

**UNCLASSIFIED**

**UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
Washington, D. C. 20523**

**BELIZE**

**PROJECT PAPER**

**INCREASED PRODUCTIVITY THROUGH BETTER HEALTH**

AID/LAC/P-224

Project Number:505-0018

**UNCLASSIFIED**

PROJECT DATA SHEET

A Add  
C Change  
D Delete

CODE 3

COUNTRY/ENTITY BELIZE 3. PROJECT NUMBER 505-0018  
 4. BUREAU/OFFICE LAC/DR 05 5. PROJECT TITLE (maximum 40 characters) Increased Productivity Through Better Health  
 6. PROJECT ASSISTANCE COMPLETION DATE (PACD) MM DD YY 10/3/81 7. ESTIMATED DATE OF OBLIGATION (Under B. below, enter 1, 2, 3, or 4) A. Initial FY 85 B. Quarter 2 C. Final FY 88

8. COSTS (\$000 OR EQUIVALENT \$) =

A. FUNDING SOURCE	FIRST FY 85			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	( 1,300 )	( 200 )	( 1,500 )	( 6,600 )	( 400 )	( 7,000 )
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1. Host Country	28	782	810	125	3,801	3,926
2. Other Donors PAHO	32		32	174		174
TOTALS	1,360	982	2,342	6,899	4,201	11,100

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION/PURPOSE CODE	B. PRIMARY TECH CODE	C. PRIMARY TECH CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) HE	520	542		0	0	1,500	0	7,000	0
(2)									
(3)									
(4)									
TOTALS						1,500		7,000	0

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each) 549 510 545 560  
 11. SECONDARY PURPOSE CODE  
 12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each) A. Code BR DEL B. Amount

13. PROJECT PURPOSE (maximum 480 characters)  
 The purpose is two-fold: 1) To control the incidence of malaria and dengue fever by 1988 to a level where they are no longer public health problems and 2) to extend coverage of water and sanitation in rural communities in three districts and improve the national water quality control program.

14. SCHEDULED EVALUATIONS Internm MM YY 10/19/81 6/19/87 Final MM YY 03/819  
 15. SOURCE ORIGIN OF GOODS AND SERVICES  000  941  Local  Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of 3 page PP Amendment)

17. APPROVED BY Neboysha R. Brashich A.I.D. Representative Belize Date Signed 12/21/84  
 18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION MM DD YY

|  
UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON, D. C. 20523

PROJECT AUTHORIZATION

Name of Country: Belize  
Name of Project: Increased Productivity Through Better Health  
Number of Project: 505-0018

1. Pursuant to Section 104 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Increased Productivity Through Better Health project for Belize, involving planned obligations of not to exceed Seven Million United States Dollars (US\$7,000,000) in grant funds ("Grant") over a four (4) year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is four (4) years from the date of initial obligation.

2. The project ("Project") will provide assistance in the control of the incidence of malaria and dengue fever, extend the coverage of potable water and sanitation systems in rural communities and villages in three districts, and improve the national water quality program.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Grant shall have their source and origin in Belize or in the United States, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have Belize or the

United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

b. Conditions Precedent to Disbursement

(1) Malaria Control and Aedes Aegypti Control Component

(a) Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for activities under the Malaria Control and Aedes Aegypti Control Component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., a detailed, time-phased Action Plan for project activities to be carried out by both the Aedes Aegypti Control Program (ACCP) and the National Malaria Control Service (NMCS) for Belize Fiscal Year (FY) 1984-85. The Action Plan should include the GOB budget for Grantee financed project activities.

(b) Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made after March 31, 1985, for activities under the subject component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. by March 31, 1985, in form and substance satisfactory to A.I.D., a detailed, time-phased Action Plan for project activities to be carried out by both the ACCP and NMCS for Belize FY 1985-86, and written evidence that the GOB has budgeted an amount adequate to finance Grantee-provided project resources, including residual insecticides.

(c) Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made after March 31, 1986, for activities under the subject component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. by March 31, 1986, in form and substance satisfactory to A.I.D., a detailed, time-phased Action Plan for project activities to be carried out by both the ACCP and the NMCS for Belize FY 1986-87, and written evidence that the GOB has budgeted an amount adequate to finance Grantee-provided project resources, including residual insecticides.

(d) Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made after March 31, 1987, for activities under the subject component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. by March 31, 1987, in form and substance satisfactory to A.I.D., a detailed,

time-phased Action Plan for project activities to be carried out by both the AACP and the NMCS for Belize FY 1987-88, and written evidence that the GOB has budgeted an amount adequate to finance Grantee-provided project resources, including residual insecticides.

(2) Water Supply and Sanitation Component

(a) Prior to the disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for activities under the Water Supply and Sanitation Component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., a detailed, time-phased Action Plan for project activities to be carried out by the Environmental Health Service in Belize FY 1984-85, which will include the establishment of a Senior Public Health Inspector position in charge of the water and sanitation program, and written evidence that the GOB has budgeted an amount adequate to finance Grantee-provided project resources for Belize FY 1985-86.

(b) Prior to the disbursement, or to the issuance of any documentation pursuant to which disbursement will be made after March 31, 1986, for activities under the subject component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. by March 31, 1986, in form and substance satisfactory to A.I.D., a detailed, time-phased Action Plan for project activities in subject component to be carried out by the Environmental Health Service for Belize FY 1986-87, which will include the establishment of a Water Quality Analyst position, and written evidence that the GOB has budgeted an amount adequate to finance Grantee-provided project resources for Belize FY 1986-87.

(c) Prior to the disbursement, or to the issuance of any documentation pursuant to which disbursement will be made after March 31, 1987, for activities under the subject component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. by March 31, 1987, in form and substance satisfactory to A.I.D., a detailed, time-phased Action Plan for project activities to be carried out by the Environmental Health Service for Belize FY 1987-88, and written evidence that the GOB has budgeted an amount adequate to finance Grantee-provided project resources for Belize FY 1987-88.

(3) Construction

(a) Prior to the disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for the construction of any physical facilities, the Grantee shall, except as the Parties may otherwise agree in writing,

furnish to A.I.D., in form and substance satisfactory to A.I.D., certification that the GOB has title to the site upon which each facility will be constructed.

(b) Prior to the disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for the construction of a water quality laboratory, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence that a Water Quality Analyst position to develop and coordinate the rural water supply surveillance and monitoring program has been established and filled.

c. Covenants

The Government of Belize shall covenant that it will:

(1) Beginning in Belize FY 1986, carry out annual GOB/PAHO/AID program evaluation for the NMCS and the AACP under the terms of reference prepared jointly by GOB, PAHO and A.I.D.;

(2) Enforce health and environmental safeguards and provide training in environmental and health safeguards throughout the life of the project, especially with regard to the application of insecticides;

(3) Make available to the NMCS adequate spray personnel to carry out the planned activities of this project;

(4) Beginning in Belize FY 1985, initiate a study of the equitability of the salary schedules for a given educational requirement, specifically as it relates to the ability of the Public Health Inspectorate to retain adequate staff necessary for project implementation;

(5) Beginning in Belize FY 1986, carry out an annual program evaluation for the Rural Water Supply and Sanitation Program, including a status report of rural handpumps, latrine coverage, drinking water quality and health education/community development/training activities;

(6) Beginning in Belize FY 1985, establish a National Action Committee on Water Supply and Sanitation;

(7) Make every reasonable effort to ensure that each participant trained overseas under this Project works in water and sanitation and vector control activities in Belize for a length of time in accordance with Government General Orders for Training; and

(8) Assign one Belizean health educator/community development/trainer as a full-time counterpart to work in close collaboration with the project financed health education/community development/training advisor.

d. Waivers

(1) Competition in the procurement of goods is hereby waived and a single-source negotiated contract with the H.D. Hudson Manufacturing Company is hereby authorized in order to permit the procurement of spray pumps and spare parts, in an aggregate amount not to exceed \$20,000.

(2) Competition in the procurement of goods is hereby waived and a single-source negotiated contract with the Lauenders Engineering Company is hereby authorized in order to permit the procurement of LECO Ultra-Volume spray units with flowmeter, in an aggregate amount not to exceed \$20,000.

(3) The requirement for nonrestrictive specifications is hereby waived and proprietary procurement from Ford is hereby authorized for the procurement of up to 25 Ford vehicles and spare parts, in an aggregate amount not to exceed \$425,000.

(4) The requirement that motor vehicles financed by A.I.D. have their source and origin in the United States is hereby waived in order to permit the procurement of approximately thirty-nine (39) motorbikes, with displacement of 125cc, in an aggregate amount not to exceed \$70,000, from countries included in A.I.D. Geographic Code 935. The provisions of Section 636(i) of the Foreign Assistance Act of 1961, as amended, are also hereby waived.

(5) Competition in the procurement of goods is hereby waived and a single-source negotiated contract is authorized in order to permit the procurement of UNICEF Mark II handpumps and spare parts, in an aggregate amount not to exceed \$175,000. Based upon the justification set forth in Part VII of the Project Paper, I hereby approve a source and origin waiver from A.I.D. Code 000 to countries included in A.I.D. Geographic Code 899 to permit the procurement described herein.

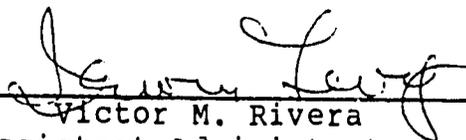
(6) A blanket determination of non-availability of U.S.-flag vessels for ocean shipment and a waiver to permit payment for ocean shipment on vessels registered in A.I.D. Geographic Code 899 countries are hereby approved.

(7) The requirement for U.S. or host country nationality of suppliers of services is hereby waived in order to permit participant training in Mexico, Panama, Haiti, Venezuela, or a Central American country.

Certifications

1. I hereby certify that I have determined that exclusion of procurement from Free World countries other than the cooperating country and countries included in A.I.D. Geographic Code 941 would seriously impede attainment of United States foreign policy objectives and objectives of the foreign assistance program in Belize.

2. I hereby certify that the interests of the United States are best served by permitting financing of transportation services on ocean vessels under flag registry of free world countries other than the cooperating country and countries included in A.I.D. Geographic Code 941.

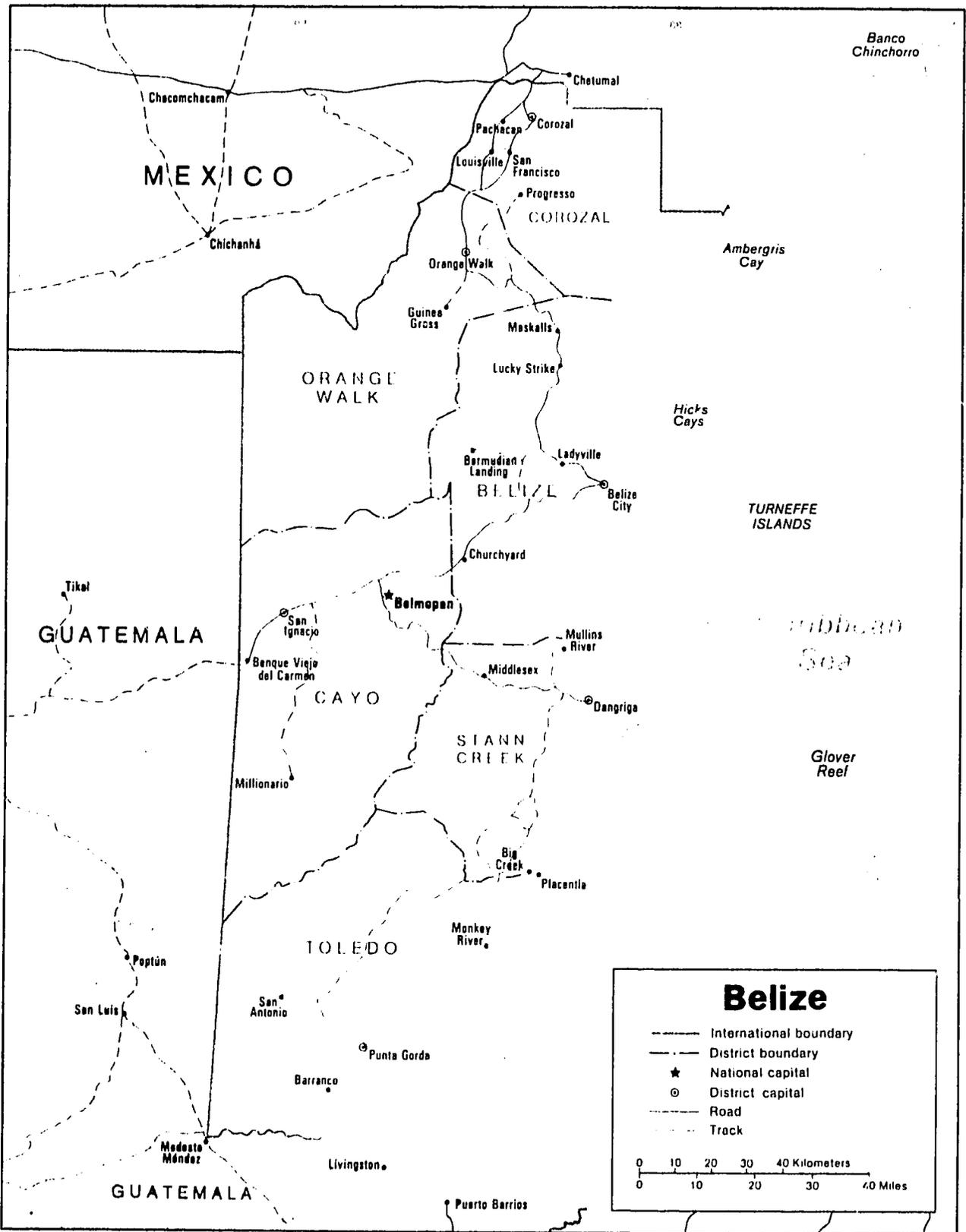
  
 \_\_\_\_\_  
 Victor M. Rivera  
 Assistant Administrator  
 Bureau for Latin America and  
 the Caribbean  
 MAR 21 1985  
 \_\_\_\_\_  
 Date

Clearances:

GC/LAC:RBMeighan RM date 3/15/85  
 LAC/DR:ILevy IL date \_\_\_\_\_  
 LAC/DR:DJohanson DFJ date 3-20-85  
 LAC/CAR:ECampbell EC date 3-14-85  
 SER/COM:PHagan PH date 19 Mar 85  
 LAC/DR:PFeeney (draft) date 3/6/85

  
 GC/LAC:PGJohnson/gw 0087B/3/6/85

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INCREASED PRODUCTIVITY THROUGH HEALTH  
(Project 505-0018)

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Part I            SUMMARY AND RECOMMENDATIONS

A. Recommendations

USAID/Belize recommends that a grant of US \$7 million be authorized to the Government of Belize to assist in the development of a project for Increased Productivity Through Health with disbursement over a four (4) year period beginning the second quarter of FY 1985 and ending in FY 1988.

B. Project Summary

The Grantee will be the Government of Belize (GOB). The implementing agency will be the Ministry of Health, Labour and Sports (MOH). The ultimate goal of this project is to improve the health and productivity of the Belizean population. Its purpose is to control the incidence of malaria and dengue fever nationally, to extend coverage of water and sanitation in rural communities in the three districts of Orange Walk, Stann Creek and Belize and improve the national water quality control program. Through the technical and financial resources provided under this grant the GOB will be able to improve its performance in the areas of malaria and dengue fever control and water and sanitation.

The MOH vector control services will benefit from long and short term training to improve the practical skills of technical, managerial and working level personnel to increase their capabilities. Training and project commodities will increase the services' operational efficiency, strengthen the transportation system, improve management and supervision as well as provide support to operations research activities.

Short term technical assistance will be provided in epidemiology, ULV operations, operations research and program management. Health education/community participation/training activities to train vector control support personnel in community spraying activities will also be strengthened.

Operations research will focus on biological control for malaria and Aedes aegypti and to improve the efficiency and cost effectiveness of alternative methodologies.

Commodities including technically appropriate insecticides, vehicles, anti-malarial drugs and laboratory equipment will be provided to support the GOB vector control operations. A small vehicle repair facility, three small storage units and a small office will be constructed. A strong evaluation component will assist the GOB to assess cost effectiveness, management and project impact of their vector control programs.

The Water and Sanitation component will strengthen the administrative and technical capability of the Environmental Health Service's (EHS) technical, managerial and field staff through long and short term technical assistance. Improvement of water systems and latrine installation, repair and maintenance will be a strong element.

Lab construction, equipment and training of local technicians will ensure water quality control monitoring. Operations research will support appropriate technology innovations tailored to community circumstances. Construction and equipping of maintenance and warehouse facilities will augment GOB current facilities.

Technical assistance in community development and health education will motivate and educate communities to improve their own health; it will also strengthen the community development/health education/training skills of MOH personnel involved in vector control and water and sanitation. Commodities, construction and the short term technical assistance will improve vehicle and equipment maintenance skills; maintenance and inventory systems will also be strengthened.

The Project committee has found the project to be administratively, technically, socially, economically and financially feasible. It is found to be consistent with the development objectives of the Government of Belize and in accord with the objectives of the USAID CDSS strategy.

### C. Summary Financial Plan

<u>SUMMARY FINANCIAL PLAN</u>			
(US \$ 000)			
US Fiscal Years 1985-88			
Project Component	USAID	Belize Counterpart	PAHO
I. Vector Control Component	1,886	2,640	52
II. Water Supply & Sanitation Component	3,008	1,275	122
III. Project Management Support Component	1,892	-	-
Allowance*	214	-	-
TOTAL	<u>7,000</u>	<u>3,915</u>	<u>174</u>

This additional allowance was included in view of the fact that a 10% contingency allowance for a project of this magnitude and complexity is considered minimal.

#### D. Summary Project Issues

The following key issues have been addressed by the Project Development Team during the formulation of the project:

1) Technical assistance will be provided in the areas of management and health planning to further strengthen the institutional capacity of the MOH to successfully execute this project.

2) A strong Community Development/Health Education/ Training element has been incorporated into the design of the water and sanitation and vector control components.

3) An Interdonor Coordination Committee has been established as a mechanism to address policy issues and share technical information.

4) The Ministry of Health's vector control organization separates the Malaria Control Service and the Aedes Aegypti Control Program. The institutional analysis (See Part III A. Institutional Analysis) determined that integration of the two services would not increase managerial efficiency. Therefore, no Condition Precedent nor Covenant relates to this issue.

5) The UNICEF Mark II handpump has been selected as the MOH standard based on reliability, competitive price and ease of maintenance and repair.

6) The institutionalization of a Belize National Action Committee for Water Supply and Sanitation for policy development and coordination of national water supply and sanitation activities is planned by the GOB.

7) The project will develop a laboratory capability to perform inorganic chemical and microbiological analyses in order to monitor rural water supply. The MOH Water Quality Monitoring Laboratory is not expected to perform pesticide residue testing due to the low risk of contamination. There is limited use of agricultural pesticides in Belize. Also, high capital costs for laboratory instruments, high recurrent costs for pesticide testing and the need for a high level of trained manpower preclude such testing in Belize.

8) Alternative energy sources for powering community water systems will be considered. Wind powered systems have not been successful to date in Belize (Care project 1976). One community where appropriate criteria have been met will be selected for pilot work in the use of a photo-voltaic pump with elevated storage.

## E. Project Development Team

Neboysha Brashich, AID Representative to Belize  
 Paula Feeney, LAC/DR/HN Health Officer  
 Lawrence Cowper, S & T/Health Vector Control Advisor  
 Mellen Duffy Tanamly, Consultant  
 Rose Schneider, Team Leader, Consultant  
 Richard Wilk, Social Scientist, Consultant  
 David Redding, Economist, Consultant  
 Robert Gearheart, Engineer, Consultant  
 Ray Beach, Entomologist, Centers for Disease Control (CDC)  
 Glenn Stokes, Entomologist, Consultant  
 Scott Goode, Graduate Student, Texas A & M University  
 David Donaldson, Engineer, Consultant  
 Ken McLeod, Engineer, Consultant  
 Mike A. Ramirez, Financial Analyst, USAID/Belize  
 Phillip R. Amos, Controller, USAID/Tegucigalpa

The team was supported in the development of the PP by Shelley Trifone, Shirley Crawford, Joy Dellinger and Liliana Koster, USAID/Belize.

## PART II PROJECT DESCRIPTION

### A Background

#### 1. Country Setting

Belize is an independent Central American country bordered by Mexico, Guatemala and the Caribbean Sea and occupies an area of about 8,900 square miles including numerous small islands. The inner coastal waters are shallow, sheltered by coral reefs. There is low coastal plain, much of it covered by mangrove swamp. The Maya Mountains and the Cockscoms form the low mountains of the southern half of the country. There are many rivers, some navigable for short distances. A large part of mainland is forest. The climate is sub-tropical tempered by trade winds.

The population density is one of the world's lowest with an estimated 1984 population of 159,000. This population is racially very mixed and derives almost wholly from immigrant stock. In general, it is divided into four major ethnic groups: Creole, Garifuna, Kekchi Maya, Mopan Maya and has a scattering of persons of European, East Indian, Chinese and Lebanese descent. The first four ethnic groups constitute localized cultural enclaves that preserve language, diet and other distinctive cultural practices in the areas of medical and child care. English is the official language of Belize.

A recent study conducted with the assistance of the United Nations High Commission for Refugees estimated that approximately 3,000 Salvadorans and 6,000 Guatemalans reside in Belize for political and/or economic reasons.

In 1982, A.I.D. and the Pan American Health Organization jointly completed a major Belize Health Sector Assessment. The assessment revealed that the vector-borne diseases of malaria and dengue fever represented major public health problems and were priority areas for government response. In addition, Belize's inadequate rural water and hazardous sanitation conditions have been identified as major sources of disease.

Morbidity and mortality statistics for Belize show apparent considerable under-reporting of infant deaths, particularly in the rural areas. In 1981, infant mortality was reported to be 27 per 1,000 live births.

The overall mortality rate for 1981 was reported as 5 per thousand with the principal causes of death being circulatory disorders and infectious diseases. Six percent of all deaths in 1981 were due to gastro-intestinal diseases, the vast majority of these occurring in infants.

Since 1980 the leading causes of reported morbidity have been malaria, gastro-intestinal diseases, measles, and dengue fever. In the last ten years the reported incidence of malaria has increased 4500%. In 1983, 4,595 cases were reported of which 13.8% were *P. falciparum*, the most severe form of the disease. The number of reported cases of malaria tripled from 1980 to 1983.

There were 3,278 reported cases of gastro-intestinal diseases in the vulnerable 0-4 age group in 1983 which represents a 363% increase from the previous year. This high incidence is not surprising since only about the half the population is served with appropriate sanitation systems and only about 20% of the rural population has access to adequate water supply.

Dengue fever, like malaria, has emerged as a major cause of morbidity in recent years. Reported cases of the disease have increased from only 4 in 1980 to 443 in 1982, representing 7.6% of all reported cases of communicable disease in that year.

## 2. Statement of the Problem

### 1. Malaria and Dengue Fever Control

The total area of Belize lies at risk of both malaria and dengue fever. Every segment of the estimated 159,000 population of the country is at risk from both of these diseases.

#### Malaria Control

Malaria control is the number one health priority of the Government of Belize (GOB) due to the widespread and increasing malaria problem.

Belize's struggle against malaria began in 1957 as a part of the world-wide Malaria Eradication Program (MEP) of the World Health Organization (WHO) and the Latin America and Caribbean regional efforts of the Pan American Health Organization (PAHO). Program activities were based primarily on the use of residual insecticides such as DDT and the provision of anti-malaria drugs such as chloroquine. By 1963, the program had satisfactorily limited active transmission and entered the Consolidation Phase of a MEP activity. Due to program difficulties, the entire country reverted to spray operations in 1965 with the exception of the Belize District. During the 1974-79 period most of the districts reduced their spraying operations. The total number of reported malaria cases in Belize in 1976 was 199. The number of cases dramatically increased from 1976. By 1982 a total of 3,868 cases were detected with 53.2% of the 359 localities in the country affected by the disease. The rise in cases was maintained in 1983 to 4,595 cases and the trend continued in 1984. The GOB is now facing increasing political as well as social and economic pressures to control this health problem.

The reasons for the rise in malaria lies in slow budget growth for malaria control combined with inflation, lower GOB revenues due to a depressed sugar market, increase in salary levels and the migration of refugees from other countries in Central America who carry malaria into Belize. Budget requirements for providing adequate support to an effective malaria and dengue fever control programs are presently beyond the capabilities of the GOB.

