work of the consulting firm through the Bank's Office in Barbados and through the pertinent technical units at Headquarters. Towards this end, the executing agency will keep the Bank's Representation in Barbados informed about the activities relating to this technical cooperation.
- 9.02 Basic responsibility for this operation will rest with the Office of the Deputy Manager of Operations, Region III, Division 7.
- 9.03 Technical responsibility for this operation will be with the Division of Physical Infrastructure (Sanitary Engineering Section) of the Project Analysis Department.

X. AGREEMENT

- 10.01 The Technical Cooperation Agreement with the Government of Barbados will be signed within 30 days from the date of approval of this Plan of Operation by the Board of Executive Directors of the Bank.

XI. EVALUATION

- 11.01 Evaluation of this Technical Cooperation will be made on the basis of analyses of:
- (a) Achievement of the objectives described in Section III of this Plan of Operations;
 - (b) Accomplishment of the work described in the Terms of Reference attached to this Plan of Operations as Annex I; and
 - (c) Review of the reports specified in Section VIII.

PROPOSED RESOLUTION

BARBADOS. CONTINGENT REPAYMENT TECHNICAL COOPERATION FOR THE
PREPARATION OF FEASIBILITY STUDIES FOR SOUTH AND
WEST COAST SEWERAGE SYSTEMS

The Board of Executive Directors

RESOLVES.

1. That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such agreements as may be necessary and to adopt such other measures as may be pertinent for the execution of the plan of operations referred to in Document AT with respect to technical cooperation with the Government of Barbados for the preparation of feasibility studies for south and west coast sewerage systems.

2. That up to the sum of CAN\$1,404,000, is authorized for the purposes of this resolution, chargeable to the resources of the Canadian Fund for the Preparation of Development Projects.

3. That the above-mentioned sum is to be provided on a contingent repayment basis, in accordance with the respective conditions which shall be set forth in the agreement to be signed for this operation.

Terms of Reference for Sewerage Studies
for Barbados

1. Objectives

Objectives of the work to be performed by the Consultant will be:

- (a) To carry out feasibility studies and present recommendations for the collection, treatment and disposal of sewage in the South Coast, and West Coast and Greater Bridgetown, as hereinafter defined;
- (b) To prepare and present preliminary engineering designs and cost estimates for the severing of South Coast, West Coast and Greater Bridgetown.

2. Areas to be included in the Studies

2.1 The South Coast Area

For the purpose of these terms of reference, the South Coast area is defined as that area within the parishes of St. Michael and Christ Church bounded by the coast line adjacent to Yacht Club in the West and Enterprise Drive in the East, and a line drawn perpendicular from the junction of Bay Street and Chelsea to the sea off Yacht Club, continuing 100 meters of Highway 7 along the eastern side of Highway 7 in a southerly direction to Balmoral Gap at Hastings where the line changes direction in a northerly direction maintaining the distance of 100 meters from Highway 7 off Hastings, Rockley, Worthing, St. Lawrence, Maxwell Main Road until it reaches Fairholme, where it continues in a straight line to the 20 ft. contour on Oisting Hill, then following the 20 ft. contour along Oistin to east of Scarborough then terminates in a straight line along Enterprise Drive to the Coast adjacent to the Coast Guard Station at Oistin.

2.2 Greater Bridgetown Area

For the purposes of these terms of reference, the Greater Bridgetown area includes that area within the parish of St. Michael circumscribed by the coast line adjacent to the western end of Brighton Road to India River and a line drawn along the eastern side of Fontabelle, turning east on Lakes Folly and north along Mason Hall Street to its junction with Baxters Road, then along Whitepark Road to its junction with Roebuck Street, then along Roebuck Street to the round-about, then along Halls Road, Martindales Road and Jemmotts Lane and to the coast line off the old Eye Hospital on Bay Street.

then along the coast to a line drawn to the sea perpendicular to Bay Street at the junction of Bay Street and Chelsea Road to Dalkeith Road, then along Dalkeith Road, turning left on to Dalkeith Hill and then right on to Culloden Road, then along Culloden, Pine, Welches, Bridge and Bank Hall Cross Roads, along Lower Bank Hall Cross Road and on to Highway 1 to Brighton Road, then along Brighton Road and to the coast.