#### Dengue Fever Control

Although dengue fever has historically been a serious health problem in Belize, the Aedes aegypti control program of the country had freed the country of the disease by 1967. Reinfestation of the vector mosquito from the bordering country

of Mexico and nearby Honduras occurred in 1970. By 1976 Belize City and other urban areas were reporting Aedes aegypti breeding. In 1982 an epidemic of dengue fever swept the country and 443 cases of the disease were reported. The number of localities found positive for Aedes aegypti increased from 19 in 1978 to 68 in 1982 with all six districts of the country affected. The GOB took immediate action to reduce the disease but the disease still is causing widespread health problems.

The Aedes Aegypti Control Program (AACP) has reported 356 suspected cases of dengue fever up to July, 1984 which indicates a growing health problem. In an outbreak of dengue fever it is common to have many sub-clinical cases of the disease and underreporting may be as high as 90% of the actual number of cases. The disease seriously debilitates its victims and it is not unusual to have a recovery period of up to six weeks. The GOB recognizes that the disease is a serious threat to the economic welfare of the country and has reorganized its effort to be more effective. However, the program requires additional external assistance for the procurement of off-shore commodities such as insecticides, laboratory equipment, light motorcycles for the inspectors, ultra low volume equipment (U.L.V.) and vehicles.

## 2. Rural Water and Sanitation

The rural water and sanitation systems have not been adequately developed to insure a safe and reliable environment for the population. Gastrointestinal diseases commonly transmitted through contaminated water and poor sanitary conditions are a permanent threat to communities. This threat is of particular importance in rural and urban fringe areas.

The major urban centers of Belize City, Belmopan and Orange Walk have treated public water systems which include chlorination. In rural areas, however, only 40% of the population has house connections or easy access to a water supply. Most of the rural water supply is provided by shallow tubewells (20-150 feet deep) with handpumps. Some communities rely on raw river water especially those in the northwest districts and near rivers or lakes.

In urban areas only 6% of the population live in houses connected to community sewage systems. The capital city of Belmopan is fully connected to a treatment plant. A partially completed collection and treatment system exists in Belize City. A large percentage of all urban dwellers, however, still rely on septic tanks and latrines. In rural regions of the country 92% of the population rely on pit latrines. Lack of latrine coverage and poorly sited and managed pit latrines are related to the high prevalence of intestinal parasites in children and the continued incidence of gastro-intestinal diseases.

The existing budgetary and human resource constraints in the MOH cannot meet the demand for rural water systems and sanitation devices. The status of existing wells, handpumps and pit latrines is such that an indeterminate number of the rural communities are without coverage. The lack of community awareness of health and sanitation and limited participation in pump maintenance and repair are seen as critical factors in both sustaining existing systems and in insuring the effectiveness of new systems.

The Government of Belize recognizes the importance of an adequate and safe water supply and sanitation. The Environmental Health Service (EHS) has the responsibility for maintaining the quality of both urban and rural drinking water. At the present time, 550 handpumps and 22 rudimentary water systems have been installed. To date no routine surveillance and monitoring program has been implemented to insure a protected and safe water supply. The intensive investment in design, construction and operation of these systems should be protected and evaluated. The EHS does not have a water quality laboratory to support this most necessary and critical function.

The development of reliable and safe rural drinking water is a necessary but not sufficient condition for the full realization of the human and natural resources of Belize.

## B. Project Description

### 1. Project Goal and Purpose

The Goal of the Project is to improve the health and productivity of the Belizean population.

The Purpose is two-fold 1) To control the incidence of malaria and dengue fever by 1988 to a level where they are no longer public health problems, and 2) To extend coverage of water and sanitation in rural communities and to develop a water quality control program.

### 2. End of Project Status

Component 1. National Malaria Control Service (NMCS) and Aedes Aegypti Control Program (AACP)

The objectively verifiable indicators which will be used in

evaluating whether the project purpose has been achieved are as follows:

a) the present epidemic rise of malaria will be controlled by 1987;

b) malaria incidence will be reduced to an annual incidence level of eight (8) cases per 1,000 population;

c) P. Falciparum species of malaria will be controlled to a level where it represents no more than 5% of the total reported cases by 1988;

d) the total number of reported Aedes aegypti positive localities will be less than 10% of the total localities in the country by 1988.

The A.I.D. inputs into the Malaria Control and Aedes Aegypti Control Programs will assist the Government of Belize (GOB) to accomplish its stated goals of providing an adequate level of health and providing freedom from these two mosquito-borne diseases. The A.I.D. inputs consist of grant financing of training, technical assistance, operations research, commodities, limited construction and evaluation. A detailed presentation of each component is provided in the Logical Framework in Annex I.

#### Component 2. Water Supply/Sanitation (WS/S) and Rural Drinking Water Quality

The objectively verifiable indicators which will be used in evaluating whether the project purpose has been achieved are:

a) an adequate, safe water supply will cover 90% of the rural population in three districts in Belize through the installation of 500 handpumps and 26 rudimentary water systems;

b) the coverage of pit latrines and alternative sanitation technologies, will be 50% of the rural population in three districts, approximately 3000 pit privies;

c) 95% of handpumps working in the three districts including those previously installed;

d) an annual report of the drinking water quality of rural areas for FY 1986, FY 1987, and FY 1988;

e) the establishment of 50 functioning village health committees who have done assessment documentation, a sanitary survey and have assessed applied appropriate water and

sanitation technologies.

The A.I.D. inputs into the Water Supply and Sanitation Program will assist the Government of Belize (GOB) to accomplish its stated goals of providing an adequate coverage of safe water supplies and sanitation devices. The A.I.D. inputs consist of grant financing for training, technical assistance, operations research, commodities, limited construction and evaluation. A detailed presentation of each component is provided in the Logical Framework in Annex I.

### 3. Project Activities

#### Management Support Unit

The Management Support Unit will provide technical assistance and assist the Ministry of Health (MOH) in project implementation, including procurement, training, research and evaluation of both project components- Vector Control and Water and Sanitation. The Management Support Unit will be contracted by USAID but will work closely and coordinate their activities with the Permanent Secretary of the Ministry of Health who will be responsible for GOB project implementation.

The Unit consists of a full time Project Manager for four years, a full time Community Development/Health Educator/Training Specialist for three years and one full time Vehicle Maintenance Specialist for ten months. In addition, five months of short term technical HE/CD/Training assistance, and four months of short term technical assistance of a Vehicle Maintenance Specialist are needed.

The staff of the Management Support Unit will provide technical and administrative support to the vector control and water and sanitation, community development/health education/training, operations research, construction and evaluation activities of this project. The Unit will be based in Belize City.

The Project Manager will direct all activities of the Unit and will provide over-all administrative support and supervision for the long term Water and Sanitation Advisor and the CD/HE/Training Advisor. The technical assistance in vehicle maintenance, and short term technical specialists in health education/community development/training, vector control, operations research and evaluation will also be responsible to the Project Manager. The Manager will be responsible for the writing of detailed annual work plans developed in collaboration with the appropriate technical specialists. In coordination with the Permanent Secretary of

specialists. The advisor will be responsible for the overall procurement, management and day to day administration of the project. S/he will serve as liaison with USAID, the Government of Belize, PAHO, and other international institutions as appropriate. The Advisor will be based in the Belize City with a minimum of 20% in-country travel. The Project Manager will be housed in the AID office space or in the warehouse/office constructed with Project funds.

The development of the initial annual work plan, initial procurement, building construction, liaison activities, the collection of additional baseline data collection, and the early development of community development/health education/training activities require that the full time long term Project Manager, and the CD/HE Training Advisor to be assigned in the initial months of the project. The Vehicle Maintenance Advisor should be assigned in the first year of the project.

The Community Development/Health Education/Training Advisor is administratively responsible to the Project Manager. This Advisor will, in collaboration with the Manager, develop a detailed work plan for the community development/health education/training activities for the water and sanitation and vector control components of the project. S/he is responsible for the coordination, implementation and evaluation of the training activities of water and sanitation, vector control and related health team personnel. This Advisor is responsible for the interpretation and incorporation of the results of baseline studies, operations research and other appropriate technical and management information into training of personnel. S/he will be responsible for the development of health education materials in support of the water and sanitation and vector control components coordinating with the Health Education and Community Participation Division of the Ministry of Health. This officer will act as a liaison on technical CD/HE/Training matters with USAID, Government of Belize, PAHO and other international agencies. The Advisor will be based in Belmopan with 40% in-country travel.

The Vehicle Maintenance Advisor will begin the ten month assignment during the second half of the first year of the project. This Advisor will be responsible to the Manager and provide support to both water and sanitation and vector control program activities. The Advisor's responsibilities include the organization of vehicle maintenance and repair facilities, establishment of inventory systems and the training of counterpart personnel.

Support for the Unit includes two vehicles, office space,

equipment and support services for two long term advisors, one Vehicle Maintenance Advisor for 10 months, one administrative assistant/secretary and a number of short term advisors.

Budgetary support will be separate from the Vector Control and Water and Sanitation Components. The total cost for the Unit is \$1,892,000.

Because a long term Vector Control Advisor is not included in the Vector Control Component, the Manager will provide stronger technical support to this component.

In addition, A.I.D. resources either centrally funded, PD&S and/or project funds will be utilized to assist the new Government and the Management Support Unit in analysing the current status of financing constraints and resource allocation problems in the health sector, particularly those which impact on the recurrent costs associated with this project. The financing system and resource allocation issues pose fundamental constraints to efficient, effective delivery and expansion of health care services in Belize.

The new FY 85 LAC Regional Health Project in which USAID/Belize is expected to participate will assist Missions and LAC countries in the following areas:

- Procurement and distribution of essential drugs through public and private channels;
- Private sector model health delivery systems including risk sharing schemes (HMOs, social insurance, cooperatives);
- Revenue generating activities for public sector health delivery systems; and
- Hospital cost containment strategies.

#### Component I

##### Malaria Control and Aedes Aegypti (Dengue Fever) Field Operations

The major components in the National Malaria Control Service (NMCS) current field operation include (1) an operational organization which carries out residual insecticide applications, source reduction, larviciding and limited ULV applications against the vector mosquito and (2) surveillance and epidemiology activities which provide treatment, collect blood slides, and carry out a variety of epidemiological services including investigation and reporting of cases and entomological current activities. During the course of this project, NMCS will continue these activities to carry out their field operations.

The Aedes aegypti program carries out its field operations under the supervision of the Environmental Health Division of the Ministry of Health. The Aedes aegypti activities consist of an operational organization at each district which provides premise inspection for infestations of A. aegypti, treatment of discovered breeding sites, health education, periodic adulticide applications in the May to September period and source reduction. No clinical treatment of dengue cases is carried out by this organization.

There are certain basic assumptions that can be made in considering Life of Project (LOP) improvements in field operation. These are:

(1) The resources currently available to the malaria and the Aedes aegypti control programs will not allow countrywide coverage. Given this constraint, epidemiology will play an increasingly important role for application of technologically sound control methodologies.

(2) The country (and these vector-borne disease control programs) must accept the fact that a certain amount of malaria and dengue morbidity will continue to occur over LOP. However, mortality from malaria is to be considered unacceptable. Dengue fever, as a general rule, does not cause death in a patient, but can be a life-threatening disease in its DHF form especially for children.

There are a number of control methodologies available for use in selected areas. The primary control methodologies which are available to NMCS and the Aedes aegypti program are discussed below.

a. Intradomiciliary Spraying

NMCS plans to use the insecticide, DDT, in its residual spraying operations during the 1985-1989 period. The quantity of coverage for a given area will be based on malaria morbidity data, cost and epidemiological conditions. The spraying program anticipates a gradual reduction in house targets from approximately 17,000 houses to 10,000 houses over the LOP and provides sufficient insecticides to protect these structures in the 1985-1989 period.

In every case, health safeguards will be built into the storage, handling, transporting, application and disposal operations of the insecticides used. The project is planning to improve the storage capacity of the NMCS by providing limited funds for district storage units.

The operational spray program for the first year will concentrate on control of the rising epidemic. The 1985 plan has scheduled DDT for houses twice a year.

Two spraying cycles using DDT have now been targeted to begin in February, 1985. The insecticide will be applied at 2 gms. (actual insecticide) per square meter. Attention is being given over the LOP to other dosage rates through applied field research activities with the objective of testing the effectiveness of lower dosages of application. See Annex O.

The 1985 and 1986 work plans, by district and phase as well as in total, are as follows:

NUMBER OF HOUSES TO BE COVERED BY DDT APPLICATION

<u>District</u>	<u>Existing Localities</u>	<u>Localities to be sprayed</u>	<u>Existing Houses</u>	<u>Houses to be sprayed</u>
Corozal	47	47	4,602	4,602
Orange Walk	59	59	4,352	4,356
Belize	48	7	10,200	382
Stann Creek	40	25	3,015	1,306
Toledo	54	54	2,962	2,962
Cayo	114	99	4,169	3,936
<b>TOTAL</b>	<b>362</b>	<b>291</b>	<b>29,300</b>	<b>17,544</b>

Note: All applications are made at 2 mg/sq. meter.

Careful entomologic and epidemiological evaluations are planned to monitor the effect of spraying on malaria transmission. NMCS practices with regard to safety precautions for protection of spraymen and families in sprayed houses have been judged satisfactory and are to be maintained over LOP.

Project plans call for periodic entomological evaluations, with major attention given to vector susceptibility and insecticide effectiveness. Susceptibility tests will be carried out in any area where spray operations are being introduced and will be repeated as epidemiological evidence indicates need.

The Aedes aegypti program does not plan to carry out any residual insecticide applications in its program over LOP.

b. Mosquito Larval Control

The control of Aedes aegypti and Anopheles albimanus larval populations may be carried out at selected localities and urban areas. In selected limited areas of Belize district, mosquito breeding sites in selected urban areas will be periodically treated where appropriate.

The larvicide being used by the Aedes Aegypti Control Program

(AACP) is Abate used at 0.5 - 1.0 ppm in the treatment of domestic water containers. This dosage is a standard application rate used worldwide for this purpose.

Larviciding in the vector control programs are particularly useful in urban and peri-urban areas during periods of the year when there is scanty rainfall, and where permanent breeding is limited to specific and accessible sites. Larval control can be cost-effective in areas of population concentration, but this method has to be carefully evaluated in rural situations. There is some possibility that communities themselves may be able to carry on some larval control activities in their immediate areas.

New larvicides and larvicidal methods are now available or are in the process of development for mosquito control use. Larvicides which may be available include monolayer films, synthetic pyrethroids and Bacillus thuringiensis (BTI-14) or B. syhaericus. These new larvicides could be candidates for applied field research studies in Belize.

Baseline studies together with continuing entomological and epidemiological evaluation will be used to assess the effectiveness of all larvicides used in the program.

#### c. Adulticiding through ULV applications

NMCS has proposed the limited use of Ultra-Low-Volume (ULV) spray applications in its urban programs in conjunction with the AACP. The AACP proposes weekly ULV applications of malathion, 91% concentrate, in the May-September period in selected urban areas.

The principal use of ULV is in the rapid control of adult vector mosquitoes in relatively densely populated urban and peri-urban areas. This technique will be used sparingly in both programs and will be evaluated carefully for operational impact.

While the most cost-effective insecticides used in ULV applications are organophosphorus (O.P.) compounds such as malathion, their use may increase the risk of O.P. resistance in the mosquito vector. A careful evaluation of the resistance status of the vector mosquitoes will be carried out over LOP.

#### d. Source Reduction

Source reduction methodology such as filling and draining mosquito breeding sites has been carried out in mosquito control programs since the early 1900's. This method can be a

useful supplementary measure in Belize's mosquito control activities. By reducing mosquito breeding sites the risk of transmission can be lowered. Such methods can be best used in areas which are densely populated. However, they may also prove beneficial in other situations such as when canalization and proper environmental sanitation reduce mosquito breeding. On a small scale, this methodology is frequently suitable for community action programs using their own resources with only limited outside technical assistance. NMCS is already carrying out source reduction activities in a few areas of the country by supplying technical assistance to municipal organizations which do the work, e.g. Belize City. The Public Health Inspectors (PHI) of the Environmental Health Division of the Ministry of Health (MOH) also assist in source reduction efforts at the community level.

Neither the NMCS nor the AACP possess any heavy equipment for major land-fill and draining work, and provision for such equipment is not made in this project. However, it may be possible to contract specific jobs of source reduction with other GOB organizations -- e.g. the Ministry of Works. Such activity would be of assistance to the country's mosquito control efforts.

The prevention of man-made malaria will require NMCS to continuously identify and, by working with other GOB agencies, correct or prevent situations which provide new or expanded mosquito breeding sites. Agriculture and irrigation systems are a particular threat to increasing the malarial potential of a locality.

#### e. Biological Control

The use of larvivorous fish and other biological control methodologies is gaining renewed interest world-wide. To date, however, biological controls other than larvivorous fish have had little use in operating malaria control programs. NMCS has in the past used larvivorous fish, Gambusia sp., primarily as a supplementary rather than as an independent control mechanism. It is an area for additional operations research which is being planned by NMCS in connection with this project. The AACP does not plan to use any biological control mechanisms in its program over LOP.

#### f. Chemotherapy

As stated earlier, NMCS is responsible for field surveillance which includes case detection and treatment, investigation and evaluation of the disease and its control through use of anti-malaria drugs.

The primary NMCS chemotherapy distribution system is composed of NMCS personnel and NMCS-associated voluntary collaborators (VC). There are presently approximately 200 volunteers; they are reported as being available to treat cases and in some situations take blood slides. The Project is expected to increase the number of VCs to 360 over the LOP. The Project recognizes the importance of VCs in reducing the disease level in their communities and in providing clinical relief to the individual patient. It is necessary to assure that all districts of the country have VC services and that the VCs live within a reasonable distance of the residents they serve. Key factors in the maintenance of such a system include regular and effective supervision, timely re-supply of required materials and encouragement to the volunteer collaborator. It is proposed in this Project to include support of annual training workshops for the malaria VCs. It may be possible in some situations to expand the role of the VC to include limited surveillance of other diseases.

Mass drug administration (MDA) to reduce foci of high malaria transmission may prove useful; in fact, the MDA technique has been used by the NMCS in the past on a limited basis. Under MDA, individuals are given a single dose of chloroquine or chloroquine-primaquine. Such mass treatments may be repeated if warranted epidemiologically. Mass drug treatment is used only when it is epidemiologically justified, either to lower the mortality and morbidity of malaria in an epidemic focal outbreak or to prevent outbreaks resulting from environmental changes due to abnormal amounts of rainfall or unusual movements of people such as refugees. Continuous epidemiological assessment is necessary not only for the initiation of such a method, but to evaluate its impact after MDA has been provided.

Component II  
Water and Sanitation

Baseline Data

To obtain baseline information for the planning of Project activities, a pre-project survey of 335 handpumps/well-sites in rural communities in all six districts of Belize was conducted in the fall of 1984.

A small study of 335 pumps was conducted to generate baseline data before the initiation of project implementation. Preliminary results indicate that only 10.5% of these pumps were not working. Older MOH pump pads are inadequate causing approximately 50% of well sites to have possible seepage into wells, which may contaminate the water source. Water quality varies regionally.

Until late 1982 all well casings installed in the country were 4" cast iron pipe. The major cause of abandonment of wells was poor water quality almost exclusively due to users' reaction to high iron content in the well water. Of the wells surveyed 44% tasted strongly of iron. The presence of iron greatly affects water taste, often causing villagers to switch to rain water catchment or surface water sources. The users consistently requested replacement of the casing with PVC pipe.

Of the 335 pumps surveyed, five manufacturers were represented as follows:

Dempster	293
Baker	18
Ministry of Health	11
Myers	6
Consalles	2
Unknown	5

An assessment of part failures and repair history indicates the most common points of failure were:

- Fatigue fractures in cast pump handles;
- Wear and failure of connecting rods at the handle connection;
- Worn out piston and cylinder assemblies;
- Broken connecting rods in connections dow hole;
- Loose handle assembly bolts;
- Infrequent lubrication.

Preliminary Report of Results: Pre-Project Survey of Existing Handpumps

The data in the Summary Table presented summarizes the technical information on pumps, pump pads, and water quality necessary for the design of the engineering aspects of the Project. Socio-economic and community development information, and more complete technical/engineering data from the pre-project survey are available in the AID Belize Mission. Information from the survey and in-country studies will be used as a baseline for project implementation. This preliminary report indicates the working status of 335 handpumps inspected in this study. In a report prepared in 1982 for the Belize National Health Plan approximately 438 installed pumps were identified.

DISTRICT	TOTAL INSTALLED	TOTAL INSPECTED	NO. WORKING	NO. NOT WORKING	%	CASING			DRILLER	RESPONSIBILITY
						PVC	IRON	UNKNOWN		
BELIZE	159	37	29	8	21.6	4	32	1	WASA	WASA
CAYO	49	56	49	7	12.5	19	33	4	MOH, MOW, MNR, WASA	MOW, MNR
COROZAL	101	57	51	6	10.5	1	55	1	MOW, MOH	MOH
ORANGE WALK	58	58	57	1	1.7	9	49	-	MOW, MOH	MOH
STANN CREEK	40	51	49	2	3.9	5	39	7	MOW	MOW
TOLEDO	31	76	65	11	14.4	31	39	5	MOH	MOH
TOTAL	438	335	300	35	10.5	65	197	18		

Site conditions of the wells vary by district. In general, the older Ministry of Works' pump pads are totally inadequate in size. Approximately 50% of the well sites have puddled stagnant water or seepage on the pad site. Water quality varies regionally. In the northern district hardness is often a problem with the conditions more predominant in the western frontier. Water quality is generally good in Cayo and northern Stann Creek with some iron encountered in southern Stann Creek. Toledo is generally good, however, marine shales in the area often contribute sediment to ground water, especially in the western interior. The major complaint, however, is the iron from steel pipe casing. Many of the wells were abandoned for this reason and casing replacement with PVC pipe was a consistent request among users.

### Technical Aspects

During this project, 20 communities of approximately 500 inhabitants, and 250 smaller communities in rural areas of the three districts of Cayo, Stann Creek and Belize, will be provided with appropriate systems for potable water. Community systems comprised of tube wells, centrifugal pumps, diesel generators, and elevated storage, and standpipes will be provided to rural population centers of over 250 people.

Deepwell pumps will be sited in those rural population centers of less than 250 people. A sanitation component comprised of latrine construction will be integrated with the water supply project. Alternative water supply systems, gravity community systems, hand dug wells with shallow well pumps, will be utilized where applicable. The priority of communities within these districts will be decided by the District Health Teams based upon a needs assessment implemented by the communities and reviewed by the Water and Sanitation Advisor and the GOB counterpart. The results of the pre-project well and sanitation survey conducted in 1984, will be used to guide the District Health Teams and the MOH to prioritize these needs and to assist in the design of a socio-cultural assessment, in sanitation technologies, and in appropriate technology for water supply systems. Project funds will be used to develop a water quality laboratory for monitoring rural water supplies. Finally, institutional reinforcement through technical assistance, training and equipment will be provided for personnel at the district level to support the activities of the Project.

### Role of the Community

A successful water supply and sanitation project must be based upon a firm acceptance of the technology by the users. A successful intervention is one in which the community participates in the selection of the technology, the choice of construction material, the technique and methods for maintenance and repair, and the management of the use of technology by the community.

The time constraints of development projects usually preclude the necessary flexibility of implementation required for community participation. Opportunities do exist, however, to encourage a high level of community participation in the selection of alternative process and management schemes. The level and quality of community participation in a water supply and sanitation project is the single best indicator of long

term success in the system's maintenance and therefore ultimately improved health status.

This project will focus on the role of the community in implementation and will support that effort with significant human resources at critical times over the LOP.

The community members, through the Village Health Committee, will first assess the existing water supply and sanitation conditions of the village. An assessment instrument designed by the PHIs, health educators, public health nurses, and village health workers, will be used to determine the water supply and sanitary needs of the village and the availability of local materials for construction. The instrument design will be based upon information obtained from the pre-project survey and other surveys performed in Belize, and on the experience of the village health committee members. Included will be questions relating to the technical requirement of the proposed system, the nature of local materials, and revolving fund alternatives.

The technological options will be developed by the MOH personnel, technical advisors for the A.I.D. project, and technical advisors assigned to other water supply and sanitation projects in Belize. This assessment of technology documentation will include standard design plans, specifications for capacity, a list of standard materials, a list of alternative materials, and costing of alternatives by bid with various levels of community contribution, operation and maintenance requirements.

The Village Health Committee will consult with the PHI and the Water and Sanitation Advisor on the feasible technical options for their community, using their assessment as a data source.

The community will then prepare a proposal for review by the District Health Team. This proposal will include the type of technology they view as most appropriate with a list of supplies and equipment needed, staff for management of the system, a list of materials and labor contributed, and a plan for establishing maintenance and repair functions within the village health committee. The District Health Committee will then review and prioritize the communities' proposals in terms of technical content, health implications, and health education requirements. The District PHI will have final approval authority on the projects, advised by the A.I.D. technical specialists.

After the proposal has been approved, the District Health

Committee will then request supplies, equipment, training material, tools and scheduling of drillers and pump maintenance crews from the Senior Public Health Inspector for Water Supply and Sanitation. The Senior Public Health Inspector and the WS/S Advisor will then review the request and issue disbursement of equipment, tools, supplies, and materials to the community. Prior to delivery of the requested material the community must assure the District Health Team that all community contributions are available and that a maintenance plan has been established. The District Health Team will monitor progress on all projects in their district.

The disbursement of these commodities will not occur until community members present a statement of commitment including their contribution of labor, materials and equipment. The form and intent of the commitment from the villages will be assessed by the District Health Team. The District Health Team will be notified by the PHI of the ongoing progress of their villages in terms of resource input. The local political representative to the national government will be notified as sites are being considered for approval and will be consulted prior to implementation in each community.

The implementation of this project relies heavily on existing organization at the village and district level. For example, the Village Health Committee, which is the critical link in the implementing of projects, is a sub-unit of the Village Council. The Village Council relates directly to the District Health Team of which the District PHI is one of three professionals. (The District PHI is also a member of the executive committee of that health team.) At the present time para-professional members of the District Health Team are representatives from the larger communities. The representation on the District Health Team needs to be expanded to include members of Village Councils. This expansion of membership will insure a balance of urban and rural representation on the District Health Team. Other members of the District Health Team include the Public Health Nurse, District Medical Officer, and hospital staff, all of whom will help in coordinating the water and sanitation project activities with other health activities.

#### 4. PROJECT INPUTS

##### Management Support Unit

##### Technical Assistance

Technical assistance provided in the Management Support Unit will consist of a long term Project Manager for four years

and a long term Community Participation/Health Education/Training (CD/HE/T) Specialist for three years. A short term advisor in vehicle maintenance for 10 months during the first two years of the project is also included. An additional five months of technical assistance for health education and training and four months for additional assistance in vehicle maintenance and repair is also scheduled.

The Project Management Support Unit inputs will provide administrative and technical support to the Vector Control and Water and Sanitation Components for program implementation of technical assistance, training, operations research and construction.

A Health Education/Community Development/Training long-term Advisor assigned to the Management Support Unit will provide technical assistance to the Water and Sanitation Component with his/her time shared with the Vector Control Component.

A short term (10 month) Vehicle Maintenance Advisor (VMA) is required to strengthen both Components of the Project which depend heavily on adequate vehicle maintenance and repair. Technical assistance responsibilities will include developing a preventive maintenance program, a parts inventory, a list of tools, a training program for the MOH mechanic, and a driver's education program. The VM advisor will conduct training for existing mechanic and motor pool personnel. The specific training needs of the motor pool personnel will be determined by the short-term advisor based upon an assessment of the aptitudes of the MOH mechanics and on the level and availability of mechanical skills in the private sector in Belize City. This Advisor will be expected to arrive in Belize in the second half of the first year, after the arrival of the vehicles.

#### Commodities

Two vehicles are included to support the Unit. The vehicles are to be used for transportation of the Project Manager, the CD/HE/T specialist and short term advisors as necessary. A small amount of funding for office supplies and basic equipment is also included.

### Component I Malaria and Aedes Aegypti Control

#### Technical Assistance

The technical assistance provided to this project will consist of a wide variety of short term malaria and vector borne disease specialists for operational research,

epidemiology, training, ULV operations and management. The total amount proposed for technical assistance under this project component is \$345,000 of which \$84,000 is for FY 85; \$106,000 for FY 86; \$77,000 for FY 87 and \$78,000 for FY 88. Over the life of the project it is expected that 24 person months (PM) will be required which includes approximately 4.5 PM of entomology assistance; 4.5 PM of ULV training; 7.5 PM of operational research assistance; 2.5 PM of management improvement assistance; 2.5 PM of training consultations and over 2.5 PM in the development of epidemiological skills.

Approximately \$56,000 over the LOP is programmed for periodic evaluations which have been planned during FY 86, FY 87, and FY 89.

### Operations Research

The project proposes to support a number of operational research efforts. Several research projects on biological control are planned in the field of Aedes aegypti control as well as malaria. In addition, the project will support field trials of alternative methodologies in malaria control. It is essential that alternative methods be introduced and studied in Belize in order to insure that the most cost-effective and efficient techniques are being used. At present, Belize does not report a chloroquine resistant strain of malaria and on-going studies must take place to insure correct up-to-date information. It is presently proposed to coordinate some operational research activities with the University of the West Indies.

Approximately \$126,000 is programmed in grant funding over the life of the project for research support of which \$111,000 is for malaria control and \$15,000 is for Aedes aegypti control

### Training

The project will provide up to twelve six-week training grants over the life of the project for six NMCS and six AACP operational personnel to attend a course in Comprehensive Vector Control either at the University of South Carolina or at a PAHO training site. In addition, support will be provided for participant training for one MSc/MPH/Ph.D. participant grant for a science officer in the malaria program.

The Directors of NMCS and the AACP will participate in observation/study tours to Mosquito Abatement Districts in Louisiana, California or Florida to observe modern mosquito control methodology and management.

To increase knowledge of field operations at supervisor and evaluator levels, twelve regional observation/study programs will be offered to six AACP and six NMCS operational personnel.

As entomological skills are in short supply in both programs, two grants for a six months training course (e.g. Mexico) are provided.

A GOB vehicle mechanic will be supported for a six weeks training experience in basic vehicle repair provided that a suitable training site can be identified in the region.

The training costs are to be grant funded at a total of \$254,000 over the life of the project (LOP) of which \$202,000 is foreign exchange costs and \$52,000 is for local cost for basic and refresher training of voluntary malaria workers in the villages, and for spraymen and evaluators.

Training inputs will be focused on development of practical skills in vector control at all levels. Emphasis will be on institutional development of both technical and management systems in order that the programs can be implemented in a scientifically sound manner. (See Table of Organization, Annex K.)

### Construction

In this project a total of \$125,000 is planned for construction of a small vehicle repair facility at the NCMS Headquarters in Belize City; for three (3) small storage and office units in Corozal, Cayo and Dangriga and an office facility for the central Aedes aegypti activity in Belize City. The storage units will provide outlying storage of insecticides and spraying equipment in a secure, well constructed facility. The three (3) storage units are required to insure secure insecticides. The garage facility will be used for program operations under both Project components.

### Commodities

The commodities requirements of both the malaria control and the Aedes aegypti control programs are substantial over the 1985-88 period, but these requirements are necessary in order to (1) halt the growing epidemics of malaria and dengue fever; (2) permit the GOB to institutionalize its newly formed Aedes Aegypti Control Program within the Environmental Health Service of the Ministry of Health; (3) support field operations in order to provide an effective vector control service; and (4) allow for expansion of its village volunteer service. There is a serious lack of foreign exchange for procurement of external

source commodities. Without these commodities, the malaria and dengue fever situation will continue to deteriorate. The project provides foreign exchange to import technically appropriate insecticides, vehicles, anti-malaria drugs, motorcycles, workshop tools, one boat, operation and laboratory equipment, sprayers and spare parts, camping equipment, and health education materials.

The total grant amount for commodities for this project component is estimated at \$658,000 of which \$350,000 is programmed for the NMCS and \$308,000 is planned for AACP support. A complete summary by year of the proposed commodities is presented in Table 4 of the Financial Plan of this Project Paper.

### Component II Water Supply and Sanitation

The resource inputs specified for this component will strengthen the administrative and technical capability of the Environmental Health Service (EHS) of the Ministry of Health (MOH). The water and sanitation component will provide a long term Water and Sanitation Advisor, short term technical assistance for maintenance, training, operations research, in addition to commodities and limited construction for the EHS rural water supply and sanitation program.

### Technical Assistance

The Water Supply and Sanitation Component will require a long-term Water and Sanitation Advisor for the duration of the project. This long-term advisor will have sanitary engineering technical background with extensive experience in implementing rural water supply and sanitation projects which have had significant community participation elements. He/she will be an advisor to the Senior Public Health Inspector for Rural Water Supply and Sanitation in the Environmental Health Service of the Ministry of Health. The long-term Advisor and Belizean counterpart, the Senior Public Health Inspector for Water Supply and Sanitation, will be responsible for project implementation. The Senior PHI will be responsible for site selection, the scheduling of equipment, the personnel and supply needs for mobilizing the community for self help. The WS/S Advisor will be responsible for training, management, operations research, technical assistance, procurement and evaluation. The Advisor will schedule and supervise the technical assistance under this project component. The Advisor will coordinate with other government agencies as appropriate and with other donor sponsored (UNICEF, CARE) water and sanitation projects.

The WS/S Advisor will be officed in a new structure to be constructed by the project. This structure will also house the equipment and supplies storage and the water quality monitoring laboratory. This structure will be located in Belize City, adjacent to the counterpart PHI's office and the office of the Principal PHI.

The Advisor will be expected to spend approximately 50% of his or her time in in-country travel. The Advisor will assist in the transportation of identified materials to the district project sites. One Project vehicle will be shared by the AS/S Advisor and his/her counterpart.

A short term Water Quality Monitoring Laboratory Technology Advisor will be required to assist in establishing the rural water supply laboratory facility and in training the PHIs to perform standard analysis. This Advisor will be required initially in the first year, after the building has been constructed and the laboratory equipment and supplies have arrived. The initial assignment will require approximately 6 weeks and will include the training of the PHI in basic techniques. A second assignment will be required in FY 86 to develop a long term monitoring and surveillance procedure and to develop quality control for laboratory procedures. The second visit will require approximately 6 weeks of technical assistance.

Three Appropriate Technology (A.T.) short term technical assistance assignments will support the water supply and sanitation effort. An A.T. Advisor will be needed to determine socio-cultural factors related to the acceptance or rejection of various technologies and factors affecting community participation within the differing cultural groups. A second A.T. Advisor will be needed to assist in testing ferro-cement technology in the construction of rain catchment vats and small reservoirs. This Advisor will need to develop and test appropriate techniques for improving the quality of rain catchment water by use of first flush by-passes, covers and screens, filtration systems and differing water management alternatives. Finally, a short term technical advisor will be needed to assist in the organization and training of the existing pump maintenance crews. The role of these crews will be changed as the Project is implemented. Presently, they spend most of their time repairing Dempster pumps. Their proposed new role will include training of village pump caretakers, repair of Mark II pumps and repair and maintenance of community system components (electric pumps, generators, elevated storage, distribution systems, etc.).

A drill rig instructor will be needed to assist in on the job

training of the MOH well rig operators. The instructor will be needed for 4 weeks in FY 85 and 4 weeks in FY 86.

### Training

The Senior PHI for Rural Water Supply and Sanitation will be sent out of the country for short term training. The training will focus on aspects of water quality, well drilling, pump maintenance, material science, and small community water system design. In addition to short term training courses, the Senior PHI will visit appropriate model rural water supply and sanitation projects close to Belize. This training will take place in the first three months of the project and will be completed prior to the arrival of the long-term WS/S Advisor. Selection of training courses, personnel to be interviewed, and sites to be visited will be specified by S & T/Health's WASH Project. The central and district level GOB professionals (Senior PHI and District PHI) will also require in-service training in project management. An initial one month training course will be developed focused on aspects of construction management applicable to water supply and sanitation projects in developing countries. This training will occur after the long term WS/S Advisor has arrived in Belize. Training funds will be necessary to support costs associated with travel, per diem, and training materials.

A training course of one week's duration will be developed for district level PHIs and PHI Assistants. The course will focus on selection criteria for water supply and sanitation technology to be considered in Belize. Course content will include more specifics on design criteria, standard materials of construction, alternative construction materials, use factors, and social cultural considerations. District PHIs from Toledo, Orange Walk, and Corozal, and other interested PVO specialists in water and sanitation will be encouraged to participate in the development and implementation of the workshop. This course will be held within the second 6 months of the project and will be of one week duration. Information from this workshop will be used to develop training and educational materials to be used in community participation activities.

The community participation requirement on this project is essential to the success of the project and for the capability of the institutions to continue after the termination of the project. The community participation element of the project will be strengthened by a workshop implemented in approximately 200 villages over the course of the project. The objectives of the workshops will be to train community members to assist in the following aspects of the project:

- 1) implementation of an environmental sanitation survey and needs assessment for water supply and sanitation;
- 2) development of user aspects of various technology for water supply and sanitation;
- 3) identification of opportunities for community participation in the construction, maintenance, repair, and management of various alternatives, and in presenting health education considerations associated with the project.

Training funds will be used to purchase training materials, assist in in-country travel and per diem, and in the development of demonstration training aids. The Community Development/Health Education/Training Advisor will be responsible for workshop design, coordination and implementation. The CD/HE/T long term Advisor will work closely with the Project WS/S Advisor and Senior PHI in developing these workshops. The selection of villages and scheduling of workshops will be coordinated with the District Health Teams and the Ministry of Health. These workshops will be staged over the first two years of the project based upon a strategy established by the District Health Teams, the MOH and USAID.

#### Operations Research

The operations research element of the Water Supply and Sanitation Component of the Project will focus on two major areas. The first study will be directed at the reliability cost and use of ferro-cement roof top catchment reservoirs as alternatives to galvanized metal vats. Within this study various techniques for improving the quality of roof top catchment water by use of appropriate covering methods, filters, screens, and conservation techniques will be evaluated. Also studied will be the villages' existing management of roof top catchment water and the effect of the proposed education program in optimizing the water collection during the rainy season so that drinking water will be available during the dry season. The results of this study will be used in the further development of health instruction media and audio-visual materials.

The second study will focus on appropriate technology to be considered in the sanitation element of the Project. Alternative means of construction and cartage collection disposal systems will be field tested at selected sites. Social-cultural factors associated with the acceptance of these systems will be a major component of this field study. Included in the sanitation activity will be studies on various

types of riser construction and modesty shelters. Several alternate types of sanitation devices will be tested as to their acceptance and applicability in various regions of Belize. This study will include the following types of technologies: agua-privy, ventilated improved latrine, composting system and double vault latrines.

### Commodities

Significant grant funds will be designated for commodities for the construction of 250 tubewells with new handpumps, to replace or repair existing handpumps, to construct 20 rudimentary water systems, and to construct 3000 latrines. This level of investment is necessary to meet the goal of 90% rural water coverage by the end of the Water Decade in 1990. The Project investment in sanitation will markedly improve the environmental conditions of rural villages and integrated with the safe drinking water supplies, will improve health conditions of rural areas of the three selected districts of Belize. The Government of Belize has selected a standard deep well community handpump, the Mark II, to be used in all future MOH rural water projects. (see Project Issues Section III G).

Approximately \$20,000 in grant funds will be spent for commodities in local currency. The majority of this local currency will be spent for building materials for pump pads, latrine slabs, storage reservoirs, centrifugal pumps, generators, and PVC pipe. The Project provides foreign exchange to import drilling rigs, vehicles, laboratory equipment, analytical supplies and training material.

The total commodities requirement for both elements of this component is \$1,488,000. A yearly distribution of the commodities requirement is found in Table four of the Financial Plan.

### Construction

A secure combined storage and office building will be required. It will serve as an interim storage facility for Project commodities and for maintenance of an inventory of parts for vehicles and equipment. This building which will also house the office of the WS/S Advisor. The storage area required will be 800 square feet, the office space needed is estimated 200 square feet. Attached to this structure will be the water quality testing laboratory which will require approximately 550 square feet. This space will be used as the microbiological and chemical testing laboratory. The laboratory will house incubators, analytical instruments, chemical storage, work space, and record keeping files. This

structure will be located at the Matron Roberts Health Center which currently serves as the central office for the Environmental Health Service. Space for construction is available at the rear of the health center. Space is also available at the health center for the interim storage of vehicles and pipe prior to their assignment to the District PHIs. A small portion of the construction money will be used to fence and secure this vehicle and pipe storage area.

##### 5. Project Output Indicators

###### Malaria and Aedes Aegypti Control Component

Effective implementation of this Project will provide Belize and the NMCS/AACP with the basic information, field experience, operational skills and tools as well as management capabilities to carry out an effective vector control operation. The Project outputs can be summarized by the various input components.

The training component provides for up to 12 short term grants for NMCP/AACP personnel to attend a six-week vector control course over LOP. These key personnel represent the core technical and management group of the two services. To provide additional competency in vector control and surveillance, an additional 12 regional observation courses will be provided to both services with special attention to dengue surveillance. To increase and strengthen entomological capabilities two six-month entomological training experiences in Mexico, Panama or elsewhere in the region have been scheduled in the Project. Four U.S. observation experiences with Mosquito Abatement Districts in Florida or Louisiana are provided over the LOP for the Directors of the two services to provide an up-date on the present state of the art in modern mosquito control methodology. A vehicle mechanic will be given a six-week basic refresher course within the region. \$52,000 has been set aside for local training of 200-360 volunteer collaborators and evaluators. The Project is also providing one long term training grant for graduate training to improve epidemiological capabilities and to provide additional health service strengths which can be used in the future integration of services.

Project commodities provide support to both services to meet Project EOP objectives. These commodity inputs increase operational efficiency, strengthen the present transport system, improve management and supervision as well as support operational research. The NMCS plans to apply residual spray to approximately 17,000 houses during the first two years. As program activities impact on the disease and stratification

process is fully initiated, the number of houses scheduled for residual spray application is to be reduced to approximately 12,000 in FY 1987 and 10,000 houses in 1988. The standard of spray coverage is to equal 30% or better coverage of targeted houses for each of the two cycles of residual spraying carried out each year.

The NMCS and AACP programs will prepare a yearly detailed Plan of Action covering proposed activities of the two services which will describe planned targets, costs, personnel required, commodities needed to carry out the activities and plans for increase community participation in the program. For example, the Project's health education activity includes (1) appropriate information and materials distributed to each of the six districts by the end of 1986; (2) educational presentations will be made at least four times a year in each district; and (3) twelve or more annual media placements for informing and educating the public will be completed. It is planned to increase voluntary collaborators from the present 200 to 360 over LOP in order that each locality will be served.

Operationally, the surveillance mechanism will aim at a 10% Annual Blood Examination Rate (ABER) and for the provision of radical treatment of detected cases within 14 days. At the present time according to records reviewed at field locations, radical treatment may be delayed as much as one month after blood sampling which is unsatisfactory. Slide examination timelags are to be improved over LOP so that slides can be examined within 10 days of collection. This improvement will be made by strengthening the logistical systems that transport the slides from field areas to the laboratory and by improving the laboratories through training and increased supervision.

The Project outputs will include at least two operations research projects which aim at testing the feasibility of replacing total coverage house spraying with alternative control methodology. In addition, two research projects will be carried out to test various methods of vector control under Belizean conditions. At least one field trial on the use of larvivorous fish will be initiated to study biological control techniques over LOP. Testing for chloroquine resistance will be carried out in each of the last three years of the Project. Mosquito susceptibility tests will be carried out against An. albomanus and Aedes aegypti each year in at least four districts. In addition, susceptibility tests against other anopheles will be carried out to insure up-to-date knowledge of these mosquitos.

The program has scheduled three program evaluations to insure the Project's development and to determine if planned

activities are on schedule. These evaluations will be held in 1986, 1987 and 1988. It is expected that PAHO will join the GOB and AID in these evaluations.

The Project has been planned to create viable AACP and NMCP services which can take on their assigned GOB responsibilities. Alternative program methodologies have been reviewed such as total drug treatment, use of only residual spray application but the designed program of a mix of known control interventions is considered the most effective technically and from a cost point of view.

### Water Supply and Sanitation Component

Effective implementation of this Project will provide rural Belize and the EHS with technical knowledge, operational skills, and management capabilities to carry out a rural Water Supply and Sanitation Project. The Project outputs can be summarized by the various input components.

The training component provides for two EHS personnel to attend short courses in well drilling, water treatment systems, and pump installation. It will also support EHS personnel to visit similar rural Water Supply and Sanitation Projects in the region, specifically projects using the Mark II pump. The total length of time for each training effort will be 2 months. In-country training will include an in-service training course in Project management designed for the district PHIs and their assistants. The rural water quality monitoring laboratory technician will be trained in Belize by a short term Advisor. This training will occur after the laboratory has been constructed and all equipment and supplies have arrived.

To provide information for decisions on choices of technical alternatives, appropriate technology technical assistance is included. This component will be supported early in the Project by an appropriate technology short term Advisor who will determine the technical and socio-cultural considerations for water and sanitation alternatives in Belize. The results of this operations research will be presented in a workshop directed at the district PHIs, representatives of the District Health Teams and members of Village Councils.

Long term maintenance for hand pumps and rudimentary water systems will improve when supported by a training/technical assistance repair maintenance Advisor during a six week technical assistance assignment. This effort will be directed initially at the EHS pump maintenance crew and later to the village maintenance person. Maintenance improvement will also

be an integral part of the long term water and sanitation Advisor's technical assistance input.

Project commodities provide support to the EHS's well drilling, construction, management, maintenance, and village participation activities. These commodity inputs increase operational efficiency, strengthen the present transport system, improve management and supervision. The Project proposes to install 500 Mark II hand pumps with 30,000 beneficiaries and contract 26 rudimentary water systems with 10,000 beneficiaries. Complementing the water supply component will be the construction of 3,000 latrines which will serve 10,000 people.

Active community participation in the local determination of alternative water and sanitation technologies, levels of operational maintenance contribution, and management plans will be increased by a strong technical assistance component and educational materials support. More than forty community participation workshops as well as T.A. support to overall village organizational activities will be undertaken over the life of the Project.

The program has scheduled three program evaluations to insure Project's development and to determine if planned activities are on schedule. These evaluations will be held in 1986, 1987, and 1988.

The EHS will prepare a yearly detailed Plan of Action covering proposed activities which will describe planned targets, costs, personnel required, commodities needed to carry out activities and plans for active community participation in the program.

#### D. Financial Plan

A.I.D. proposes to finance 62% of the health Project, as indicated in Table 1, for a total of US \$6,786,000. Of this, \$1,886,000 is for the Vector Control component, \$3,008,000 is for the Water Supply and Sanitation component and \$1,892,000 is for management support for the two components. Details on this proposed financing are shown in Tables 2-6 which follow. The figures have been adjusted to include a 5% annual inflation factor and a 10% total contingency factor.

Another donor, PAHO, will provide \$ 52,000 in malaria control services, as a part of the Project, in the form of technical assistance, training and some commodities. It will also provide \$122,000 in technical assistance and training for

water supply and sanitation. Moreover, UNICEF and CARE plan to provide water supply and sanitation services in the three districts of Belize not covered by the Project.

The Government of Belize will provide 36% of the resources for the Project, according to cost estimates provided by the MOH officials most directly involved. (See Part III.B. for further discussion of these cost estimates.) This contribution is to be partly in the form of community labor and material and partly in the form of Government of Belize (GOB) financing of local-currency and some foreign exchange costs.

Local communities will provide labor and materials valued at about \$225,000 to build slabs for water pumps, construct slabs and risers and pits for latrines, and lay pipes for community water systems (see Table 1). They plan also to provide by FY 1988, 360 volunteer collaborators to dispense prophylactic drugs and to strengthen community involvement in the malaria program in rural communities. This represents a near doubling of the 200 collaborators now serving. On the basis of the currently estimated one-day-equivalent per collaborator per week (50 days each per year) and an average labor cost if hired of \$6 to \$7 per day (US\$ equivalent), the local contribution to the malaria program would be \$60,000 the first year with a total for the life of Project of about \$360,000 (see Table 1)

The Government of Belize (GOB) will finance an estimated \$3.3 million (U.S. \$ equivalent) of the Project costs, if the plans of the MOH officials directly involved are realized. For the Vector Control effort \$125,000 in foreign exchange is to be spent for DDT during the four-year period. In addition, MOH officials have projected GOB expenditures totaling US\$2,280,000 for local salaries, per diem and travel, operations and maintenance, and material and supplies for the malaria and dengue fever programs (see Tables 1 and 7). For the water supply and sanitation program the GOB projects \$1,050,000 in local costs to cover local salaries, in-country travel, per diem and materials and supplies. These figures for both components include a 5% annual allowance for inflation.

Tables 2 through 6 provide details on the proposed uses of the AID grant funds. Table 2 summarizes the uses by major Project component, while Table 3 shows virtually the same detail grouped by inputs. Table 4 details the costs of commodities and equipment for each Project component, while Tables 5 and 6 do the same for technical assistance and training respectively. As already noted, Table 7 shows GOB recurrent cost estimates, which are discussed in Part III.B.