2.3 West Coast Area

For the purpose of these terms of reference the West Coast area is defined as that area within the parishes of St. Michael, St. James and St. Peter bounded by the coast line adjacent to the western end of Brighton Road to Six Men's Bay and a line drawn perpendicular to the coast line at Six Men's Bay at its junction with Mile and Quarter Road to 0.4 Km east of Highway 1, then continuing in a southerly direction parallel to the coast maintaining the 0.40 Km distance from Highway 1 until it reaches the St. James/St. Michael Parish Boundary, then continuing at a distance of 0.20 Km. East of Highway 1 until the line reaches opposite Brighton Road where it makes a right angle and continues along Brighton Road terminating at its junction with the sea at Brighton Beach.

3. General Requirements for all Areas of the Studies

3.1 Review of Study Area

It shall be the responsibility of the Consultants to review the definitions of the study areas and present their own on the subject for review and approval by the Government Executing Agency and the Bank in accordance with the provisions of the Contract.

3.2 Population and Land Use

The Consultants are required to present a report on current and projected population and land use for the study area - with special attention being paid to high density tourism oriented development - for a period of at least 20 years. For these projections the Consultant shall take into account official statistical data available, elements of the Revised 1965 Physical Development Plan, and other physical development projections by the Town and Country Development Planning Office and the Ministry of Civil Aviation and Tourism. It shall be the responsibility of the Consultant to present their own opinion on the subject for review and approval by the Government Executing Agency in accordance with the provisions of the Contract.

3.3 Actual Conditions

The Consultants shall evaluate and define the source of potable water and its distribution, and any existing sewerage or in-situ disposal systems (e.g. package plants) in the areas herein defined. In such

definition and evaluation the areas should be broken down into service zones such as residential, tourism, commercial, industrial and others.

3.4 Waste Water Flow

For determining the contribution of waste water to the Sewer System in any area, the Consultants should take into account plans for increasing the physical facilities in the area and the plans and projections of the Waterworks Department and when applicable the Water and Sewage Authority for a period of at least 20 years. It shall be the responsibility of the Consultant to establish their own estimate of design flows.

3.5 Topographical Maps

The following topographical information will be made available to the Consultants by the Government Executing Agency:

- (a) Topographical maps to the scale of 1:10,000 with 20 ft. contour intervals. The maps were printed in 1955;
- (b) Topographical plans of the Oistin Redevelopment area;
- (c) Out line maps of the area to the scale of 1:1250 which are available at the Land Valuation Department.

It shall be the responsibility of the Consultant to perform any additional topographical survey which should include, but not be limited to the execution of a field survey and levelling program to update and/or supplement existing topographical or Photogrammetric maps of the study area.

3.6 Marine Studies

The South and West Coast areas are coastal strips where because of their proximity to the sea marine pollution has been a serious problem. It shall be the responsibility of the Consultants to perform marine studies necessary for:

- (a) adequate siting of marine outfalls for the discharge of treated sewage effluents if these are considered necessary;
- (b) determining the adverse effects or otherwise the discharge of sewage effluents will have on marine life and its ecology in general;
- (c) determining the effects of coastal development on the marine environment; and
- (d) making a preliminary analysis of the effect of non-point sources of pollution, and oil pollution on the Southern, South Western beaches, as well as on the marine ecology.

Such studies should include, but not be limited to the evaluation of bathymetric conditions, marine tides and currents, meteorological factors, salinity, and temperature profiles.

Available information made available to the Consultants by the Government Executing Agency will include:

- (i) Copies of "A Report on the Investigation of Coastal Currents in the Vicinity of Barbados" by Allan R. Emery of the Bellairs Research Institute;
- (ii) Copies of the Report on "Study of the Effects of Oil Pollution on Beaches, Coral Reef Structures, Inshore Fisheries and Marine Life around Coasts of Barbados" by Farmer and Hunte;
- (iii) Report on "Study of Possible Effects of Oil Pollution on Beach Structure and Beach Erosion around the Coast-Line of Barbados" by Dr. Gillian Cambers.

3.7 (i) Soil Studies

It will be the responsibility of the Consultants to perform all soil borings and other soil studies that may be necessary to determine the geology and soil conditions of the study areas. The soil studies should take into account the soils information contained in the Report on the Studies for the Redevelopment of the Oistin area and other relevant soil studies done in the areas.

(ii) Geotechnical Report

The Consultant shall submit to the Government Executing Agency a geotechnical report for each area which shall include all field and laboratory data, a description of the geological conditions encountered, and conclusions and recommendations relative to the area to be sewered.

The report shall also contain an engineering geological map illustrating the general subsurface conditions of rock and water, and shall contain discussion on any unusual subsurface conditions and an indication of the soil in the area above and below the ground water-table.

3.8 Protection of Beaches from Pollution

The Consultants shall submit to the Government Executing Agency proposals for the collection, treatment, and disposal of sewage in a manner to prevent the pollution of beaches and inshore marine areas along the South, Southwest, and West coasts, together with drafts of regulatory Acts, by-laws and codes of practice and their enforcement procedures considered necessary for their application.

3.9 Land Disposal of Sewage Effluent

The Consultants shall present specific recommendations for the protection of ground water sources of potable water or water used for irrigation purposes, and in this context, shall state their views on the probability of using any suitable upper elevation areas adjacent to the study areas for the disposal of treated sewage effluent for ground water recharge or irrigation purposes. Such recommendations include drafts of any legal and administrative dispositions and enforcement policies required to execute the recommendations made.

3.10 Presentation of Plans

The Consultants shall present to the Government Executing Agency plans showing the areas to be sewered, the method or methods of sewage treatment to be employed, and the methods and areas of sewage disposal. In determining the methods of sewage collection, treatment and disposal, attention should be given to the recommendations of the Consultants for the Sewerage Study for Bridgetown and surrounding areas by Lawler Matusky and Skelly Engineers, as contained in their "Supplement to the Report on the Bridgetown Sewerage Study" dated April 25, 1975.

Separate maps shall be presented for any areas of localised sewerage, and for any stage of phased sewerage if recommended. Special maps and/or drawings shall be submitted to support recommendations for the protection of beaches and inshore marine areas from pollution by sewage and other wastes discharged from the Study area.

3.11 Alternate Systems

The Consultants shall define the areas where the use of septic tanks and other individual systems may be continued with disposal by wells or percolation fields based on the infiltration capacities of the soil. An analysis of alternative systems, must be submitted based on technical, economical, financial, institutional and legal considerations. The Consultant is required to recommend the most attractive method or methods.

3.12 Collection Treatment and Disposal of the Sewage

Special attention is required of the Consultants regarding the treatment of sewage prior to its disposal. Treatment methods must take into account the need to minimise as far as practicable for the efficient treatment of sewage, the cost of fuel and other non-renewable energy. It is expected that disposal of effluent methods considered will include marine disposal, land disposal by spreading and/or recharge of ground water, and irrigation. Recommendations for Land disposal of sewage effluents for ground

water quality. It is also expected that methods considered for the treatment and disposal of sludge will take into account the need to eliminate the possibility of offensive odour and other adverse environmental conditions in the immediate surrounding area particularly in the high density housing and holiday development areas. Before presentation of preliminary designs for the collection, treatment and disposal of sewage by the most attractive alternative, the consultant shall present the conceptual design and drawings necessary for the technical, economic, and financial analysis of each mutually exclusive alternative. These studies and documents shall be submitted to the Government Execution Agency and the Bank for review and approval in accordance with the Contract.

4. Specific Requirements

4.1 Documents, Engineers Report and Preliminary Designs to be Submitted

The documents mentioned at 3.12 shall be included in an Engineering Report for the areas studied.

All plans and documents shall be presented in accordance with the requirements of the Inter-American Development Bank and the Government Executing Agency. It will be the responsibility of the Consultants to secure the necessary information on the above requirements.

4.2 Operation

The Consultants shall present recommendations for the organization to operate the Sewerage System for the study area, including the Bridgetown sewerage system under construction. Such organizational structure shall take into consideration the organization of the Barbados Water and Sewerage Authority which will be responsible for the operation of Water and Sewerage System throughout the island. A schematic structural chart of the organization shall be presented with summary description of functions.

4.3 Economic Studies

The economic analysis will compare all technical feasible alternatives, as indicated in 3.11 and 3.12 above, and will provide the basis for selecting the best approach for disposing of waste products. In the analysis of all alternatives, the economist will convert financial to economic prices using the national accounting parameters developed jointly by the Bank and the Government of Barbados. Of particular importance are the accounting prices for fuel and other energy-intensive products which are in scarce supply in Barbados. The benefit and cost projections should be for a period of 20 to 30 years, taking account of the additional investment requirements which may occur beyond the initial construction period and of any salvage value remaining at the end of the analysis period used.