TABLE 1  
Summary of Proposed Project Resources  
 (U.S. \$ 000)

	Fiscal Year (FY) *				1985-88
	1985	1986	1987	1988	
I. National Malaria Control Service (NMCS) and Aedes Aegypti Control Program (AACP)					
1. AID Grant**	560	412	477	437	1886
2. Government of Belize	444	547	611	678	2280
3. Community Contribution	60	70	105	125	360
4. P.A.H.O.	8	14	15	15	52
5. Component Resources: Total	<u>1072</u>	<u>1043</u>	<u>1208</u>	<u>1255</u>	<u>4578</u>
II. Water Supply and Sanitation (WS/S)					
1. AID Grant	1059	663	661	625	3008
2. Government of Belize	221	245	275	309	1050
3. Community Contribution	85	75	45	20	225
4. PAHO	24	32	32	34	122
5. Component Resources: Total	<u>1389</u>	<u>1015</u>	<u>1013</u>	<u>988</u>	<u>4405</u>
III. Project Management Support	<u>512</u>	<u>499</u>	<u>487</u>	<u>394</u>	<u>1892</u>
IV. Project Resources					
1. AID Grant: Total	2131	1574	1625	1456	6786
2. Government of Belize	665	792	886	987	3330
3. Community Contribution	145	145	150	145	585
4. P.A.H.O.	32	46	47	49	174
5. Total Project Resources	<u>2973</u>	<u>2557</u>	<u>2708</u>	<u>2637</u>	<u>10875</u>

\* U.S. fiscal year 1985 covers the period 10/1/84 through 9/30/85; Belize FY 1985-86, figures for which are shown in some Project tables under FY 1985, covers 4/1/85 through 3/31/86, and PAHO data, shown here under fiscal years, are actually for calendar years.

\*\* The AID figures are adjusted for inflation and contingencies. A compound inflationary factor of 5% per annum for U.S. resources is assumed except for FY 1985 where it is set at 2.5%. Thus, the factor would be 7.6% for FY 1986, 13.0% for FY1987, and 18.7% for FY 1988. The weighted average for FY 1985-88 would be an estimated 9.2%. The contingency factor of 10%, based on total costs adjusted for inflation, applies to AID only. GOB figures also include an inflationary factor. PAHO resources are relatively flexible and can be shifted between categories (including other health subsectors). Specific inflationary or contingency factors are not provided for.

TABLE 2  
SUMMARY A.I.D. FINANCIAL PLAN  
(U.S. \$ 000)

		Fiscal Year (FY)				
		1985	1986	1987	1988	1985-88
I.	<u>NMCS/AACP</u>					
	1. Technical assistance	84	106	77	78	345
	2. Operational research	12	45	40	29	126
	3. Training	36	64	88	66	254
	4. Construction	125	-	-	-	125
	5. Commodities/equipment	240	119	151	148	658
	6. Evaluation	-	14	28	14	56
	7. Subtotal	<u>497</u>	<u>348</u>	<u>384</u>	<u>335</u>	<u>1564</u>
	ADJUSTED FOR:					
	Inflation (estimated at 5% p.a.)	509	374	434	398	1715
	Contingencies (10% total)	<u>560</u>	<u>412</u>	<u>477</u>	<u>437</u>	<u>1886</u>
II.	<u>WS/S</u>					
	1. Technical assistance	259	211	190	172	832
	2. Operational research	5	7	4	7	23
	3. Training	41	13	9	7	70
	4. Construction	40	-	-	-	40
	5. Commodities/equipment	588	328	315	257	1488
	6. Evaluation	6	22	14	36	78
	7. Subtotal	<u>939</u>	<u>581</u>	<u>532</u>	<u>479</u>	<u>2531</u>
	ADJUSTED FOR:					
	Inflation (estimated at 5% p.a.)	962	603	601	569	2735
	Contingencies (10% total)	<u>1059</u>	<u>663</u>	<u>661</u>	<u>625</u>	<u>3008</u>
III.	<u>Project Management Support</u>					
	1. Technical assistance	400	400	370	280	1450
	2. Support costs	54	22	22	22	120
	3. Subtotal	<u>454</u>	<u>422</u>	<u>392</u>	<u>302</u>	<u>1570</u>
	Adjusted for inflation (5% p.a.)	465	454	443	358	1720
	Adjusted for contingencies (10%)	<u>512</u>	<u>499</u>	<u>487</u>	<u>394</u>	<u>1892</u>
IV.	<u>Total Project: AID Grant</u>					
	Costs estimated at 1984 prices	1890	1351	1308	1116	5665
	Adjusted for inflation (5% p.a.)	1936	1431	1478	1325	6170
	Adjusted for contingencies (10%)	<u>2131</u>	<u>1574</u>	<u>1625</u>	<u>1456</u>	<u>6786</u>
	Additional allowance for contingencies*					<u>214</u>
	TOTAL AID GRANT					<u>7000</u>

\* This additional allowance was decided upon after completion of the tables, in view of the fact that a 10% contingency allowance for a project of this magnitude & complexity is considered minimal (e.g. see AID Handbook 3, Project Assistance). This additional allowance is shown only in Summary Table

TABLE 3

Use of A.I.D. Funds  
(U.S. \$ 000)

	FY 1985		FY 1986		FY 1987		FY 1988		FY 1985-88	
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC
1. <u>Technical Assistance</u>	743	-	717	-	637	-	530	-	2627	-
I. <u>NMCS/AACP</u>	84	-	106	-	77	-	78	-	345	-
A. NMCS	49	-	60	-	49	-	46	-	204	-
B. AACP	35	-	46	-	28	-	32	-	141	-
II. <u>WS/S</u>	259	-	211	-	190	-	172	-	832	-
III. <u>Management Support</u>	400	-	400	-	370	-	280	-	1450	-
2. <u>Operational Research</u>	7	10	28	24	21	23	21	15	77	72
I. <u>NMCS/AACP</u>	5	7	25	20	20	20	18	11	68	58
A. NMCS	5	7	22	18	17	18	16	8	60	51
B. AACP	-	-	3	2	3	2	2	3	8	7
II. <u>WS/S</u>	2	3	3	4	1	3	3	4	9	14
A. Supply & San.	1	2	2	2	1	2	1	2	5	8
B. Quality Control	1	1	1	2	-	1	2	2	4	6
3. <u>Training</u>	46	31	53	24	75	22	53	20	227	97
I. <u>NMCS/AACP</u>										
A. NMCS	10	10	33	10	45	12	39	12	127	44
B. AACP	15	1	20	1	30	1	14	1	79	4
II. <u>WS/S</u>	21	20		13		9		7	21	49
4. <u>Construction</u>		165								165
I. <u>NMCS/AACP</u>	-	125	-	-	-	-	-	-	-	125
II. <u>WS/S</u>	-	40	-	-	-	-	-	-	-	40

(page 2 of Table 3 - Use of A.I.D. Funds (U.S. \$000))

	FY 1985		FY 1986		FY 1987		FY 1988		FY 1985-88	
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC
5. <u>Commodities/Equipment</u>	855	27	446	23	465	23	404	23	2170	96
I. <u>NMCS/AACP</u>	240	-	119	-	151	-	148	-	658	-
A. NMCS	91	-	57	-	96	-	106	-	350	-
B. AACP	149	-	62	-	55	-	42	-	308	-
II. <u>WS/S</u>	580	8	324	4	311	4	253	4	1468	20
III. <u>Management Support</u>	35	19	3	19	3	19	3	19	44	76
6. <u>Evaluation</u>	6	-	30	6	42	-	38	12	116	18
I. <u>NMCS/AACP</u>	-	-	14	-	28	-	14	-	56	-
II. <u>WS/S</u>	6	-	16	6	14	-	24	12	60	18
A. <u>Supply &amp; Sanitation</u>	6	-	16	-	14	-	24	-	60	-
B. <u>Quality Control</u>	-	-	-	6	-	-	-	12	-	18
7. <u>All uses subtotal</u>	1657	233	1274	77	1240	68	1046	70	5217	448
<u>ADJUSTED FOR:</u>										
<u>Inflation (5% p.a.)</u>	1936		1431		1478		1325		6170	
<u>Contingencies (10% total)</u>	2131		1574		1625		1456		6786	

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**Table 4**  
**AID-Financed Commodities and Equipment\***  
**(U.S. \$000)**

	FY 1985		FY 1986		FY 1987		FY 1988		Total	
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC
<b>I. NMCS/AACP</b>	240	-	119	-	151	-	148	-	658	-
<b>A. NMCS</b>	91	-	57	-	96	-	106	-	350	-
1) Drugs	15	-	15	-	15	-	15	-	60	-
2) Vehicles (3 trucks)	18	-	14	-	42	-	42	-	116	-
3) Motorcycles(28)	15	-	6	-	6	-	16	-	43	-
4) Boat	6	-	-	-	2	-	2	-	10	-
5) Vehicle parts	8	-	8	-	10	-	10	-	36	-
6) Sprayers and parts	6	-	4	-	2	-	4	-	16	-
7) Laboratory supplies	4	-	4	-	4	-	4	-	16	-
8) Tools & Equip.	5	-	-	-	5	-	5	-	15	-
9) Educ. supplies/Misc.	14	-	6	-	10	-	8	-	38	-
<b>B. AACP</b>	149	-	62	-	55	-	42	-	308	-
1) Malathion.	30	-	30	-	30	-	30	-	120	-
2) Vehicles and parts	60	-	20	-	-	-	-	-	80	-
3) ULV Sprayers & parts	20	-	-	-	10	-	-	-	30	-
4) Operating equipment	20	-	10	-	10	-	10	-	50	-
5) Motorcycles(7) & bicycles (4)	14	-	-	-	3	-	-	-	17	-
6) Other	5	-	2	-	2	-	2	-	11	-
<b>II. WS/S</b>	580	8	324	4	311	4	253	4	1468	20
1) Vehicles(7)& parts	133	-	7	-	9	-	11	-	160	-
2) Motorcycles (3)	5	-	-	-	-	-	-	-	5	-
3) Rigs(2), accs, parts	171	-	10	-	-	-	-	-	181	-
4) Hand pumps & parts	30	-	46	-	44	-	44	-	164	-
5) Pump maintenance/ repair parts	20	-	5	-	5	-	5	-	35	-
6) Centrifugal pumps and generators	10	-	40	-	30	-	10	-	90	-
7) Lab-testing equip.	18	-	2	-	-	-	-	-	20	-
8) Tools	-	8	-	4	-	4	-	4	-	20
9) Casings	69	-	74	-	74	-	59	-	276	-
10) Cement, sand, rebar, etc.	94	-	125	-	135	-	110	-	464	-
11) Chemicals	22	-	11	-	10	-	10	-	53	-
12) Education materials	8	-	4	-	4	-	4	-	20	-

(Table 4 )

	<u>FY 1985</u>		<u>FY 1986</u>		<u>FY 1987</u>		<u>FY 1988</u>		<u>Total</u>	
	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>
<b>III. <u>Project Management</u></b>										
<u>Support</u>	35	19	3	19	3	19	3	19	44	76
1) Vehicles (2) & Parts	25	-	-	-	-	-	-	-	25	-
2) Operations & maintenance	2	5	2	5	2	5	2	5	8	20
3) Office supplies & equipment	8	2	1	2	1	2	1	2	11	8
4) Per diem, rental and miscellaneous**	-	12	-	12	-	12	-	12	-	48
<b><u>TOTAL PROJECT</u></b>	<b>855</b>	<b>27</b>	<b>446</b>	<b>23</b>	<b>465</b>	<b>23</b>	<b>404</b>	<b>23</b>	<b>2170</b>	<b>96</b>

\* Figures shown here are unadjusted. The inflation and contingency adjustments are made only in the summary tables (1,2, and 3).

\*\* This row, while mostly per diem (10,000) and not commodities, is included here for convenience only.

TABLE 5  
TECHNICAL ASSISTANCE\*  
 (U.S. \$000)

	FY 85	FY 86	FY 87	FY 88	FY85-88
I. <u>NMCS/AACP</u>	<u>84</u>	<u>106</u>	<u>77</u>	<u>78</u>	<u>345</u>
A. <u>NMCS</u>	<u>49</u>	<u>60</u>	<u>49</u>	<u>46</u>	<u>204</u>
Entomology	14	7	7	7	35
Epidemiology	14	4	--	4	22
Training	21	7	7	--	35
Management	--	14	7	7	28
Research	--	28	28	28	84
B. <u>AACP</u>	<u>35</u>	<u>46</u>	<u>28</u>	<u>32</u>	<u>141</u>
Entomology	14	7	7	7	35
ULV	14	21	14	14	63
Epidemiology	7	4	--	4	15
Management	--	7	--	--	7
Research	--	7	7	7	21
II. <u>WS/S</u>	<u>259</u>	<u>211</u>	<u>190</u>	<u>172</u>	<u>832</u>
1) <u>WS/S Advisor</u>	<u>160</u>	<u>160</u>	<u>160</u>	<u>160</u>	<u>640</u>
2) <u>Short-term</u>					
<u>Consultants</u>	<u>99</u>	<u>51</u>	<u>30</u>	<u>12</u>	<u>192</u>
-Rural Sociologist/ Community Development	42	12	12	12	78
-Drilling Rig Instructor	12	6	6	--	24
-Appropriate Technology	24	12	12	--	48
-Water quality lab	21	21	--	--	42
III. <u>Project Management</u>					
<u>Support</u>	<u>400</u>	<u>400</u>	<u>370</u>	<u>280</u>	<u>1,450</u>
A. Project Manager	180	180	180	180	720
B. CD/HE/T Advisor	160	160	160	70	550
C. Vehicle Maintenance Specialist	60	60	30	30	180
TOTAL					
<u>Technical Assistance</u>	<u>743</u>	<u>717</u>	<u>637</u>	<u>530</u>	<u>2,627</u>
A. Long-term	500	500	500	340	1,840
B. Short-term	243	217	137	190	787

\* Consultant costs estimated at \$14,000/mo; long-term technical assistance costs at \$160,000 to \$180,000 per year. Figures shown here are unadjusted. The inflation and contingency adjustments are made only in the summary tables (1,2, and 3).

TABLE 6  
 TRAINING\*  
 (U.S. \$000)

	FY 85		FY 86		FY 87		FY 88		FY 85-88	
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC
I. <u>NMCS/AACP</u>	25	11	53	11	75	13	53	13	206	48
A. <u>NMCS</u>	10	10	33	10	45	12	39	12	127	44
Long-term					25		25		50	
Short-term	10	10	33	10	20	12	14	12	77	44
B. <u>AACP</u>										
Short-term	15	1	20	1	30	1	14	1	79	4
II. <u>WS/S</u>	21	20		13		9		7	21	49
Short-term										
Project Management	6								6	
Drilling	15								15	
Well/Pump										
Maintenance		10		5	3		3			21
Community										
Development		10		8	6		4			28

\* Figures here are unadjusted. The inflation and contingency adjustments are made only in the summary tables (1, 2, and 3).

TABLE 7  
 GOB Recurrent Costs  
 (U.S. \$000)

	FY 1985		FY 1986		FY 1987		FY 1988		FY 1985-88	
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC
1. <u>GOB Salaries</u>		213		261		295		332		1101
a. NMCS		144		181		210		241		776
b. AACP		29		35		36		37		137
c. WS/S		40		45		49		54		188
2. <u>Per diem and Travel</u>		167		186		205		224		782
a. NMCS		128		142		156		170		596
b. AACP		6		8		9		10		33
c. WS/S		33		36		40		44		153
3. <u>Vehicle Operation and Maintenance</u>		118		160		176		193		647
a. NMCS		40		54		56		58		208
b. AACP		9		30		35		40		114
c. WS/S		69		76		85		95		325
4. <u>Pump/Rig Operation and Maintenance</u> (WS/S only)		75		83		95		109		362
5. <u>Material &amp; Supplies</u>	28*	53	30*	60	32*	68	35*	77	125*	258
a. NMCS	28*	41	30*	46	32*	52	35*	58	125*	197
b. AACP		8		9		10		12	--	39
c. WS/S		4		5		6		7		22
6. <u>Other</u>		11		12		15		17		55
a. NMCS		8		9		11		13		41
b. AACP		3		3		4		4		14
c. WS/S		-		-		-		-		-
<u>TOTAL RECURRENT COSTS</u>	28*	637	30*	762	32*	854	35*	952	125*	3205
a. NMCS	28*	361	30*	432	32*	485	35*	540	125*	1818
b. AACP		55		85		94		103		337
c. WS/S		221		245		275		309		1050

\* For Purchase of DDT

## E. USAID Assistance Strategy

### 1. Relationship to GOB Development Plans

The Government of Belize (GOB) has recently established a Ministry of Economic Development, centralizing previously dispersed development planning activities. The creation of this Ministry will bring needed coherence to the nation's overall planning capability. The Ministry is presently working on the first National Development Plan.

The present economic strategy of the GOB places heavy emphasis on agricultural development and diversification to meet goals of import replacement and export promotion. Large quantities of foodstuffs continue to be imported (about US \$40 million in 1983). Replacement of these imports by domestic production is planned. Export crops of sugar and citrus provide a narrow cash crop base. Active efforts are being made to diversify into cacao, bananas, livestock products, and farmed shrimp.

To meet their economic goals, the GOB recognizes the need to raise the standard of living, including the level of health care and access to safe water and adequate sanitation in rural areas. It is planned that this will slow rural-urban migration and increase the labor output of the agricultural sector. To reach these objectives the government has been actively promoting a primary health care system in the Toledo District (as a model for expansion nationally), improving the quality of rural and agricultural education, and improving rural roads, communication systems and other aspects of rural infrastructure.

This Project supports the GOB's development plans through increasing the health and effectiveness of the work force engaged in agriculture and industry by controlling malaria and dengue fever and providing adequate water and sanitation. This should make rural areas more attractive places to live, work and invest, thereby encouraging the populace to remain in rural areas. In addition, the Project directly augments GOB efforts to involve communities in self-help activities, to increase the effectiveness of national medical institutions, and to improve standards of health education in the populace at large.

### 2. Relationship to the Country Development Strategy Statement

In its 1984 Country Development Strategy Statement (CDSS), USAID/Belize identified three major barriers to economic growth; fiscal instability, a narrow productive base and a lack

of infrastructure. A major component of the strategy for addressing these problems are projects directed at increasing agricultural production for import replacement and export promotion. Agricultural production efforts are hindered by two major public health problems identified in the CDSS; malaria and environmental sanitation.

As in many other Caribbean and Central American countries, the incidence of malaria has increased dramatically in recent years, hampering rural development and taxing the local government's public health budget. Diarrheal diseases are a major cause of morbidity and infant mortality in rural areas, due primarily to inadequate water and sanitation. The achievement of the agricultural development, economic improvement and other goals of the USAID assistance program in rural areas hinges on improvement of these pressing public health problems.

A major component of the CDSS involves export promotion, small business development, OPIC insurance guarantees and Export-Import Bank credits. The perception of Belize as an unhealthy area, characterized by inadequate sanitation and epidemic malaria and dengue fever, is a definite handicap in attracting foreign investors and enterprises. Urban outbreaks of malaria are an unattractive prospect for those contemplating small business development for export. Tourism in particular has unrealized potential which will remain underdeveloped if health status is not improved.

Belize is included in the U.S. Caribbean Basin Initiative (CBI) and the Central American Initiative. This Project is directly responsive to the recommendations on health of the Bipartisan Commission on Central America.

### 3. Relationship to Current Mission Programs

Until the USAID/Belize office opened in 1983, A.I.D. financed health activities in Belize had been supported through A.I.D.'s Regional Development Office/Caribbean (RDO/C) in Barbados. Ongoing (RDO/C) activities include Belize's participation in their Caribbean Epidemiology Center Project which provides support for epidemiological surveillance and training.

Most of AID's current programming in Belize will support increased agricultural production and improved basic infrastructure in rural areas. USAID/Belize is completing the first year of funding for a rural roads and bridges Project which will rehabilitate about 180 miles of road and install approximately 15 new bridges in the rural areas of the three

districts of Cayo, Orange Walk and Belize. Many of the involved communities in this Project will have road access dramatically improved before or during the Project period. This will stimulate the process of community participation in the vector control and water and sanitation activities.

USAID/Belize is also providing 2 million dollars in guaranteed loan funds through the local credit unions as part of a Housing Investment Guarantee Fund. These loans are often used for improvements in home water catchments and sewage systems in rural areas. The strengthening of credit unions and associations under this program will complement the community-involvement and self-help elements of the present Project.

The Livestock Improvement Project, also funded by USAID/Belize, is currently working to increase swine production, pasture improvement, meat processing and meat inspection. Project activities in Cayo and Belize Districts will benefit from improved health status of farmers stemming from the new health Project. The installation of latrines and improved water supply will complement the swine improvement Project directly, as swine are presently a major vector for human parasites and cause of water contamination. Health education efforts under the present Project will help convince farmers to pen their hogs.

USAID/Belize also has a \$40,000 PASA agreement with the National Institutes of Health for biomedical equipment maintenance and training, bolstering Belize's general capabilities in sanitation, environmental health monitoring and diagnosis. These capabilities will also be generally augmented through the provision of testing equipment, laboratory reagents and training under the livestock Project for a meat inspection lab.

AID, through the Regional Development Office for the Caribbean (RDO/C), is providing support for the Caribbean Agricultural Extension Project activities in Belize (CAEP). This Project is training extensionists to be more community-oriented and rurally based, and will have an important effect in stimulating community involvement. The major agricultural programs currently under development by the AID/Belize Mission will also benefit directly both from improved health of farmers and through the community development required by this new Project. The major agricultural programs currently under development by the Mission will also benefit directly both from improved health of farmers and through the community development activities of the present Project.

USAID/Belize has given an OPG of \$618,000 to the Pan American Development Foundation for a cacao development Project. The two communities involved in this program are both target areas for water and sanitation improvements. They will benefit directly from the present Project, improving opportunities for increased cacao production.

The Belize Junior School of Agriculture (with AID/Belize OPG support of \$50,000 through Peace Corps) is an outstanding example of community participation and self-help in Belize. It will serve as a focal point for further development of the community participation aspects essential to the new Project.

Belize is receiving the benefit of two centrally financed matching grants with PVOs. The Project Hope matching grant provides for technical assistance and training in laboratory services and nursing education. The second Project, with Project Concern International, provides for the improvement of primary health care services, including the training of community workers, in the Toledo District.

Finally, in FY 84 A.I.D. has provided CARE/Belize with an Operational Program Grant (OPG) for \$500,000 for a three year water and sanitation/nutrition education Project in the Corozal and Orange Walk Districts. This Project will complement both the A.I.D. and the UNICEF rural water and sanitation Projects.

#### 4. Relationship to other Donor Activity

The Pan American Health Organization (PAHO) has provided technical and financial support to the national malaria program for over a decade. In 1983 PAHO provided approximately \$200,000 in commodity support for vector control activities. This support included DDT, anti-malaria drugs, three microscopes, 30 sprayers, nine vehicles, laboratory supplies and two boats with motors. This assistance supported the first comprehensive spray operation in three years which began the process of establishing an effective vector control program in Belize. This PAHO contribution was a "special case" allocation of resources made at the end of PAHO's fiscal year. PAHO does not anticipate other such allocations during the LOP.

During the life of the Project PAHO is expected to provide limited technical assistance especially for program evaluation as well as continued commodity support. PAHO's total contribution during the life of the Project will be approximately \$174,000 divided over the four years of the Project. For the years 1984-85, PAHO's total planned contribution to Belize's health sector is \$624,000.

Malaria program support is also provided by Health Talent International, a private voluntary organization based in Alabama. This organization's program in Belize provides for the training of volunteer malaria village collaborators and supplies them with health education materials.

Belize's largest donor in water and sanitation Projects is the Canadian International Development Agency (CIDA) which is providing assistance to install a water and sewage system in Belize City. Phase I of their Project totalled Canadian \$13.3 million; Phase II will provide Canadian \$34 million. CIDA has also made a small contribution to rural water systems development in the Cayo District.

UNICEF has finalized plans for a three year Water Supply and Sanitation Project in the Toledo District. UNICEF's contribution is US\$453,000 to benefit 6,500 people. Thirteen villages will be provided with 39 wells with hand pumps and 7 villages will receive rudimentary community water supply systems. The Project will be an integral component of the Toledo District's primary health care (PHC) program now being implemented with the assistance of Project Concern International through an A.I.D. matching grant. This PHC program works with the district health team to train community health workers and support community health committees.

### PART III. PROJECT ANALYSES

#### A. Institutional Analysis

Malaria and Aedes aegypti control in Belize are the responsibility of the Ministry of Health, Labour and Sports (MOH), while water and sanitation are the shared responsibility of the MOH and the Water and Sewerage Authority (WASA) which is part of the Ministry of Energy and Communications. The Ministry of Works once had a major role in water, but is presently inactive, and the Agricultural Department of the Ministry of Natural Resources still drills agricultural wells in rural areas, some of which are also used as sources of potable water for human consumption.

The Government of Belize (GOB) is the major provider of health care, disease prevention, sanitation and potable water in the country. Services are provided through a network of one general hospital in Belize City, 6 District hospitals, 18 Rural Health Centers, and 9 urban health centers. There are also five mobile clinics and a network of village primary health care workers in Toledo District. Policy is set at the Ministry level in Belmopan. Technical services are headquartered in Belize City. Operations are decentralized to the districts, each of which has a Medical Officer-in-Charge. See the Organization Chart in Annex K.

Component I National Malaria Control Service (NMCS) and Aedes Aegypti Control Program (AACP)

##### 1. Institutional Background and Organization

Both the NMCS and AACP activities are included under the responsibility of the Ministry of Health, Labor and Sports in Belize. The Tables of Organization are included in Annex K. The major difference in the organizational position between these two activities is that the NMCS is a semi-autonomous service while the AACP is a functional activity of the Environmental Health Service. Both the NMCS and AACP have existed in one form or the other over the past two decades and as a result have an institutional base, experienced field personnel and a management system. The Headquarters for each Service is Belize City. The Services have field offices which cover all six districts of the country. Malaria control is primarily a rural health activity while the AACP concentrates its efforts in urban and peri-urban areas. The Malaria Control Program has a total of sixty-two employees. The AACP has a director and 10 staff. In the past AACP has been combined with the Malaria Control Program and within the last two years has been transferred back to the Environmental Health Service. The

transfer was made to give more emphasis to the AACP and to strengthen its role through more involvement with the Public Health Inspectors (PHIs). The placement of the AACP in the Environmental Health Service also allows for better supervision of the AACP inspectors at the district level by the PHIs.

The Malaria Control Program staff of sixty-two (including spray personnel and supernumerary employees) is headed by an experienced medical director. The support staff include a qualified Administrative Officer, Chief of Operations, three supervisors (one for each two districts), five administrative personnel, three laboratory personnel (one recently has resigned) and three spray Brigades (7-8 person teams). There are two mechanics supported by the NMCS budget, but they are shared with other areas of the Ministry. It is essential that at least one mechanic be assigned full time to repair and maintenance of NMCS and AACP vehicles and equipment.

The stated organizational arrangements have been prescribed by the GOB and there are no plans to combine the organizational placement of the two services in the immediate future. There is no reason to believe that the field activities cannot be satisfactorily carried out under this administrative pattern. The question of merging the two vector control services raised at the PID review was carefully studied by the PP team with concerned GOB officials including the Permanent Secretary of Health and the two Directors of NMCS and AACP. The GOB decision to retain the present organizational position is now reflected in their National Health Plan (1984-1988) as it is seen that the two services basically require two different management systems. The malaria control program needs to remain a vertical operation in order to impact on the epidemic while AACP needs to concentrate on community action leading to better environmental health to overcome their dengue disease problem.

## 2. Administrative Analysis

The analysis of the two services indicates a number of similar patterns and difficulties with regret to personnel, coordination, organization, budget, reporting and staffing patterns. The most pressing administrative problems revolve around adequate budgets to support their assigned activity responsibilities. For example, while the NMCS budget has been increased gradually from \$BZ 378,000 in 1981-1982 to a projected \$BZ 578,000 in 1984-85, these levels primarily cover salaries, leaving very little for operational support. Funding levels are confirmed on a year-to-year basis creating uncertainty in program support over the LOP. For example the administrative decision to buy DDT insecticide has not been

made for FY 1986. The present stock of DDT will carry the NMCS through June of 1986, so it is expected that firm budget allotments can be made for timely purchase of the required insecticide. The funding of an additional spray team to cover the projected 17,000 houses is also of concern as the GOB/MOH has stated that there is a personnel freeze. The decision on these additional personnel will have to be made quickly so planning can take place for their recruitment and training for the 1985 spray cycles.

Except for the spray personnel, the staffing patterns of NMCS is satisfactory and there are few vacancies. An important vacancy exists in the NMCS laboratory as one microscopist has recently resigned. At present, there is a backlog of almost 1,000 unread slides which delays treatment and program response to focal outbreaks. This position needs to be filled quickly. It may be possible to use Peace Corps Volunteers to strengthen laboratory services. This possibility is under investigation. (See annex R.)

A common personnel requirement of the two services is the need for training and up-grading employee skills. The AACP personnel are especially in need of entomological and public relations training. The project is providing an adequate level of formal level training as well as in-service training through the provision of technical assistance. It is expected that by the end of the project all personnel in both services will be up-graded in technical skills and that management capabilities will be improved in all of the senior and mid-level officers.

Adequate supervision is a common need in both services. The work activities included in the NMCP and AACP must be done correctly, on time and with suitable materials. The NMCP and AACP must also incorporate considerable public relations-skills and to structure adequate evaluations. A part of the supervision problem is the lack of adequate transport to oversee the field activities. The project will provide vehicles to support and increase project supervision as well as improve the logistic systems. In addition, project funding includes a support element to provide spare parts, training of a mechanic, provision of technical assistance for vehicle repair and construction of a small vehicle repair facility. All these project inputs will help to improve not only supervision but project management. Supervision is also hampered to some extent by discipline practices within the services. Personnel may not be responsive to supervisory comments and it is difficult for the supervisor to take disciplinary actions on some occasions due to outside interference or influence, existing personnel systems and the

need to retain the employee for the demanding work at hand. To overcome this difficulty, authority must be properly delegated to field supervisors and this authority backed up by responsible GOB officers.

### 3. Administrative Feasibility

The activities under this Project represent a continuation of the type of control efforts which have been carried out in the past with a variance in success levels. If the two vector services are given the means to carry out their responsibilities, the planned program is feasible. In the past, the program has not had supplies and incidence of the two diseases has risen. Indicative of the GOB commitment to carry out this renewed effort is its procurement of adequate insecticides for the NMCS to cover operational needs through June 1986. The present economic crisis which has resulted from low sugar prices (the major reported export crop) and increased import costs has materially hindered the development of health services by reducing government revenues.

The Project does address those areas of program need in the present AACP and NMCS activities which lead to long-term, nationally supported, cost effective vector-borne disease control programs.

The question of future integration of the NMCS and AACP with the national health services is important to consider. In the case of AACP, a start has already been made by bringing the program under the Environmental Health Service of the MOH. However, the NMCS has for some time been a vertical service separated from the direct line administrative flow of the MOH. Due to this organizational arrangement, health services personnel often consider malaria as not being their direct responsibility but belonging to the NMCS. At one health center visited during the PP preparation, the nurse explained that some medical personnel would not collect blood smears from malaria in-patients, but called on the malaria supervisor at the health center to do this task. It must be recognized by all levels of the MOH that such attitudes and practices need to be changed. Malaria control should be considered the day-to-day function of all the health structure. The Project will address this need through local training, in-service educational development and joint NMCS/MOH activities over the LOP. However, at present, there are only limited primary health care facilities in Belize and the separation of such field services is considered administratively correct at this time.

The AACP and NMCS have immediate needs in improving and implementing village development and health education activities. The Project addresses these needs by providing a long term Community Development/Health Education/Training Advisor and short-term T.A. over the LOP.

The major personnel weaknesses in the AACP effort is the variance of supervisory capacity. There should be additional mid-management assistance to the AACP Director similar to that provided in the NMCS by the national Chief of Operations and the Operation Supervisors who cover specific districts.

The NMCS Headquarters building is considered adequate but the office areas of the AACP is inadequate. The Project provides for construction of a modest office facility for the AACP in the area of the Environmental Health Service.

In summary, a decision on the administrative feasibility of the Project must consider a number of important factors including budget, personnel, supervision, community participation and management. The Project has identified program needs and has provided support elements in the Project to modify and overcome most of these needs. Periodic evaluations and technical assistance planned for this project will include management aspects as it will be in this area that difficulties are foreseen. In summary, the Project is considered administratively feasible based on this PP review.

## Component II Water Supply and Sanitation

### 1. Institutional Background and Organizations

Rural water supply and sanitation responsibilities are carried out by the Environmental Health Service, (EHS) based in Belize City, a unit of the Public Health Bureau of the Ministry of Health. The Public Health Bureau is administered by the Chief Medical Officer of Health. The EHS is administered by the Principal Public Health Inspector. Most of the administrative support services for the Inspectorate are housed at the Matron Roberts Health Center in Belize City.

At the central level, the Principal Public Health Inspector, assisted by two Senior Public Health Inspectors, administers and supervises the six district EHS programs. (See Annex K.) The present district administration assigns administrative responsibility to two District Public Health Inspectors (PHIs). The district organizational chart/staffing pattern, in actuality, contains one District PHI and one Environmental Health Assistant (EHA). In effect, the EHA

carries the more advanced district PHI responsibilities without the full training, organizational support or salary compensation. Project training activities, technical assistance and a proposed study of salary structure address this issue.

There are a total of 14 PHIs in the 6 districts of Belize, with almost half of those 14 based in Belize City. There are established positions for 13 Environmental Health Assistants, eleven of which are filled. The rural water supply and sanitation function of the EHS is supported by budgeted positions for 2 well-rig operators, 4 well drillers assistants, and a pump maintenance crew with 4 positions. The EHS is responsible for food sanitation, pollution control, rural water supply and sanitation, water quality control, the AACP and occupational health at the national and district levels.

The Environmental Health Service is integrated with other health functions at the district level. The District Health Center has staff comprised of District Medical Officer, District Health Nurse, District Health Inspector, and support staff. They coordinate district health programs through a District Health Team which is made up of all professional District Health staff and officials from other sectors. At the district level, the Environmental Health Service is operationally responsible for monitoring and inspection of food-handling, sanitary surveys, solid waste management, tube well and pump installation, and education of the community on health education matters.

## 2. Administrative Analysis

The Environmental Health Service (EHS) has demonstrated the capability to manage rural water supply and sanitation programs with their existing administrative alignment. The EHS unit operates more or less independently of the other units within the MOH at the Senior PHI level.

An analysis of the EHS indicates several serious deficiencies in the administration of the rural water supply and sanitation program. Deficiencies in budgeting, staffing, and organizational structure seriously affect the productivity and effectiveness of the WS/S program. In the area of budgeting, the salary support for PHIs has gradually increased while line items for operating expenses have not increased proportionately to the increased programming. Long range budgeting is not done by the MOH; difficulties, therefore, arise in assessing fiscal needs of multi-year programs. Increased salary support for well drillers and pump maintenance activities have remained as high priorities for the EHS but their budget is inadequate to meet these demands.

The proposed realignment of the EHS to include 3 Senior PHIs with one Senior PHI having sole responsibility for the administration of rural water supply and sanitation programs will strengthen the organization. The parallel realignment at the district level to have two PHIs in each District, with one PHI designated as solely responsible for water and sanitation, will facilitate project implementation. This proposed alignment is viewed as necessary for adequate management of the district water and sanitation activities. All the positions discussed have been defined in the new MOH/EHS FY 1985 budget. Personnel have already been selected from existing staff for these posts.

With increased staff the senior PHI for Water Supply and Sanitation will be able to afford increased supervision and coordination of the three WS/S projects (CARE, UNICEF, and USAID). Since each of these projects will have a full time technical advisor, the EHS will receive assistance with technical as well as managerial issues. All GOB personnel involved in this project will need to have their management and technical skills in community development and water supply systems upgraded. Through the use of short term advisors, short term training and in-service education, the management and technical skills of EHAs, PHIs, and senior PHIs will be raised to a level sufficient to successfully execute the project.

The Environmental Health Service has ongoing problems with high staff turnover. There have been 31 assignment changes between 1961-1981 from the ranks of the PHIs. Significant GOB and donor resources have been invested in these personnel who have received out of country training in certificate and degree programs. They then move to other governmental jobs which have lower educational requirements but higher salaries. The loss of this investment in education and experience has significantly affected the effectiveness and morale of this unit. The continual drain of staff to higher paying jobs in other divisions of the government would be significantly diminished with the implementation of a adequate career ladder and with salary scale commensurate with educational requirements and levels of responsibility.

Adequate operational costs, vehicles, pump parts, tools and per diem are also serious deficiencies in the EHS. The lack of appropriate and dependable vehicles greatly reduces the effectiveness of the existing water supply and sanitation program. In most cases more time is spent waiting for, or repairing, vehicles than in using vehicles for program implementation. This problem particularly affects the efficiency of the well drilling and pump maintenance crews.

The reduced budget for the purchase of hand pumps has caused the EHS to develop and manufacture their own pump; its cost is considerably less than the Dempster pump. This local pump is totally inadequate for use as a community deepwell pump. The survey data show that most of these pumps are non-functional within months of installation. This poor performance record in meeting rural water supplies needs is detrimental to establishing the communities' confidence in water programs.

### 3. Administrative Feasibility

The Project will support the existing program in rural water supply and sanitation in Belize which has had relative success over the last 20 years. If the administrative structure is realigned, as proposed, and the 1985 GOB budget funds the PHI positions at the district level, supports training and technical support and vehicles, the EHS program can be adequately implemented. Reduced operational budgets in the past have seriously reduced the quality and quantity of rural water supply and sanitation in Belize.

The project is designed to strengthen the EHS by realignment of the organization and support in the training of personnel. The installation of a reliable handpump will significantly decrease maintenance costs after the end of the project period.

If administrative functions faltered at the Senior PHI level, the Project will be affected in the following areas: coordination of commodities procurement and delivery, scheduling of well drillers, and coordination of health education and community participation.

The water quality monitoring element of this project will be a new function for the EHS. This new area of responsibility will require management decisions in implementing surveillance programs and record keeping. The added cost to sustain this function after the project period will be approximately US \$3,000/year. Organizational realignment to adequately administer this laboratory is needed.

The present building for the Senior PHI for Water Supply and Sanitation is inadequate. This PHI and the long term advisor will be housed in a new structure constructed with project funds at the back of the Matron Roberts Health Center in Belize City. Space for the laboratory functions will be made available adjacent to the Health Center.

Designation is needed to make the MOH the sole ministry responsible for supplying rural water supply and sanitation to rural areas. Such an organizational change would greatly enhance the MOH capability to implement projects. If this realignment of responsibility is not carried out, inefficiencies and inequalities will remain. Among the responsibilities of the National Action Committee on Water Supply and Sanitation will be to initiate and support this important consolidation effort.

The strong community participation element of the Project should enhance the MOH's ability to implement project activities which are accepted by the users and to develop a sustainable approach to rural water supply and sanitation which will remain after the Project terminates. The integration of health education will improve the impact on community development.

## B. Financial Analysis

### 1. Financial Analysis

A.I.D.'s share of the financing of the proposed malaria/dengue fever/water supply and sanitation project is currently about 62% (see Table 1 in Part II.C.), although it may well turn out to be higher in view of the GOB budget stringencies discussed below.

Of A.I.D.'s proposed grant, \$1.9 million (28%) is for malaria and dengue-fever control programs, \$3.0 million (45%) for the water-supply and sanitation component, and \$1.9 million (28%) for management support for the two project components (see Table 2). The total for all three components is \$6.8 million. An additional allowance for contingency brings the total to \$7 million.

AID funds are heavily allocated in the first year of the project, particularly in the water supply and sanitation component. This is essential to fund commodities and vehicles to begin rapid implementation.

Technical assistance accounts for nearly 39% of A.I.D. financing (see Table 3), while commodities and equipment account for over 33% of the A.I.D. grant. Training is the next largest category (5% of the total). Most of the technical assistance (55%) is for the management support component (see Table 5).

Commodities/equipment account for 59% of A.I.D. expenditures in the water supply component, compared with 42% for malaria/dengue fever control. This reflects partly the GOB financing of DDT but even more the expense of drilling rigs, casings, and other equipment and supplies for the water and sanitation component (see Table 4).

## 2. Recurrent Costs

As already noted, MOH officials directly involved in the project provided the project team with the data on GOB recurrent costs shown in Table 7 (Part II C, Financial Plan). The figures indicate a U.S. \$ equivalent of \$3,205,000 in recurrent costs for the lifetime of the project plus \$125,000 in foreign exchange expenditures for DDT.

For FY 1985-86 (4/1/85 - 3/31/86), the total is BZ\$ 1,330,000, or US\$ 665,000 equivalent. Of this, BZ \$888,000 (444,000 US\$ equivalent) is projected for vector control, and BZ \$221,000 is for water supply and sanitation. These figures, when compared with the MOH FY 1985-86 budget request of BZ \$1,035,000 for the same components, indicate a shortfall of BZ \$295,000 to pay for Belize recurrent costs in FY 1985-86. The shortfall is larger for water supply and sanitation (the cost estimate is BZ \$442,000 compared with an MOH budget request of BZ \$240,000) than it is for vector control (the cost estimate here is BZ \$880,000, compared with a budget request of BZ \$795,000).

The apparent shortfall of BZ \$ 295,000 for FY 1985-86 recurrent costs might turn out to be even larger. It is by no means certain that the MOH will receive the full amount requested, particularly since the request is 33% larger than the current appropriation. In any event, the shortfall might also turn out to be manageable, since the figures given the project paper team may well represent an optimum situation for the services involved, so that MOH personnel could in fact carry out the most essential tasks with a smaller allocation.

The situation is unlikely to be clarified in the next few weeks, or even months, given the change of government following the national election on December 14, 1984. Accordingly, USAID/Belize may need to earmark certain ESF counterpart funds for this project, especially during the first year or two, and MOH officials will probably need to scale downward some of the lower-priority expenditures planned for the Ministry.

Financing of recurrent costs in the next few years as well as after completion of the project will probably continue to pose problems for the GOB. However, the problem will be a manageable one if (1) the GOB is successful in its efforts to expand government revenues (see Part III. C Economic Analysis), and (2) places a sufficiently high priority on vector control and water and sanitation. Some tightening of costs by MOH officials will also be necessary.

## C. Economic Analysis

### 1. Economic Overview

Belizean economic growth has slowed substantially during the 1980's. Averaging 4.5% annually in the 1970's, real GDP grew by only 1% in 1981, declined by 5% in 1982, and grew by only 1% in 1983. Thus, real GDP (and even nominal GDP) in 1983 was below that at the start of the decade; and per-capita GDP has fallen still further behind.

The slump in the world price of sugar (which generates about 20% of GDP), a construction slowdown, and a virtual stoppage of the re-export and transshipment trade with Mexico were the principal responsible factors. The decline in total exports (over 25% from 1980 to 1983) and the rise in foreign debt (65% for public debt since 1980) have led to a sharp rise in foreign debt service as a percentage of exports--from less than 2% in 1980 and 1981 to over 7% in 1983. Citrus production and exports have picked up in 1983 and 1984, as have sugar exports to a limited degree, but not sufficiently to allow government revenues to rise to former levels or to the levels needed for Belize to increase its development budget and to resume a more rapid rate of growth.

This economic deterioration, though not severe by the standards of other developing countries and not accompanied by sharp inflation (a 7% rise in consumer prices in 1980, followed by 13% in 1981 but only 2% in 1983), has been partially offset by IMF, World Bank, and bilateral assistance programs, including substantial ESF and USAID development grants. Much of this assistance is aimed at the building of roads and other infrastructure, which are essential to expanded production, exports, and tourism. Some USAID programs are aimed directly at expanding production and exports, particularly in agriculture. The currently-proposed project is designed to expand production and foreign exchange earnings somewhat less directly, by improving health, and thus productivity, by reducing time lost from work due to sickness or the need to care for the sick, and also by providing a more welcome environment for expanded tourism and foreign investment, one which is relatively free from the risks of malaria and dengue fever as well as from gastro-intestinal disease.

### 2. The Problem

Detected cases of malaria in Belize, according to the latest MOH sources, will number about 5,000 in 1984, out of a total population of about 160,000--an incidence of over 30 per 1,000. This represents a 50-fold increase during the past ten

years, making malaria by far the most frequently reported communicable disease in Belize (nearly 65% of the total in 1982, according to MOH figures)\*. Gastro-intestinal diseases have the second highest incidence (over 15% in 1982). And dengue fever (transmitted by the Aedes aegypti mosquito) is also on the rise, with nearly 450 reported cases in 1982 (nearly 8% of total communicable diseases reported) and an estimated 10 times that number of less severe cases going unreported.

Cause-effect relationships are clearer in the cases of the two mosquito-transmitted diseases than with gastro-intestinal disease. But with most households in the rural areas of Belize, Stann Creek, and Cayo Districts (the three districts in which the proposed USAID Water Supply and Sanitation efforts will take place) relying on a combination of wells, catchments fed by rainfall on galvanized roofs, or water carried by bucket or piped directly from rivers or streams, and with a substantial though unknown percentage of this water being contaminated, a ready medium is available for transmitting gastro-intestinal and other sickness. Moreover, the lack of sufficient water for washing in the dry season and the increased contamination during that period, particularly in rural areas, compound the problem.

\* Two human malaria parasites, P. vivax and P. falciparum, occur in Belize. P-falciparum malaria is more severe, and the first attack can be followed by frequent relapses for up to 3 to 5 months. If untreated, it may be fatal in 25% of infants. Such cases in Belize now account for an estimated 14% of the total, compared with only 2% of malaria cases in 1981. P. vivax is generally less serious but can also be fatal. Relapses occur with this strain, and a single malaria infection can thus last for years, which magnifies the total impact of the disease on health and the economy.

### 3. Project Benefits

Benefits, as with causal relationships, are clearer in the case of malaria/dengue fever activities than with water supply/sanitation projects. However, most experts believe that providing sufficient quantities of uncontaminated water for drinking, cooking, and washing, monitoring the quality of water so that contaminated sources can be avoided (or usage reduced), and encouraging better hygiene and preventive health measures through health education and community-development efforts--all these will yield substantial health benefits. These, as well as the benefits from the malaria/dengue fever components of the project, may be listed from an economic point of view.

At the personal level, families will gain from the greater convenience of more ample water supplies for gardens (which also contribute to health), for washing of household food and clothes as well as for personal sanitation, for cooking and preserving of food, and also for cleaning marketable produce. Workers (whether self-employed or hired) will lose less time from work while sick or while caring for the sick, as a consequence of greater supplies of uncontaminated water for drinking throughout the year. Thus, they can produce and earn more not only because of improved health while working but also because of more days at work. They will also benefit from lower medical costs as well as from fewer expenditures on caring for and educating children whose premature death or incapacitation cancels or reduces prospective future gains from those expenditures. Some persons will also gain from expanded job opportunities not only directly in health and water-supply fields but also in the likely-to-expand fields associated with tourism and foreign investment. And possibly even more important in the short run, they will avoid the loss of income, which could occur if tourism drops precipitously due to a continued rise in malaria and dengue fever accompanied by adverse publicity.

Rural and urban employers will also gain from the improved health and productivity of their workers--as will rural communities, especially if they take full advantage of the training/education aspects of the project.

Finally, Belize as a whole will profit from all of the above, in addition to perhaps some slowing of rural-urban migration and a consequent lower burden of public expenditures, if the health situation improves in rural vis a vis urban areas, while the Government will profit from the increased revenues and foreign exchange earnings derived from expanded tourism and private foreign investment.

#### 4. Quantification of benefits

Some of the above listed benefits can be quantified, on the basis of Belizean surveys and reporting supplemented by informed estimates of Belizean and U.S. health experts. Going beyond partial order-of-magnitude calculations to more precise and comprehensive estimates of the benefits from this health project, however, is not feasible.

Malaria and dengue fever control. Actual cases of malaria incidence in 1984 probably numbered at least 10,000, based on 5,000 reported cases and an estimated one to two times that number of unreported cases (see Table 1. III.C). This number

would increase by an estimated 30% to 35% annually during the next four years if this project were not initiated, according to Belizean and U.S. experts.

Dengue fever incidence usually varies substantially from year to year, even though the trend is sharply up in the absence of preventive measures. The 350 case base chosen for 1984 is actually an average of the nearly 450 reported cases in 1982 and the preliminary estimate of over 250 cases in 1984 (see Table 1. III.C). Given the severe underreporting, the actual annual incidence of dengue fever has probably averaged about 3,500 in recent years. While an annual doubling of cases is not unusual in the early years of an epidemic, a more conservative estimate of a 50% annual increase during the next four years is used here, with the total leveling off at 10,000 in FY 1987 and FY 1988.

On the assumption that the USAID program becomes increasingly effective during the lifetime of the project, the expected incidence of malaria and dengue fever would take a sharp dip starting in FY 1986, with a substantial number of cases avoided.

Average work time lost is estimated at 4 to 5 weeks in the case of dengue fever and 2 to 3 weeks for malaria (an average for the two different strains). Based on an average daily wage of US\$6 for unskilled labor, the income loss avoided would be nearly US\$ 5.9 million. Even at half this amount, so as to take account of the fact that many cases involve those who are too young or too old or unwilling or unable to find work (unemployment is officially estimated at 15%), the income loss which could be avoided would be about US\$3 million for both malaria and dengue fever.