Elements of importance for the economic analysis include the following:

- (a) Among the alternatives for sewerage collection, treatment and final disposal, the evaluation should look at the costs and benefits of improving the existing facilities.
- (b) The analysis should identify the potential users by zones (residential, tourist, industrial, commercial, etc.) and by income group. The definition of income group (basically the low income group and the rest of the private sector) will be based upon the per capita income value agreed upon by the Bank and Barbados for identifying low income persons. Moreover, surveys will be undertaken to establish the willingness of potential users to connect to an integrated sewerage system. In this regard, account must be taken of the connection costs which will be paid by the users, if any.
- (c) For setting the tariff structure of a public system, as well as for the economic analysis of alternatives, the evaluation will present a detailed breakdown of operating costs (e.g., materials, labor by skill level, replacements, chemicals, etc.). If a public sewerage system is chosen as the best alternative, the consultants will indicate sewer charges necessary for covering marginal costs, including depreciation.
- (d) If a subsidy is proposed by the Government for any group of potential users, the economic evaluation should estimate the size of the subsidy, the alternative ways of providing the subsidy and who will ultimately pay for the subsidy.

In addition to the cost-benefit analysis, using efficiency prices the economic studies will include an evaluation of the net economic benefits accruing to low income groups. The consultants will use the methodology developed within the Bank for this purpose.

4.4 Other Work to be Performed by the Consultants

It will be the responsibility of the Consultants to perform any other work not specifically mentioned in these terms of Reference that will be required by sound engineering practice for the completion of reports, plans, specifications, cost estimates and other documents that are produced by the Consultants for the satisfaction of their responsibilities under the terms of the Contract.

DETAILED BUDGET
(in CAN\$ equivalents)
1US\$ = CAN\$1.17

	<u>IDB</u>	<u>Beneficiary</u>	<u>Totals</u>
1. <u>CONSULTING FIRM</u>			<u>1,203,193</u>
1.1 FEES	-		
<u>Honoraria</u>	<u>356,265</u>	-	
-Sr. Sanitary Engineers (51 m/m)	187,785		
-Sr. Civil Engineers (9 m/m)	31,590		
-Other Experts (45 m/m)	129,870		
-Computer Science Tech. (3 m/m)	7,020		
<u>Overhead (150% of Honoraria)</u>	<u>534,398</u>	-	
1.2 EQUIPMENT (Rented)	<u>46,800</u>	-	
-For water quality analysis	11,700		
-Bathymetric, wave, current, tide studies	35,100		
1.9 OTHERS (Soil Mechanics & Percolation Tests)	<u>23,400</u>	-	
2.5 <u>BUSINESS TRAVEL</u>	<u>242,330</u>	-	
<u>International</u>			
-Tickets	35,100		
-Per Diem	207,230		
6. <u>GENERAL SUPPORT</u>	<u>17,550</u>	<u>202,293</u>	<u>219,843</u>
6.1 OFFICE FACILITIES AND SUPPLIES	-	<u>23,400</u>	
6.5 COMPUTER SERVICES	<u>11,700</u>	-	
6.6 SUPPORT PERSONNEL	-	<u>161,343</u>	
-Civil or Sanitary Engineer (15 m/m)		26,325	
-Technicians (108 m/m)		112,320	
-Additional Support Personnel (34 m/m)		22,698	
6.7 PUBLICATIONS	<u>5,850</u>	-	
-Printing Final Report	5,850		
6.8 COMMUNICATIONS	-	<u>5,850</u>	
6.9 OTHER (Local Travel)	-	<u>11,700</u>	
98 <u>CONTINGENCIES (15%)</u>	<u>183,257</u>	<u>31,707</u>	<u>214,964</u>
TOTALS	<u>1,404,000</u> =====	<u>234,000</u> =====	<u>1,638,000</u> =====
Percentages	86%	14%	100%

GENERAL EXECUTION PROGRAMMEFeasibility Studies

Activity 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Work Program

Bimstral Report 1

Bimstral Report 2

Bimstral Report 3

Bimstral Report 4

Preparation and
completion of Draft
Final Report

Beneficiary's
Review of Draft

Bank's Review of
Draft

Submission of
Final Report