Other potentially quantifiable benefits from the malaria/dengue fever program involve principally the potential tourism losses and the financial costs of sickness and deaths avoided. If the number of cases of malaria and dengue fever envisaged in the absence of a USAID program materialized, it would undoubtedly generate sufficient unfavorable publicity to affect seriously the inflow of tourists (as well as foreign investment). With a 35% decline in tourism, the loss to Belize would be estimated between US \$1 Million and \$2 Million. Estimates of direct and indirect job losses and of indirect income losses are not now feasible. Calculations of foreign-investment-inflow reductions and job losses are, therefore, not feasible to make at this time. Quantifying the costs of medical/pharmaceutical treatment, whether paid for publicly or privately, is not feasible at this time. Treatment in most cases consists of that given in a single visit to a health center. An evaluator will

often follow up the more severe cases of malaria; follow-up seems to be less frequent for other sickness--except in those relatively few cases which are treated in hospitals.

Summing up, the quantifiable benefits, or costs avoided -- based on the assumptions noted -- are on the order of magnitude of \$3.3 million for malaria, \$2.6 million for dengue fever, and \$2 million for tourism. These total about \$8 million US\$ in quantifiable benefits or costs avoided as a result of the vector control program.

	CY 1984	Table 1				Total 1985-88
		FY 1985	FY 1986	FY 1987	FY 1988	
<u>Malaria</u>						
No. of reported cases	5,000					
Estimated total cases						
a. if no USAID proj.	10,000	12,300	15,900	20,000	26,900	75,800
b. if USAID project	10,000	9,000	6,000	4,000	1,400	20,400
Estimated cases avoided		3,300	9,900	16,000	25,200	45,400
Estimated total workday loss avoided, if 10 work-days lost per case		33,000	99,000	160,000	255,000	454,000
Income loss avoided, using the average daily wage of \$6 paid to unskilled labor(US\$000)		198	594	960	1,530	3,282
<u>Dengue Fever</u>						
Estimated number of reported cases		350				
Estimated actual cases						
a. if no USAID project	3,500	4,800	7,200	10,800	10,000	32,000
b. if a USAID project	3,500	4,000	3,000	2,000	1,500	10,500
Estimated cases avoided	--	800	4,200	8,000	8,500	21,500
Estimated total work day loss avoided, if 20 workdays lost per case		16,000 (US\$000)	84,000	160,000	170,000	430,000
Income loss avoided, using the average daily wage of \$6 paid to unskilled labor (US\$000)		96	504	960	1,020	2,580

Notes to Table 1 by row:

1. Source: MOH statistics

2. Total malaria cases are estimated to be about double the reported number; dengue fever cases about 10 times. The increases, without USAID assistance, are estimated at 30% to 35% for malaria annually (the lower percentage is used for the calculations here) and 50% annually for dengue fever, with cases leveling off at 10,000. (The increases for the nine month period CY 1984 to FY 1985 are 22.5% and 37.5 respectively). All estimates, including those for the improved Belizean situation if there is a USAID program, were made by Belizean and U.S. health experts. Note that malaria can and often does recur and that persons recovered from one of four strains of dengue fever are still at risk from the other three strains.

3. The lower ends of the experts' estimates are used for both malaria (10 work days, from the 2 to 3 week range) and dengue fever (20 work days, from the 4 to 5 week range).

4. U.S. Embassy Data.

Water Supply and Sanitation. The number of beneficiaries of the Water Supply Component are estimated at some 30,000 who will benefit from uncontaminated year-round wells (500 wells serving as estimated 10 rural families each, with an average household size of 6) and an additional 10,000 who will benefit from new community water systems. Approximately 18,000 persons will also benefit from the sanitation improvements flowing from the construction of some 3,000 pit latrines, each serving a single household of about 6 persons. Many of these people will also benefit from the improved health resulting from health education efforts flowing from the project.

Gastro-intestinal and other contagious diseases, will clearly be reduced, as will medical expenses and time lost from work. Human productivity levels resulting from better health and nutrition will clearly bring both economic and non-economic benefits.

#### 5. Cost-benefit Calculations

From Table 1 on page 36, the total costs for the malaria and dengue fever elements of the Project are shown to be \$5.5 million (including \$946,000 for project management support). The actual cost figure used in the Benefit/Cost (B/C) calculation, however, does not include the \$2.3 million GOB counterpart since it is likely that these costs do not represent true incremental costs as required in B/C analysis, but rather a shifting or assignment of additional tasks to existing underutilized personnel. On the benefit side, the \$6.9 million benefit from income loss, which is avoided, is shadow priced at 50% to reflect the likely low marginal productivity of the workers affected by the two diseases. Tourist receipt loss reductions are conservatively assumed to be \$1 million. Thus, benefits of \$4 million per year, project costs of \$3.3 million, and the assumption of no on-going operating costs in

later years, after the project funding period ends, produce a B/C ratio greater than 7 at a 15% discount rate over 10 years. Adding \$1 million as additional operating expenses, still produces a large B/C ratio of 2.85.

Benefit/Cost calculations of the water supply and sanitation component are not attempted, because benefit estimates are difficult, time consuming and costly, and because substantial work has been conducted in other parts of the developing world that have unequivocally demonstrated the large rates of return to be generated by such projects.

## 6. Cost Effectiveness

Malaria/dengue fever control. The alternatives available to reduce the incidence of malaria are essentially the following: (1) to attack the parasite through the massive provision of prophylactic drugs, (2) to attack the mosquito through a massive campaign of insecticide spraying, or (3) to attack the parasite and the mosquito in a balanced manner, while introducing other measures that lower the cost of the most expensive element, which is insecticide.

The proposed malaria control component has chosen the third alternative as the most cost-effective way to reduce the incidence of malaria. Its annual cost to AID is about U.S.\$1.75 per beneficiary, including capital costs. Per-beneficiary costs including financing by the GOB and PAHO would be much higher -- in the U.S.\$5 range if the GOB contribution approaches the levels sought by MOH malaria-control officials. Providing prophylactic drugs to the population residing in malaria regions (which in fact encompass all of Belize) is not practical, according to the experts; and the costs per beneficiary would in any event be an estimated 50% higher than that of the more balanced approach chosen for this project. Because the costs of massive, total-coverage insecticide spraying would be prohibitive, calculations were not made of the cost-effectiveness of this approach.

Attacking the Aedes aegypti mosquito is the only alternative for dengue-fever control, since prophylactic drugs or vaccines are not presently available.

Water supply and sanitation. Of the water supply alternatives available, none has as low a cost per user as the tubewell-handpump alternative chosen as the primary focus of water supply in low-population-density rural areas. Some AID money will also be spent on operations research and training to improve the quality of catchment water, but any work resulting from this activity will be performed by rural residents themselves.

As shown in Table 2, the direct costs of drilling,

handpumps, and PVC casings are only U.S.\$33 per user -- compared with costs of U.S.\$43 to \$83 per user for rain water catchments (on galvanized roofs fed by guttering into storage tanks). The cost differs by the storage tank used. Moreover, the tubewell/handpump alternative normally provides uncontaminated water, whereas catchment water is often contaminated by bird droppings on roofs as well as by organisms which enter and multiply in the storage tanks.

The rudimentary community water systems are all substantially more expensive per user than the tubewell/handpump, so their use will be confined to the rural villages where a tubewell for each 10 families are not feasible.

Table 2  
WATER SYSTEM COST DATA  
(in U.S. Dollars)

Type of System	System Capital Cost	Number of Users	Capital cost per user	Annual Operating and Maintenance Costs per User
<u>Tubewells/handpumps</u> <sup>1</sup>	2,000	60	33	2
<u>Community systems</u>				
a. Rudimentary gravity <sup>2</sup>	38,000	300	128	3
b. Well pump/generator <sup>3</sup>	75,000	500	151	20
c. Pump/surface water <sup>4</sup>	83,000	500	166	26
<u>Catchments - 500 gal. size</u>				
a. Ferro-cement	260	6	43	minimal
b. Galvanized metal	450	6	74	minimal
c. Concrete	500	6	83	minimal

Cost estimates by the PP Team Water-Supply Engineer based on:

- 1 costs of drilling, complete handpump, and PVC casing.
- 2 two mile distance to source - only main lines through community, with individuals paying for house connection.
- 3 same as Number 2, except with a tubewell, submersible pump, and generator.
- 4 same as Number 2, except for surface-water treatment (pre-sedimentation, coagulation, filtration).

## D. Social Soundness Analysis

Belize is a multi-ethnic country numbering approximately 159,000 people. Population density is very low, divided evenly between urban and rural areas, with more than a quarter of the population living in Belize City. The city is predominately English speaking Creole (Afro-American), while the rest of the country is diverse. A majority of the rural population speaks Spanish as a first language. Nationally, the largest group are Creoles (39.7% of total population in 1980), followed by Mestizos of mostly Maya ancestry (33.1%), Garifuna (Afro-Indians, 7.6%), Yucatec and Mopan Maya (6.8%), Mennonite (3.3%), Kekchi Maya (2.7%) and East Indians (2.1%). An estimated 5,000 - 10,000 refugees from El Salvador and Guatemala have entered the country in the last five years, scattering in rural areas and the cities, and forming several villages of their own.

The complex mix does not divide easily into groups by class, wealth, or economic role. Mixed communities are common. The only single-ethnic communities are the Mennonite settlements, the Amerindian villages of the south, and some Mestizo villages in the west and north. The mixture of the rural population and its high rate of mobility combined with past government policies, have left most rural communities poorly organized. This has slowed community involvement in health care, though there are significant signs that this situation is changing. Each ethnic group has its own language, traditions, and beliefs about disease and curing, all of which must be taken into account in educational efforts and community involvement. This educational effort is beginning.

### 1. Project Beneficiaries

#### Malaria and Aedes Aegypti Control

The Malaria and Aedes Aegypti Control Component of this Project will benefit the entire population of Belize. The population is scattered throughout 210 villages, 8 towns (between 1500 and 15,000 people), Belize City and Belmopan (the Capital). Those who will receive the most direct benefit are in the northern and western portions of the country where malaria is endemic. It is this population which is at greatest risk of malaria and dengue-related mortality and morbidity.

Pregnant and lactating women are especially susceptible to malaria. Infants and young children have the highest malaria mortality and morbidity rates. The Project will lower malaria incidence resulting in healthier infants and fewer problems during pregnancy and delivery. Reduction in malaria and dengue

fever rates will also reduce convalescent time and complications in those frequent cases where these illnesses co-occur with diarrhea, malnutrition and other infectious diseases.

The working adult population (a large part of which in the cities is female) will benefit directly through reduced loss of productive work time. An increase in productivity can also be expected through a decrease in the frequency of sub-clinical infections.

Secondary benefits will come through increased health education for children and adults, more community involvement in health care, and greater awareness of environmental hazards to health. The network of Voluntary Collaborators will benefit directly through training and improved drug supply, to improving their ability to work effectively within their communities. Health professionals within the vector control programs will benefit directly from training and the improved morale which will stem from better mobility, material support and understanding of the communities in which they work.

#### Water and Sanitation

The beneficiaries of this project component include the 33,000 rural residents of the Belize, Cayo and Stann Creek Districts, who live in 108 villages and hamlets ranging in size from 50 to over 1000 in population. Each district centers administratively, culturally and economically around its district town, in which government functions are carried out.

The Belize District population is mainly Creole and engage in small scale farming and ranching. They are in dispersed communities along the major rivers and highways. This is one of the more economically depressed parts of the country, with a serious rural-urban migration problem.

Cayo District contains most of the refugees and many Mennonites, along with a large proportion of Mestizos and Yucatec Maya. This area of the country has the most mixed farming and cattle ranching, and a growing cacao industry.

The Stann Creek District is split between coastal Garifuna communities, highly mixed valley communities along the highway, and a number of Mopan Maya and Kekchi Maya communities in the southern hills. Migrant-worker settlement in the citrus and banana industries in this district present special public health and sanitation problems because community involvement is problematic when villages are not owned by their inhabitants. The Maya are small farmers in a traditional Amerindian system

of shifting cultivation and communal land ownership. The Garifuna form linear beach-front villages, and are engaged in subsistence farming (largely by women), fishing, and migratory wage labor.

In all three districts the project beneficiaries will generally be the poorest of the population - those living in small rural communities with few services. Children and women, who presently bear the greatest burden of mortality and/or morbidity from diarrheal diseases and parasite infection, will benefit the most from the project. Infant mortality should decline markedly, as will the number of work days lost to adults through illness.

Immediate benefits will especially be felt by children and women who will no longer have to carry water long distances. Drastic dry-season water shortages which divert all adult labor to providing potable water will be eliminated. Time saved can be used for income generation and other activities.

The entire public health system, including the Public Health Inspectors, will directly benefit from education and training. Their roles will be more clearly defined, and they will have a strong leadership role in the augmented District Health Teams which will administer the project at the district level.

Secondary benefits will be seen in improved animal health, in greatly improved community organization and motivation, and in better health education in general. Especially important will be the growth of effective systems for communities to interact with government on a guided-self-help basis rather than on a dependent basis. Communications at all levels will be augmented. New community health groups are likely to undertake other self-help projects after their initial success in water and sanitation.

## 2. Relationship of the Project to Target Group

Equity is not a serious issue with this project, which will benefit the entire spectrum of society in both components. At all levels, this project will be working through existing Belizean institutions, often strengthening linkages between levels. This will have a benefit in overall administrative effectiveness and organizational development.

Urban-rural differences in quality of life in Belize are often dramatic, with rural areas lagging behind in government services, in communications, education, community involvement

and general economic level. The Project, by bringing rural water and sanitation standards closer to those of urban areas, may contribute to slower rural-urban migration and contribute to the economic development of rural areas.

### 3. Social Acceptability

#### Vector Control

Malaria spraying has a long history in Belize. The sprayers and evaluators have had time to learn local beliefs and adapt their work to them. Acceptance to spraying in most areas is high, especially because spraying tends to keep down pests other than mosquitos. At one time, there was opposition in some areas because of mortality among pets, but this has largely been calmed through educational efforts. In many of the rural areas the NMCS spray teams are well-integrated into the rural organization. They are well known to the people, provide small services, carry messages, collect information, and often accompany visitors including officials.

At present the major problems with spraying acceptance are among Mennonites, Europeans and the Amerindians in the south. The first two groups object to the use of DDT which they consider to be a health hazard. In the south there is a general lack of knowledge about the causes of malaria. There is a tendency to blame the incidence of malaria and dengue not on mosquitos, lack of spraying or open water for breeding, but rather on the influx of refugees and "aliens" from neighboring countries.

The high ethnic diversity of Belize makes it hard to generalize about how malaria and dengue are identified and treated. Very little research has been done on this issue. Maya and Mestizo groups in particular use many herbal remedies in curing, and often visit folk-practitioners. There is a tendency for refugees and recent immigrants from the surrounding countries to self-diagnose and self-treat rather than use the local health system. Although in urban areas the use of western medicine is almost universal, there is little awareness of the connection between mosquito breeding and disease. This has been a major impediment to the success of the Aedes control effort.

In general, Aedes control is less supported and less well understood in the entire country. This is partially because dengue fever has not been differentiated by the populace from other fevers and illnesses, and because people have not been convinced of the connection between open water containers and transmission of the disease. Education and better training of

the Aedes control personnel is needed. As the primary health care system develops in Belize (it is presently beginning in Toledo district), cooperation and participation should increase. Community involvement in water and sanitation activities will also have a positive spread effect on the vector control programs.

### Water and Sanitation

In the three districts where the Water and Sanitation Component will work there are few cultural or educational obstacles to the continued spread of pit latrines as a sanitary facility. In most communities, the physical material is lacking for construction of slab and riser - local materials are used for the superstructure. In some of the Garifuna communities along the coast the high water table presents a problem; at present bucket latrines emptied onto the beach, or over-water latrines on piers are used. Appropriate technical alternatives must be sought before an educational effort as to advantages of latrines can be conducted. The Maya communities in the south will require close attention to the present cultural and ecological context of human waste disposal.

It is hard to tell to what degree the wide acceptance of pit latrines is due to knowledge of the health benefits of proper sanitation, and how much of it is due to social pressure and emulation. It is clearly perceived by most villagers that a latrine is "modern" and desirable, while using the bush is old fashioned and low-status. This has led to the rejection of latrines by a significant minority of "traditional" Amerindians, who see their own practice of using the bush as a mark of ethnicity. For some, use of latrines is a symbol of a modern way of life which seeks to eliminate their own traditions and culture.

An educational effort should be carried out through the schools, as children are presently the largest non-users of latrines. Education about animal disease vectors and the need to wear shoes to eliminate hookworm are vital if parasite cycles are to be interrupted. Women, who may not be responsible for the construction of latrines, but who maintain them, should be involved in any construction and education program.

Water use is a more complex issue. Most villages have multiple water sources, each with varying quality and availability in terms of distance and season. By far the most preferred potable source is rainwater from rooftop catchments. This is only available to those wealthy enough to have a tin roof (almost everyone in Belize District, about half in Cayo

and Stann Creek) and a vat. This usually runs out during the dry season. By and large, well water is the least preferred water source, mainly because of the iron taste which comes from old iron well casings. Surface water is used frequently, as is water from shallow hand-dug wells where available.

In most areas people will not give up their rainwater collection systems because a new system is installed. These vats will continue to be a significant source of drinking water through much of the year. For this reason, attention should be given to upgrading and improving water catchment systems, as well as providing better primary sources.

Settlement patterns of the population must be taken into account in assessing the needs and technical solutions to water and sanitation needs in each community. Distinctive settlement patterns present opportunities and problems. Creole settlement along the Belize and Sibun Rivers in the Belize District is highly dispersed. Houses may be several hundred meters apart, on both sides of the river. In these cases household-level systems may be appropriate or may be possible to build several multi-household units at intervals along the river.

The relatively nucleated Mestizo communities in Cayo District are easier to serve. Roadside strip communities in all districts present community development problems, for in many cases these are not typical communities, having no center and weak village institutions. In these areas the schools may be the linkage for community participation. Garifuna beach strip settlements and nucleated communal Maya villages argue for maximum community participation in defining problems and solutions.

#### 4. Community Organization and Participation

Belize is politically organized on three levels, National, District and Community. Communities elect a council (town or village), and also participate in national elections for a representative for their political division (usually the rural area of a district is divided into two divisions) who represents their interests directly to the national government. At the district level there are appointed officials who are usually the lower-level public servants from each ministry who are responsible for services in the district.

The historical effect of this system has been to stifle community participation and self-help efforts. Water systems, village community centers, road improvements and the like, have usually been given to a community as a result of direct pressure applied to a political representative, or as a measure

of the largesse of the central government. The result is that the local level perceives that things only get done by the national government, and that installations and innovations are handed out rather than built locally. Weak local institutions and councils result, oriented towards petitioning rather than acting and organizing.

There are optimistic signs that this situation has been changing during the last few years. The central government has been studying the prospects for greater community participation. At the district level, the CARE REAP councils and the District Health Teams have begun to act as intermediary institutions which also coordinate the village activities of the different ministries. Many villages are now beginning to take more initiative in planning their own activities, building on traditional institutions. This process is uneven with some communities far more organized and motivated than others.

The existing village structure for community participation is the Village Council of elected members with a chairperson, and the Village REAP council (in about 1/2 the villages in the area) consisting of the schoolteacher, members of the council and parents of schoolchildren. In some areas the village also has an elected Alcalde (mayor) and an informal council of elders. Other key individuals include the School principal, the Malaria Voluntary Collaborator, and a Peace Corps volunteer if present.

Given some real participation in decision-making, most communities will be able to develop or strengthen organizations on their own. The most important and difficult interface will be between the village committee and the District Health Teams. The Teams tend to be dominated by urban health-care professionals. These people, during workshops and training, should be sensitized to the village's views and to the importance of making the communities equal participants in change. In some villages that presently have very weak organizations, the incentive of improved water and sanitation will strengthen institutions and will likely stimulate more development.

One development from community participation is likely to be that some communities will decide that sanitation and water improvement are not their first priorities. Educational efforts may be necessary to heighten awareness of health problems.

Community participation efforts ultimately rely on continued support from the central government. The degree to which local long term control will develop in the Belizean

system is still unknown. At present the Ministry of Health has taken the lead in these efforts and has the most experience. A spread effect of the present Project will be increased experience with community participation in sectors other than health.

#### 5. The Role of Women

Female roles in Belize vary greatly among cultural groups. Women take a strong public role in community decision making among both Garifuna and Creole, but are much less visible in community affairs in Maya and Mestizo areas. In all groups the burden of child care, cooking, and care for the ill falls primarily on women, and they can be expected to benefit in many ways from this Project.

For benefits to be maximized it is crucially important that women be involved in the community participation element of the project and that they be accorded a role in the decision making about water and sanitation alternatives. This can best be achieved, in areas where women do not form a part of the formal village decision-making bodies, by involving other informal groups which do include women, and by affording the communities enough time to discuss issues and problems at the household level before final decisions are made. Examples of alternate groups are the women's groups formed by the Women's Bureau of the Department of Social Welfare, school parents groups, church groups, craft circles and credit syndicates. Public health nurses, who frequently deal with women on child health matters, are important contact people in this effort.

#### 6. Criteria for Selection

As presently envisioned, most of the communities in each district will participate in the water and sanitation project. The issue then becomes one of prioritization rather than selection. The Village Health Teams will have a primary screening role in setting these priorities, with the PHI having the actual decision-making role at the District level.

Since the overall success of the project will depend on the vitality and viability of community-level institutions and decision-making, the most important criteria for selection should be linked to community participation, combined with technical criteria of how well the proposed system will work. If a community has successfully conducted a needs survey, has consulted with technical specialists, and has developed a plan for self-help participation and maintenance funding, this should be a sufficient criteria for selection. The priority can then simply be first-come, first-served.

## E. Technical Analysis

### 2. Malaria and Aedes Aegypti

#### a. Technical Feasibility - Malaria Control (NMCS) and Aedes Aegypti Control (AACP)

This project is designed to incorporate a variety of vector control measures which will enhance the operational impact and efficiency of NMCS and AACP. It also emphasizes increased data analysis to guide operational decisions by the NMCS and AACP directors and their senior staff and to provide the basis for implementation of standard and alternative control measures. Malaria Program operations will rely on (1) continual stratification of the malaria program, based on a range of epidemiologic, entomologic and other data and (2) the application of a variety of control measures, as dictated by the stratification and the resources available. Over the Life of Project (LOP), the Aedes Aegypti Control Program (AACP) will (1) expand its operation from the urban centers where it is presently working to provide a surveillance service to limited rural areas; (2) increase ULV applications for Aedes mosquito control during the May to September period to reduce the possibilities of dengue outbreaks; and (3) develop more timely and reliable epidemiological and entomological systems. The discussion below describes the technical and operational feasibility of applying the various control techniques and methodologies in the Belize malaria and Aedes aegypti control programs.

#### 1. Stratification of Activity Areas

A critical epidemiologic issue for both malaria and Aedes aegypti control is the setting of priorities for operations. The important factors determining priority are data on the intensity and seasonality of transmission, measurements of mosquito vector density and inoculation rates, and estimates of the potential for intervention (e.g., insecticide and drugs, human population variables such as refugee movement and accessibility), and measurements of the public health impact of malaria and dengue fever (e.g., estimate of mortality). To accomplish the task of setting priorities, an epidemiologic data base is required for operational stratification. At present, sufficient data are not available in Belize and will have to be developed over the LOP. Using only available malaria and dengue case reports, the NMCS/AACP has identified areas of high priority and has commenced activities based upon this information. The areas of highest malaria priority constitute approximately 20 localities in northern Belize. These

localities provide over 60% of the reported malaria. Obtaining epidemiological data to better stratify these malarious areas requires the training and technical assistance provided by this project.

The Belize Malaria Control Service (NMCS) and the Aedes Aegypti Control Program (AACP) understand and endorse the stratification concept and has demonstrated this understanding in preparing new Plans of Operations. NMCS/AACP are committed to stratification and to annual re-stratification over LOP based on expanded and improved data collection on entomologic, ecologic, climatologic, anthropological and sociological factors. The planned strengthening of NMCS/AACP personnel, management procedures and epidemiological systems through technical assistance and training will provide feasible and cost-effective assistance to NMCS and the AACP. In order to insure progress in the program's development, an evaluation of the stratification effort is planned in late FY 1986. This evaluation will provide guidance for corrections in program directions and will assist NMCS/AACP in future planning.

#### b. Analysis of Technologies Selected

##### 1. Surveillance System

The stated objectives of the Project are (1) to contain the resurgence of malaria transmission; (2) develop within the GOB health services an infrastructure with the capacity to set priorities for long-term malaria and Aedes aegypti control; and (3) to improve the operational and institutional capacity of the NMCS/AACP in providing health services. Malaria and Dengue Fever surveillance should be based on the objectives of the program. Multiple, complementary data bases will be required. Considering the acute need to define and deal with a rising epidemic situation in both malaria and dengue fever, available data and spot surveys will be required to set priorities, and data available outside the NMCS/AACP network should be actively sought. For the long-term stratification and program assessment of malaria and dengue fever, a thorough evaluation of epidemiologic activities is necessary.

NMCS has basically two sources of malaria surveillance data - Active Case Detection (ACD) carried out in the Districts by the evaluators and supervisors and Passive Case Detection (PCD) which includes slides from Health institutions and the Village Collaborators (VC). In addition, slides taken by the evaluators during the limited epidemiological investigations assist in defining the malaria problem.

Activated Case Detection (ACD) is one major source of slides in the Belize NMCS. The project will focus on improving this area of activity. In 1982 and 1983 the ACD mechanism collected 39.75% and 35.06% respectively of all slides collected. Passive Case Detection (PCD) carried out by GOB health institutions and voluntary collaborators outside NMCS is the other major source of slides. The program derives substantial direct operational assistance from this area of surveillance. In 1982 and 1983, the PCD mechanism collected 60.25% and 65% respectively of the total slides. The project will be carrying out efforts to improve the relationships between the NMCS and these PCD institutions. Training experiences, joint conferences and more joint health education activities are planned to integrate more malaria and dengue fever control activities within the health structure.

The Voluntary Village Collaborator (VC) network is an important asset to malaria surveillance and therapy activities in Belize, but at the present time is limited in distribution. The project will increase the VC participation in the 360 localities of the country. Any VC network depends on close supervision, a reliable system of providing supplies of materials and medications, and prompt collection of blood slides and return of laboratory results. This project includes plans to strengthen all these areas. The project will also stress epidemiologic improvement through provision of technical assistance, training and limited operations research.

Attention during the LOP will be paid to evaluating the proficiency of the Central laboratory. The Central laboratory needs to be strengthened to improve the accuracy of parasitologic data. It is planned to use the laboratory technician at Stann Creek to read malaria slides thereby reducing the time lag in malaria case identification and expediting treatment.

For the long-term development of surveillance activities, emphasis must be placed on utilization of data derived from sources outside NMCS. PHC programs and fixed health facilities will be strengthened, and coordination in malaria diagnosis and therapy among all GOB health activities will be crucial. Malaria and Dengue surveillance should not remain a responsibility solely of NMCS/AACP.

A surveillance improvement schedule for the *Aedes Aegypti* Control Program is to be developed over the Life of the Project to increase its effectiveness and to adapt its methods to modern technology.

## 2. Chemotherapy

There are three situations when malaria drug therapy is indicated and will be provided. The first and most important in terms of both generating local data on malaria cases and treating suspected cases is drug chemotherapy provided by the evaluators, supervisors, community volunteers and cooperating public health facilities. Treatment with chloroquine is provided to all fever cases arriving at the VC post. Primaquine is only administered by NMCS employees after determining that the case is positive. Since all fevers are presumed to be malaria, the drug treatment is termed a presumptive treatment. Because of the special malaria risk to children under five and pregnant women, they are provided with an additional appropriate dosage of chloroquine adequate to ensure a rapid reduction or elimination of the malaria parasites; this comprehensive drug regimen is termed radical treatment. Due to the dramatic increase of P. falciparum malaria the NMCS plans to include the drug, primaquine, in its presumptive treatment schedule especially in those localities which are severely affected. In addition to these two specific drug regimens provided by the health posts and NMCS employees, NMCS may organize a Mass Drug Administration (MDA) in carefully delimited special circumstances to reduce malaria transmission in areas (foci) where there has been continued high transmission. In MDA all, or as nearly as possible all, residents of an area are provided with drugs.

The distribution and use of anti-malaria drugs in the VC system is technically sound and feasible. Chloroquine, the drug of choice, is cheap, effective and has few side effects. Chloroquine is used to suppress symptoms; primaquine reduces the possibility of transmission as it acts on the gametocyte forms of the P. falciparum malaria parasite. There are plans to provide selected VC posts with primaquine after training has been carried out. In some limited cases the VC presently provides primaquine to detected malaria cases under the guidance of a NMCS supervisor.

The use of large-scale drug distribution requires careful planning and execution. Full coverage of malarious areas with anti-malaria drugs in selected areas will be based on malaria rates, accessibility and cost considerations in relation to other less expensive measures. Continuing evaluations of drug effectiveness and parasite sensitivity to the drugs is planned. For these evaluations, NMCS will assign well-experienced personnel for training in proper evaluation procedures and sensitivity testing in areas where drug distribution is used. External technical assistance either from PAHO and/or A.I.D. is provided in this Project to develop

and monitor a rational evaluation program, for possible operations research on alternative drugs, drug combinations and methods of distribution, and for a thorough reevaluation of total antimalaria drug use in the country i.e. by public and private health facilities. The projected use of focal mass drug distribution and the conduct of essential field research is technically sound and is feasible within the constraints noted. The technical assistance required is available and is incorporated into the project design.

The *Aedes Aegypti* Control Program does not provide clinical treatment services as there is no specific therapy for dengue except rest and limited non-prescription drugs.

### 3. Evaluation of *P. falciparum* Drug Sensitivity

The available data on the drug sensitivity of *P. falciparum* in Belize indicates that the malaria parasite is sensitive to chloroquine and that this is the drug of choice. Over the LOP careful investigations will be made to determine any changes in this status. It is important to develop clear guidelines for anti-malaria drug distribution. This has been incorporated into the Project's design and will be implemented over the LOP.

### 4. Intradomiciliary Spraying

There has been greater experience in Belize with residual intradomiciliary spraying than with any other malaria control intervention. Such spraying operations have, in the past, been reasonably well planned, organized and implemented when adequate funding and materials were available. While evaluation of operational results has not always been complete or performed on a timely basis, good evaluation is within the capabilities of the NMCS. Residual spraying is to be used selectively in the project with DDT as the insecticide of choice. Field studies in Belize have demonstrated that intradomiciliary spraying with this insecticide is suitable for malaria control. In September, 1984 the vectors of malaria were determined to be susceptible to this insecticide. The use of DDT for control is considered technically sound and feasible, provided that:

a. The behavior pattern of the vector will be such that intradomiciliary insecticide residues will interfere to a significant degree with the transmission of malaria;

b. Safe application and handling practices are employed with the insecticide so that there are no significant problems of pesticide toxicity to program personnel to recipient populations, as determined by carefully organized and effective monitoring; and,

c. There is frequent entomologic evaluation of the efficacy of the spraying and of the sensitivity of anopheline populations to the insecticide.

The determination and assurance of these qualifications are within the technical and administrative capabilities of the NMCS, but will require additional staff training, technical assistance, institution of operations research to develop alternative approaches and materials, and increased professional supervision. The project is designed to meet these requirements and to insure that a continually improved and epidemiologically sound spray operation is being implemented. NMCS with external assistance from A.I.D. and/or PAHO will carefully monitor the mosquito population to identify the emergence of resistance to the insecticide in the vector or any significant alteration in its behavior patterns. The planned NMCS mechanism for this monitoring is considered technically sound and should detect early changes in vector behavior or respond to insecticides provided it is strengthened by the addition of project planned technical assistance and training.

One of the priority operations research efforts that the project will support is a series of trials of alternative insecticides to assess their usefulness for control. Demonstration of the efficacy of new insecticides would permit NMCS to develop operational alternatives. Operational research is also essential to determine behavior patterns of the anopheline mosquito vectors in the variety of ecologic situations throughout Belize and to determine any emerging or expanding patterns of mosquito resistance to DDT. Such research can be conducted by NMCS, with the assistance of A.I.D. and PAHO advisors, and short term technical assistance. The project has specifically scheduled both training and technical assistance in mosquito resistance evaluation.

The *Aedes Aegypti* Control Program will not be applying any residual spray over the life of the project.

##### 5. Larviciding

This method is appropriate for Belize and it is currently used on a limited basis in urban, sub-urban and other selected situations to achieve reduction of malaria and dengue mosquito populations. The *Aedes Aegypti* Control Program uses the O.P. compound, Abate, for larval control. Since the Malaria Control Service uses DDT, a chlorinated hydrocarbon for residual spraying, there is little danger of Abate induced resistance in the malaria mosquito from this activity. Abate is considered the insecticide of choice for reasons of both safety and

cost-effectiveness. Provided sound principles are followed, and that each larviciding effort is evaluated for effectiveness, the measure is considered sound and feasible for limited application by NMCS. Most of the larviciding to date has been done around the six district centers, but there are plans to expand such activities to outlying sites over the Life of the Project. The conduct and evaluation of limited operational field studies on the effectiveness of various larvicidal methods are within the capacity of NMCS from both a technical and managerial point of view. but will require the technical assistance provided by this project to develop a field project in applied research.

#### 6. Area Spraying (Adulticides)

The use of Ultra Low Volume (ULV) and fogging applications for control of adult vector mosquitoes is sound and feasible if used specifically for control of focal problems, if suitable insecticides are used, and if the application equipment used is correctly adjusted and operated. Limited ULV activities have been carried out in Corozal, Cayo, Belmopan and Crange Walk. However, entomological evaluations to date have been minimal and more needs to be done in ULV evaluation. The project includes technical assistance and training in ULV spray operations. Conducted as planned, this malaria and dengue control intervention could be selectively applied on a technically sound basis during certain periods of the year. It is planned to use malathion, 91% concentrate, in this ULV operation and careful applications are to be done to insure a cost effective operation with minimal environmental implications.

#### 7. Source Reduction

Source reduction (environmental modification) is considered a technically sound malaria control method, particularly as it provides for permanent reduction in mosquito breeding sources. The feasibility of source reduction methods in the malaria and dengue control programs demands specific program efforts to identify, assess and correct situations which are suitable for this type of intervention. The AACP has in the past carried out such work with the various municipalities, but lack of enforcement of existing mosquito breeding laws, supervision limitations due to lack of mobilization and shortage of staff has limited effective action. With increased training and retraining of personnel as planned over the LOP, it may be feasible to expand source reduction activities especially in the AACP activity. The project plans to encourage community participation in minor source reduction actions. Community

action in source reduction is technically sound provided that NMCS and AACP personnel guide and give supervision to such efforts. The project will provide light motorcycles to improve the supervision elements and operational activities of both vector control services.

#### 8. Biological Control

A number of biological control methodologies are being tested world-wide; they include the use of bacteria, viruses, and nematodes. Geneticists are also attempting to discover mechanisms for the control of mosquito reproduction and insecticide susceptibility status. However, this project has no present plans to make operational application of any biological control except larvivorous fish and possibly BTI. The use of larvivorous fish appears to be an inexpensive, effective, and potentially community-based measure for reduction of mosquito populations in permanent breeding areas. It is a sound, time-tested measure and further exploitation of the method is feasible for NMCS. NMCS has reported considerable experience in this methodology in the past using Gambusia affinis. Additional fish breeding facilities, methods of distribution, and field studies evaluating the effectiveness in a variety of habitats are needed and will be considered in this project. It is considered feasible and desirable for NMCS to implement such biological control methods. Field research in additional biological methodologies is being planned within the project. NMCS is capable to doing these studies but will require external technical assistance and training in planning and evaluating such biological control activities. The project has included such technical assistance and training in its activity funding.

#### 9. Aedes Aegypti Control Program (AACP)

The project will provide support through technical assistance, training and operations research dealing with dengue fever and yellow fever in Belize. The AACP efforts are almost entirely focused on urban environments and the elimination of Aedes aegypti breeding sites. Thus, urban control efforts are very important for this program. The techniques for controlling Aedes aegypti are well known and the AACP can successfully carry out its responsibilities. The AACP has already initiated a modest activity in surveillance of Aedes aegypti, the vector of yellow fever and dengue. Project training, operations research and technical efforts are being provided to establish, in coordination with other donors, improved baseline data and personnel for this activity. This approach to improving the data baseline, increasing operational capability and training personnel is considered sound and scientifically correct.

## 10. Training

NMCS provides a variety of formal pre-service or in-service training experiences within Belize for its staff. The spray operation field personnel are given in-service training after each spray cycle. A portion of the in-service training is done on an ad-hoc basis at district supervisor conferences or at similar meetings. The development of an organized, focused effective training effort is a high priority activity in the project as both malaria and dengue control personnel are in need of training and technical improvement.

The project plans to put approximately \$254,000 into training support for the project. The training assistance is aimed at developing both malaria control and Aedes aegypti surveillance skills. The project plans to train up to 32 NMCS/AACP staff in vector borne diseases. This training is to include basic vector disease knowledge, alternative control methodologies and operations research skills. One senior staff member will be given an opportunity to obtain graduate training in public health and epidemiology. Sixteen observation tours within the Latin-American Region and the U.S. are scheduled to allow a more hands-on approach to required training. Special courses in entomology and epidemiology are being proposed along with approximately two training experiences in various aspects of entomology. Particular weight is attached to the need to provide augmented in-country training for the Voluntary Collaborators. (See Annex N)

The training provided by the project is considered directly in accord with NMCS/AACP needs and is directly in support of both the GOB's and the Project's objectives. The training schedule proposed by the Project are ambitious, but realistic over LOP.

## 11. Health Education

Health education designed to increase the understanding, cooperation, and participation of the people in the program at the community level is as important as the technical operations of vector control, case finding, and treatment. Because it is relatively difficult to achieve results in this area, health education is often neglected in malaria and Aedes aegypti surveillance programs; Belize has been no exception. NMCS and AACP leadership, at all levels, recognizes the importance of health education and is attempting to strengthen that component of the program. As integration of vector control activities into the general health services proceeds, such education should become an important element of the overall health education program for NMCS, AACP and general health service employees.

A systematic effort is to be undertaken during the Project to study and change villagers' attitudes and practices through operations research (See Social Scientist Statement of Work in Annex J), training of village volunteers and briefing community and government leaders, and applying innovative mass media techniques modeled after successful experiences elsewhere.

NMCS and AACP are handicapped by shortages of trained health educators assigned to the program. The programs believe that all NMCS and AACP employees should be health educators and that such activities are a part of every employee's job.

This project will provide the services of a long term community development/health educator/training specialist and short-term consultants specializing in health education to improve in-country training, funds for operations research to study community knowledge, attitudes and practices in relation to malaria and Aedes aegypti control. The plans to carry out this health education activity are modest, but will result in a considerable improvement in the management of health education functions within NMCS/AACP and increase community awareness of the program over the LOP.

## 12. Operations Research

Operations research, as opposed to basic research, constitutes those activities which are conducted to identify control problems, to determine operational priorities, or to define problem solution or effective interventions. All operations research should be designed to provide knowledge and experience, on the basis of which control programs can be designed, conducted and/or improved.

In Belize it is clear that new approaches to malaria and dengue control must be undertaken, building on past experiences but not being limited by those experiences. It is possible to list many operations research topics which could be pursued productively. The following are, however, among the priority issues which need to be addressed. The list is neither definitive nor exhaustive.

### Vector-borne disease-related research

- (1) Socio-cultural studies of malaria and dengue fever
- (2) Epidemiology and Surveillance
- (3) Drug Resistance

- (4) Development of epidemiological profile of malaria and dengue fever
- (5) Field trials of new insecticides including larvicides
- (6) Alternative methods of vector-borne disease control

c. Long-term Sustainability and Impact

If successfully executed, the Project will have assisted NMCS/AACP to move substantially forward in their transition from a vertically organized program emphasizing a limited number of interventions to integrated programs utilizing a selective mix of vector control measures and a better balance between active and passive case detection and treatment methods, for malaria, and also for dengue fever/yellow fever. Progressive reduction of malaria transmission by vector control and drug treatment for humans may reduce the operational area to be actively controlled, thereby reducing the administrative and financial costs of the program. Successful execution will depend on a number of key variables, including vector resistance to chlorinated hydrocarbon insecticides, epidemiologically directed spray and larviciding operations, cooperation and participation of the public and general health services staff, reduction in the incidence of P. falciparum malaria, collaboration of municipal authorities, and expanded use of feasible alternative control measures which are the result of operations research, increased training and technical assistance inputs.

An important impact from the standpoint of government administration will be significant savings from not having to continue to import large quantities of expensive insecticides. The long-term impact on social and economic development will be substantial in terms of reduced morbidity and increased productivity.

2. Water and Sanitation

a. Technical Capability

The Ministry of Health has assumed responsibility for rural water supply and sanitation, and is the counterpart agency identified by USAID, CARE, and UNICEF for their rural water sanitation projects. The Ministry of Health now operates the cable percussion drilling rigs and provides one full time and one part time pump and rural piped system repair crew. The full-time crew operates out of the Ministry of Health

maintenance shop in Orange Walk Town. The part-time crew doubles as the drilling crew in the Toledo District, the southern district. The MOH Orange Walk crew services the two northern districts of Orange Walk and Corozal along with the western district of Cayo, leaving Belize district to WASA, and Stann Creek district to the Ministry of Works.

The Ministry of Natural Resources through its Department of Agriculture has drilled some wells, but currently limits its activity to agricultural development interests, apparently public and private.

The Ministry of Works was once an important driller of rural roadside wells and siting of many pumps during the sixties and early seventies. They currently provide pump repair service to areas where other agencies are unable to work due to the lack of facilities or transportation. CARE has, on occasion, made special maintenance arrangements with the Ministry of Works to service some these remote areas.

The Water and Sewer Authority (WASA), a division of the Ministry of Energy and Communications, currently maintains and occasionally drills roadside wells, primarily in Belize District. Their mandate, however, is to maintain and develop municipal piped water systems for the urban sector. They have expressed an interest in ceasing their rural water activities. They are, however, currently the only agency in Belize equipped with chemical and biological water quality testing facilities.

The Environmental Health Service's Public Health Inspectors (PHIs) have had an active program in well siting and pump installation in all six districts, beginning in the early 1960's and continuing to date. The EHS program supports two well drilling crews who operate percussion rigs with well siting done by District PHIs and local officials. These drilling crews are well experienced and have a thorough working knowledge of applied hydrogeology, drilling techniques, and equipment maintenance. They have had an excellent performance record given the age and condition of their equipment. The interest and technical capability of the EHS pump maintenance crew has been judged to be sufficiently high to insure an important role in maintenance and repair of water systems where they travel throughout all six districts repairing approximately 250 pumps per year. Given that Dempster pumps have a high frequency of malfunction, the repair crew is overextended.

The technical capability of the PHIs is weak, however, in the area in rudimentary systems design and operation. In some districts the PHIs has had limited involvement in developing

feasibility studies and in designing storage reservoirs. The Project will address these technical deficiencies by implementing an in-service training program which would include pump-generator sizing, hydraulic design of systems, elevated and spread reservoir design, spring capturing and surface treatment systems.

The PHIs have also had limited experience in community development aspects of water programs. All PHIs have had course work and limited experience in health education and community participation. They have also served on the District Health Teams which have had programs in education and community development. This project will require redirection and reinforcement of the PHIs in health education and community development.

The water quality monitoring function of the EHS is without any technical support at this time. While most PHIs have had course work in laboratory analysis, their experience has mostly been in areas of surveillance and sampling. A training program will be needed to teach analysis and record keeping skills to a yet to be appointed laboratory technician.

#### b. Analysis of Technologies Selected

##### 1. Tube Wells and Handpumps

This favored type of water system is comprised of a tubewell cased to the bottom of the well with PVC pipe, grouted at the top, with a Mark II handpump installed for water extraction. Ground water is the most available source for most areas of Belize. The high rainfall and short duration of the dry period allows for adequate quantities of water in the aquifer.

Wells will be drilled with percussion drilling equipment and cased with PVC pipe. An intake screen (at the bottom of the casing) will serve as protection for the pump. The pump will be placed on a concrete slab of a minimum area of 25 ft<sup>2</sup>/ which has been properly drained. The specific configuration and design features of pump pad will be developed. The currently used EHS pump pad design does not meet acceptable standards. The pump pad must drain water a minimum of 25 feet from the pad before being released to surface drainage or to soil percolation.

Wells will be allocated according to the WHO standard of one well per 10 families which, with an average Belizean family size of six, this allows for 60 people per well. Variations in the criteria are acceptable for "ribbon developed communities",

communities strung along a road or river bank. Specific well siting will be determined by villagers with assistance from the PHI and village health councils. The initial cost for tubewells and handpumps is estimated to be U.S. \$33.00 per user with an average annual maintenance cost of U.S. \$12.00 per family.

## 2. Gravity-Rudimentary Community Systems

The gravity rudimentary community system is the cost-effective system of choice if certain conditions are met. There are several gravity systems currently in use in Belize but for the most part they are not considered viable alternatives. Several regions of the country have the potential for gravity water systems. Areas in Stann Creek and western Cayo appear to be conducive to surface exposure of ground water. The opportunity for gravity sources will be identified in the Project and, in coordination with the villages, considered as a viable alternative to deepwell or surface sources.

A gravity system design for the Project will consist of a spring capturing structure, a delivery mainline to the village, ground storage with spread reservoirs, and community standpipes and/or house connections. House connections, if selected as the option, will be paid for by individual households. Siting and design of the reservoir will be highly dependent on terrain, distance to source and spring water production. The unit cost for this alternative is estimated U.S. \$128.00 per capita with an annual maintenance cost of U.S. \$18.00 per family.

## 3. Surface Water Rudimentary Community Systems

Surface water may be the only viable source for some communities to use as a public water supply. If the surface is protected, and considered to be safe, the water can be used without treatment as a water source for the community. If the surface water is contaminated technology treatment will be needed. The surface water treatment process would consist of pre-settling, sedimentation and slow sand filtration. A surface water system would require a pump, generator and elevated storage.

The Project will fund water main lines and community distribution lines. Household connections will be paid for by the individual families. A significant level of community participation will be required to prepare trenches, contribute local materials, assist in the construction of elevated

storage, and in the operation and maintenance of the system. The cost per capita for the surface water system is estimated to be U.S. \$166 with a U.S. \$156 annual operating and maintenance cost per family.

#### 4.a. Water Storage - Ferro-cement

Vat water (rainfall captured by roof tops and stored by the house) is a common source of water for drinking purposes throughout Belize. This water is preferred as drinking water because of taste but in most cases is not adequately protected and managed. An important element of this project is to develop appropriate technologies for constructing vat storage and roof-top catchment systems to assure adequate protection against contamination. The management of the stored vat water as a dependable source of water over the dry period will be needed to transfer ferro-cement technology and other techniques for lubricating vats for village uses.

Vat water is generally not considered to be a safe and dependable source of water under normal operating conditions. In many situations, however, this vat water can be the sole source of drinking water in the dry season. Educational media and technical intervention techniques will be field tested to determine the optimal use of vat water for drinking purposes. This Project will not directly support the use of rain water catchment systems but will indirectly assist the EHS in determining the strengths and limitations of this technology.

#### 4.b. Water Storage - Galvanized

Galvanized water storage vats are the most common storage vessels in Belize. These vats are for the most part made by the local Mennonites. They are readily available in most of the central and northern district towns. These vats eventually rust out, more quickly in locations close to the ocean where salinity is high. A 500 gallon galvanized vat would cost approximately U.S. \$74.00 per capita.

#### 4.c. Water Storage - Concrete

Large concrete storage vats are common in the district towns and in Belize City. These concrete tanks are built directly on the ground and usually require pumps to supply operating pressure to pump water to homes. This system costs about U.S. \$83.00 per capita; excluding pumping cost.

## 5. Latrines

Essential to the improvement of environmental sanitation and complementing effective handpump and rudimentary water systems, will be the provision of household latrines for 18,000 beneficiaries. Alternative sanitation devices will be used in selected sites as demonstration projects. These alternatives will include ventilated improved latrines, aqua privies, septic tanks and composting privies. For the majority of sites pit latrines with improved risers, structures, pit lining, and site selection will be used. The pre-project survey data indicated a high level of need for materials and technical assistance in latrine construction.

The Environmental Health Service has in the past supplied slabs and siting assistance for latrine construction. The Project will build on the existing institutional capability by supplying molds, riser material, and tools, for communities to assist in constructing sanitation devices.

Communities located along the coast and in low lying mangrove swamps have high ground water and sandy soils. These communities presently use bucket latrines with ultimate disposal to the surrounding land or the sea. These regions will be sites for operations research and training in alternative sanitation devices. In all cases the village assessment, sanitary survey, and technology selection will incorporate community acceptance early in the process. Details on this process are presented in Role of the Community section of Project Activities II C3.

The Project budget supports the construction of 3000 latrine slabs. Risers and privy structures will be supplied by the individual family with technical assistance from project staff and the village health committee. The estimated cost of the slabs given in the Project Paper are based on local contracted cost for fabrication of slabs. The cost savings with the use of local labor and material will extend latrine coverage. Estimates of from 20-35% cost reduction due to community assistance has been obtained from in-country sources.

Table 1

WATER SYSTEM COST DATA  
(In U.S. Dollars)

Type of System	System Size No. of Users	Capital Cost Per User	Operating and Maintenance cost Per Family/Year
1. Tubewells-Handpumps <sup>1</sup>	60	\$ 33.00	\$ 12.00
2. Rudimentary-Gravity <sup>2</sup> Source	300	128.00	18.00
3. Rudimentary - well <sup>3</sup> pump - generator	500	151.00	118.00
4. Rudimentary system <sup>4</sup> surface water/pump	500	166.00	156.00
5. Water Storage Ferrocement-500 gal.	6	43.00	minimal
6. Water Storage Galvanized metal - 500 gal.	6	74.00	minimal
7. Water storage concrete 500 gal.	6	83.00	minimal

1. Based upon drilling cost, complete handpump cost, and PVC casing.
2. Based upon 2 mile distance to source - only main lines through community with individuals paying for house connection.
3. Same as number 2 except with a tubewell, submersible pump, and generator.
4. Same as 2 except for surface water treatment (pre-sedimentation, coagulation, filtration).

### c. System Design

The Environmental Health Service has developed a standard design for well pads and latrine slabs which does not utilize locally available material and minimally involves the community in the siting, construction, maintenance and repair of the system. Work on a new standard design for the various water and sanitation technologies needs to insure both effectiveness and use by the community. For example, the Dempster pump should be eliminated as a component in tubewell programs. Pump pads need to be redesigned to consider adequate drainage. Alternative designs for rudimentary systems need to be considered as well as ferro-cement storage vats and techniques to insure water quality protection of vat water. Different types of spring capturing structures need to be developed for various types of springs. The opportunity exists, with this project, to develop standard designs which take into account the geological and terrain variations of Belize.

#### Criteria and Conditions for Selection of Water and Sanitation Alternatives

1. A tubewell and handpump for each 60 people in a rural village - WHO criteria one well for each 10 families.
2. Rudimentary water systems for each village larger than 250 people.
3. Between 10 and 20 gallons/per capita, dependent on local conditions.
4. PVC pipe used for all tubewell casing.
5. Conduits PVC for all household connections should be a minimum of 1" in diameter.
6. Handpump systems designed for a 10 year life, rudimentary systems designed for a 20 year life.
7. Reservoir storage should be designed at 50 gallons/per capita. This allows for approximately 48 hours reserve storage.
8. One latrine per family, located no closer than 200' from a well or other drinking water source.
9. All mainlines and distribution lines buried.

### d. System Construction, Operation and Maintenance

#### 1) System Construction

The construction of the water supply systems and sanitation devices will be supervised by the District PHIs. The degree of supervision by the District PHI, the Senior PHI, and the WS/S Advisor will depend on the complexity of the particular system. The Village Health Committee will be responsible for construction of latrines, digging trenches, etc. Before the

installation of village handpump systems, a map of the village will be prepared. It will include home sites, latrine sites, schools, churches, existing wells, and the site of the proposed well. The map will also include the proposed drainage scheme and the proposed latrine sites. A plan view drawing of the pump pad with specific information for the drainage plan will also be required.

The actual well drilling will be done by the EHS drilling crew, scheduled by the Senior PHI. The village will contribute to the process by supplying water for the drilling operation, if necessary, food for the drilling crew and security of the rig during non-working hours. The community members, with supervision from the District PHI, will pour the pump pad based on EHS specification and specific site design features as indicated on the plan. The pump maintenance crew will then install the pump in the tubewell. This will be done with assistance of the village pump caretaker and other members of the village health committee. This will be the first of a series of on-the-job training activities planned for the selected pump caretaker.

The Senior PHI for water supply and sanitation will perform the final inspection on the tubewell installation, pump pad construction, and pad drainage system to assure quality standards for the management of their construction. At the time of installation, a water quality test will be made for dissolved minerals, pH and color. A more complex microbiological analysis will be made of the well water in years 2, 3, and 4 of the project, as the laboratory begins to function.

Installation of community water systems will follow a process similar to the village handpump system. A map will be required which identifies all the distance factors for a sanitary survey for the proposed alternatives. A complete hydraulic profile of the community systems from pump to reservoirs including all watermains will be done. Construction drawings will be required for any elevated storage or spread reservoirs. A detailed construction plan will be made which includes the scheduling of trenching, reservoir construction and materials. The District PHI with assistance of the Senior PHI will review this plan and coordinate construction activities with the village health council and the village pump caretaker. A final inspection will be performed by the Senior PHI and the WS/S Advisor.

Gravity and surface water systems will follow a similar construction management scheme. The project management personnel will make every effort to enlist village volunteer

labor for the construction of all aspects of the project. The installation of pumps and generators will be handled by the pump maintenance crew. At the present time, they do not have this responsibility but during the project will be trained to install these systems.

Construction of the water quality laboratory will be done on the grounds of the Matron Roberts Health Center in Belize City. The plans will be prepared by the Ministry of Works and approved by USAID with the construction going out to bid. Inspection will be performed by Ministry of Works engineers and appropriate USAID personnel.

## 2) System Operation and Maintenance

Maintenance is viewed as a critical element of the water supply program. The Project is designed to strengthen this element. The designation of the Mark II handpump as the standard for EHS water projects will reduce the present frequency of pump malfunctions. This decrease in pump malfunction will result in reduced cost of repair, simplify maintenance requirements and will contribute to an overall reduction in cost. The GOB has demonstrated a commitment to pump maintenance with their existing program. The maintenance crew will be trained in Mark II pump repairs. They will also assume the training of village pump caretakers. The role of the maintenance crew will evolve into a 50% repair and 50% training function.

At the present time there are approximately 450 Dempster pumps in Belize with an average age of 6 years. The existing Dempster deepwell pumps as they break will be replaced by the Mark II. Some of these Dempsters can then be rebuilt for use as family deepwell or shallow well pumps. An alternative to supplying 60 people (10 household water with one community pump) is to supply each group of 10 to 15 people (2-3 households) with a rebuilt Dempster. The reduced use of a pump in this setting is more in line with the original design criteria for the Dempster pump. Ribbon communities, along major highways, lend themselves to the use of rebuilt Dempsters.

The village contribution to tubewell and pump systems will be identified early in the planning process. As discussed in the section entitled Role of the Community the initial assessment of needs and identification of alternatives will specify the community's view of needs for pump maintenance and well pad drainage. Health education concerning the consequences of poor drainage, pump malfunction, and ground water contamination will be taught during community development activities. Training on Mark II pump maintenance and repair,

will be given to all village pump caretakers. The EHS pump maintenance team will monitor the schedule for the handpump repair. Maintenance requirements for the pump pad will also be defined.

The use of a revolving fund for repairs for the handpump and pump pad will be slowly integrated into the Village Council's responsibilities. The first step in any revolving fund program is to develop credibility for the handpump. The equipment must have value before community members will contribute to its upkeep.

Rudimentary community water systems have much greater repair and maintenance requirements than handpump systems. Within these systems, the pump, generator, storage reservoir and mainlines all require routine maintenance. Various treatment processes also require extensive operational requirements. This requirement must be fully examined in the initial assessment so that village committees may make appropriate decisions. It is not envisioned that many rudimentary water systems will be selected as appropriate to community needs.

Community systems, requiring tubewells and pumps, are expected to be the most common selection of communities of populations between 250 and 800 people. The major operation and maintenance requirement will be the generator if electricity is not available. Many villages of this size do not currently have electricity, therefore the EHS pump maintenance team will be trained to repair and maintain portable generators and pumps. A critical consideration in a community water system is managing the addition of increased standpipes and/or household connections. The Village Council will play a strong role in making these decisions and in monitoring the expansion of the community water systems. These factors will be identified early in the assessment and technology selection phase.

#### e. Technology Selection Criteria

A critical element in the project design is the involvement of the community in selecting technologies, materials, and management systems to meet their water supply and sanitation needs. To promote this process in an orderly and efficient manner, significant community motivation and education is planned. This approach is based on the concept that communities that are involved in all phases of solving their water and sanitation problems are more likely to do the required operation, maintenance, repair and management.

Some villages are presently involved in solving their own problems in Belize. The Project will build on the existing community participation potential by providing this significant motivation, education and training component. A handbook will be developed by the GOB with assistance from the Project Management Team, which will present the technical aspects of the various systems considered viable in Belize for supplying water and sanitation. (The format, syntax, and language will be designed to reach target ethnic groups). The information on each water and sanitation system will include: design features, specifications, social/culture factors, materials, alternative materials, labor requirements, operation and maintenance considerations, and cost data. The Village Council together with the District PHI and Senior PHI will select the appropriate system based upon the village assessment of needs and the availability of water and local materials. The emphasis in this selection process will be on identifying community human resources and areas of technical assistance needs.

The economic analysis done of available systems for Belize indicates that tubewells with handpumps are cost effective for dispersed village rural communities of under 250 people. For rural communities greater than 250, which are densely settled, rudimentary systems with tubewells and storage reservoirs are cost effective. Under all situations the most cost effective solution will be selected as the alternative of choice. Cost effective choices depend on the factors such as the availability of local materials, the source of water, amount and quality of volunteer labor as well as meteorological and geological conditions.

#### F. Environmental Concerns

The IEE has been prepared with a negative determination. At the P.I.D. Review, the DAEC Committee requested additional information on the use of program insecticides. The Initial Environmental Examination (IEE) is provided as Annex H. The insecticides to be used in the Belize Malaria and Dengue Control Program are those commonly used in other such vector control programs around the world. Numerous environmental studies and assessments have already been undertaken for these chlorinated hydrocarbons and organophosphorus insecticides, and all have concluded that these compounds if properly applied have a favorable risk-benefit impact on the environment. In view of these studies and the fact that Belize has not experienced any past or present health problems in its spray operations due to the safeguards built into the program such as adequate supervision, regular and refresher training, and proper storage and distribution practices, the Mission has concluded that no

further environmental analysis is required and recommends a negative determination. If new chemical, biological, or physical malaria control methodologies are introduced into the program after the approval of this project, the environmental impact will be reviewed, and, if necessary, environmental studies or assessments will be carried out.

The DAEC review requested that the Agromedical pesticide interactions be reviewed to obtain which insecticides are used in Agriculture and if these insecticides would interfere with the application of insecticides in the NMCS and AACP.

Discussions were held with Mr. R. Neal, Acting Principal Agricultural Officer in the Ministry of National Resources; Mr. James Martly and Mr. Richard Dunn of the Crop Protection Section at the Central Farms of the Ministry of Agriculture; and the manager of the leading pesticide importer, Prosser, on this subject. In brief, Belize uses only limited amounts of pesticide of any kind in the Agricultural Sector in response to focal outbreaks of insect pests except in pest control in the raising of vegetables where malathion is presently the insecticide of choice. Details of the discussion are presented in Annex Q.

## G. Project Issues

### 1. National Action Committee on Water Supply and Sanitation

The Government of Belize is presently implementing rural water supply projects in four ministries: the Ministry of Health, the Ministry of Works, the Ministry of Natural Resources, and the Ministry of Energy and Communications' Water Supply and Sewage Authority (WASA). The MOH five year Health Plan proposes that a National Action Committee be formed to assist in the redirection of all rural water supply and sanitation projects to a single ministry. The need for this alignment has been recognized by the GOB but implementation of this policy has not happened. At the present time the Ministry of Health has the official responsibility for supplying safe water and effective sanitation to the rural communities. It is proposed that rural water supply and sanitation projects, UNICEF, CARE-AID, and USAID, will be institutionalized with the Ministry of Health. The combined beneficiaries of these three new projects will be approximately 65,000 people in the rural areas, which is approximately 40% of the total population. The institutionalizing of these three projects within the MOH, the implied sector responsibility, and the MOH's institutional capability to execute water supply and sanitation projects strongly suggests that this policy be implemented.

## 2. Pump Selection: MARK II

The UNICEF project, in the Toledo District, highlights Belize's need to evaluate existing pumps and to standardize on one particular type of handpump. The India Mark II pump has been chosen by the MOH based upon its reliability in third world settings, its ease of maintenance and repair, its competitive price, and its widespread use, which insures availability of spare parts. Input from World Bank evaluation reports and case study papers as well as discussions with PAHO, UNICEF, and CIDA technical advisors were used in selecting the Mark II pump.

The process and information base the MOH used for selecting the Mark II pump, is considered technically sound. Further information obtained during the development of the Project Paper reaffirms the decision in selecting Mark II as the handpump of choice for rural Belize water supplies.

- (1) 600,000 installed in the India Rural Water Supply Project.
- (2) Production 100,000 units per year under Crown Agents Quality Control.
- (3) Exported to some 30 LDCs.
- (4) Further research being carried out in Coimbatore TN India to simplify the maintenance factor to village level, or the sub district mechanic through the use of plastics.
- (5) Production is being established in Africa in East and West Regions under UNDP and UNICEF.

The Mark II pump can be obtained through UNICEF/New York from one of the 25 qualified manufacturers for approximately \$308.00 (delivered price). This price includes pumphead, cylinder, 100 ft galvanized pipe, and connecting rods and any additional shipping cost. The actual cost will vary in Belize depending on the number of pumps ordered. This price compares to the estimated cost of \$350 for the U.S. manufactured Dempster pump.

Maintenance requirements on the Mark II are minimal and easily accomplished by a village pump caretaker. Minor repairs on the Mark II pump require the technical skills of a bicycle mechanic. Repairmen with these skills do exist within or close to all villages and rural communities in Belize. The present MOH maintenance and repair crew have the capability now to perform major repair tasks on the Mark II. They will be targeted for specific training in the repair of the Mark II pump.

### 3. Water Monitoring

This project will develop a laboratory capability to do inorganic chemical and microbiological analysis in order for the EHS to monitor rural water quality. This laboratory will begin to function in the second year of the Project.

There is limited use of agricultural pesticides in Belize at the present time. The use of pesticides will, however, increase as the agricultural sector develops. The present risk of water supplies being contaminated by local application of pesticides or by aerial release of pesticides is considered to be low. At the present time no capability exists to analyze water for pesticides nor is there expected to be capability in the near future.

The high capital cost for laboratory instruments, high recurrent costs for pesticide testing and the need for a high level of trained manpower, coupled with the low risk of contamination, precludes pesticide residue testing from consideration as a function of the MOH Water Quality Monitoring Laboratory.

### 4. Health Education/Community Development/Training

A strong health education/community development/training element has been developed for the water and sanitation component. The Project will provide a technical advisor for three years to assist the MOH's Division of Health Education and Community Participation to organize community support for water and sanitation efforts, to develop health education materials and programs, and to plan, develop and evaluate the training of EHS personnel in health education community development activities. In addition to the long term advisor, five months of short term technical assistance is included. Both long and short term technical advisors will be expected to identify and incorporate social and cultural information into the community development/health education/training activities.

#### IV. PROJECT IMPLEMENTATION

##### A. A.I.D. Arrangements

###### 1. Project Monitoring

Project management responsibility will rest with the Mission's General Development Officer (GDO), who will be assisted by the Mission's Controller and the Administrative Section. USAID expects that the the GDO direct hire position will be filled no later than March, 1985.

USAID, given its staff limitations, will depend on a senior Project Manager, with at least five years of international operational experience in the management of health projects in developing countries, who will be provided under a master contract with a qualified American firm. This Project Manager will serve as technical advisor to the MOH over the life of the project, and will be located in Belize City at the USAID Mission.

The Project Manager will serve as project liaison officer with day-to-day contact with the NMCS, and the Department of Environmental Health including the AACP. S/he will work closely with the project financed long and short-term consultants to insure that the project is implemented in a timely manner. S/he will also work closely with the GDO to insure complementary implementation and close coordination with other Mission assisted health activities, i.e. CARE OPG. This coordination is deemed critical to the successful implementation of both project components.

The GDO will participate in donor coordination meetings at a technical level every two months. Policy level donor coordination meetings at which A.I.D. will be represented by the A.I.D. Representative are anticipated to be held every quarter. The donor community in Belize active in health and water and sanitation includes, in addition to USAID and Peace Corps, CIDA, UNICEF, CARE, ODA and PAHO.

###### 2. Disbursement Procedures.

Most of the AID provided grant funds will be used for procurement of goods and services requiring dollar payment to be undertaken through the procurement procedures and facilities of USAID, the Regional Contract Office at RDO/C in Barbados or AID/W, as appropriate. A relatively minor element of the project to be financed by AID funds under the master contract will result in Belize dollar expenditures, and these can best

be handled through the procedures of the contractor. Examples of such expenditures are the salaries of a secretary, gasoline and service for the vehicles assigned to the long term consultants, in-country air transportation, normal office supplies and equipment, training supplies, operations research activities, etc.

Such expenditures may be met from an advance funding authorization which may not exceed the requirements for the ensuing three months, and for the use of which the contractor must account to the USAID controller.

### 3. Procurement Procedures

#### a. Technical Assistance

This Project will finance a total of 189 person months (PM) of technical assistance consisting of 3 long term advisors for 132 PM (expected to arrive in June, 1985) and 57 PM of short term technical assistance.

Technical assistance will be provided under:

i. A master contract negotiated by RDO/C's contracting officer in accordance with A.I.D. procedures, with a capable U.S. firm. The Mission, in response to the Gray Amendment, anticipates contracting with an 8 (a) firm. (185 PM)

ii. In addition, a PASA will be negotiated with the Centers for Disease Control (CDC). (4 PM)

PAHO, UNICEF and CARE will also be providing a limited amount of technical assistance in collaboration with the MOH during the life of the A.I.D. project. The consultants provided under the master contract will work closely with the local PAHO office to insure that the technical assistance is complementary.

#### b. Commodities

The commodities required under the Project include: vehicles, motorcycles, ULV fogging machines and sprayers; training, administrative, health education and research equipment; anti-malaria drugs; supplies and equipment for the operations research and laboratory activities; drilling rigs handpumps and parts, lab testing equipment, tools, educational materials, centrifugal pumps, generators, etc.

To ensure that insecticides and anti-malaria drugs are procured in a timely and efficient manner throughout the project, the Mission will handle all insecticide and anti-malaria drug procurement with assistance from SER/COM, AID/Washington, in accordance with A.I.D. policies and procedures for direct competitive procurement.

Utilizing the services of the Regional Contracting Officer (RCO) at RDO/C, the Mission will also procure directly the vehicles, ULV machines, well drilling equipment, etc. The RCO will select suppliers on the basis of standard competitive procurement procedures, except for certain spray equipment which will require waivers (see Section VI).

#### c. Operations Research

There are a number of operations research activities proposed for this project. Where appropriate grant(s) to the University of the West Indies will be awarded by USAID and/or to the master contractor and/or to the CDC under the PASA to carry out specific operations research activities. A.I.D. procedures will be followed in announcing, awarding and evaluating the research efforts. In addition, the operations research activities will be reviewed with PAHO with respect to technical soundness prior to contract signature.

#### d. Construction

Construction activities will be carried out under host country contract which will include the construction of a small vehicle repair facility, three small storage and office units, a small office facility, a small storage/office unit, and a small water quality testing laboratory.

#### 4. Methods of Implementation and Financing

The Mission proposes to use only preferred methods of payment authorized by the Payment Verification Policy Statements. No special justification is therefore required.

<u>TYPE OF ASSISTANCE</u>	<u>METHOD OF IMPLEMENTATION</u>	<u>METHOD OF PAYMENT</u>	<u>APPROX.AMT. OF ASSIST. (\$000)</u>
Technical Assistance	Direct AID Contract	Direct Reimbursement	\$2,627
Operations Research	Direct AID Contract	Direct Reimbursement	149
Training	Direct AID Placement	Direct Payment	324
Construction	Host Country Contract	Direct Reimbursement	165
Commodities	Direct AID Contract	Direct Payment	2,266
Evaluations	Direct AID Contract	Direct Reimbursement	<u>134</u>
		SUBTOTAL	\$5,665 505
Inflation			
Contingencies			616
Additional Allowance for Contingencies			<u>214</u>
		TOTAL	<u>7,000</u>

A complete institutional analysis of the Ministry of Health, Labour and Sports' contracting, commodity procurement and payment verification procedures was not made, since all procurements and payments will be handled by AID. The USDH Project Officer will administratively review and approve contractor's and other invoices for payment. The commodities purchased under this project will be under the control of the National Malaria Control Service for the malaria activities, under the control of the Aedes Aegypti Control Program for the dengue fever activities and under the control of the Environmental Health Service's rural water and sanitation component. An assessment was made of the internal controls that the Ministry has in place for controlling inventories.

Currently, the National Malaria Control Service is storing and accounting for other donor commodities which are primarily insecticides and medicines for combatting malaria. The existing inventory is valued at \$13,000. Control of existing inventory is maintained through a ledger account by type of product which is adequate to show date of receipt, invoice number, quantity received, quantity issued and balance of stock on hand. The signature of the receiving person and date are also shown. The system does not provide for approved

requisitions as the basis for issuance and the responsibility of receiving and posting the ledger is vested in one person. The inventory is stored in a secured, well constructed building. Due to the deficiencies of this setup, technical assistance in inventory management will be furnished.

The Aedes Aegypti Control Program and the Environmental Health Service's rural water and sanitation program do not have inventory or spare parts currently in stock. This unit purchases parts on the local market as they are needed. They currently have no stock records or current inventory control procedures. Again, technical assistance will be furnished early in the project so that adequate internal control systems are established.

The Mission has not budgeted any funds for audit coverage, since implementation will be through AID direct contracts and direct placement of participants by AID. Under these circumstances, audit coverage will be provided by the Inspector General. Financial reviews as needed will be made of inventory controls.

#### B. Implementation Plan

Project activities are planned to occur over the period FY 1985-1989. It is expected that the Project Agreement will be signed in February 1985. The Project Assistance Completion Date (PACD) is May 31, 1989. The proposed implementation schedule for Components I and II is presented in Tables I and II in this section.

##### Management Support Unit

The activities to be implemented in Components I and II will be fully supported by the technical assistance assigned to the Management Support Unit.

The Project Manager (48 PM) and the Community Development/Health Education/Training (CD/HE/T) Specialist (36 PM) are expected to arrive in Belize as soon as possible after the Project Agreement is signed. A May 1985 arrival is anticipated. The Project Manager will be allowed two days in Washington en route to Belize to confer with AID/W technical staff.

Short term technical assistance in CD/HE/T (total of 5 PM) is anticipated during Years 3 and 4.

The Vehicle Maintenance Specialist (10 PM) is expected to arrive in May 1985. A total of five additional months (2 follow-up visits) are required in FY 87 and FY 88.

Two vehicles and office equipment will be procured in FY 85.

Malaria Control and Aedes Aegypti Control Component

Immediately upon signing the Project Agreement A.I.D. will initiate procurement of (1) seventeen motorcycles, six pick-up trucks, one boat with 18 HP motor and trailer (for the boat) and four bicycles with rack for \$105,000; (2) three ULV sprayers, compression sprayers, malathion (91%), operational equipment for \$120,000 and (3) \$15,000 of anti-malaria drugs for a total of \$240,000. The order for the pick-up trucks would be reduced to four vehicles (one for Malaria and three for AACP) if the Assistant PHI and Aedes Aegypti Asst. Inspector are not recruited for the AACP and not confirmed by the GOB.

Prior to signature of the Project Agreement, PIO/Cs will be prepared and will be signed at the time of the Project Agreement. The PIO/Cs will be prepared as soon as possible after project approval is obtained with the assistance from SER/COM. Draft specifications for the required items have been prepared by the PP Team and are included in Annex L.

The scope of work for the contract required for implementation of this project are described within the Project Paper and should be completed immediately. The negotiation process with qualified 8 (A) firms should begin with inquiries as to expression of interest. Upon receipt in LAC/DR/HN of letters of interest, a request for a proposal should be made to those qualified 8(A) Firms with a 30 day time limit set for receipt of the proposal. A review panel of LAC/DR/HN and S and T/H will screen the top three proposals and send these proposals to USAID/Belize for final selection with the GOB. In the event that no 8 (A) Firm is found to be fully qualified, the RFP process will be developed between LAC/DR/HN and the concerned contracting offices for the long term contract.

The in-country chloroquine-resistance study will be provided through an agreement with the Centers for Disease Control (CDC) on a trip by trip basis using project funds to support travel, per diem and local costs including vehicle rental.

Over the Life of the Project (LOP), approximately 24 person months (PM) of short term technical assistance at a cost of \$345,000 is provided by project funding. This technical assistance covers a wide range of skills including operations, training, research, entomology and epidemiology.

The project has major components of training and operations research to improve NMCS and AACP technical and operational skills. Comprehensive programs in both areas have been scheduled over LOP. The training component includes graduate training at a School of Public Health in the U.S. for a two year period in the field of epidemiology during the period from September 1986 - July 1988. Short term training includes twelve (12) short term courses in vector control, sixteen (16) observation tours in the Region and the U.S.: training in vehicle maintenance and support for local training of 360 village volunteer collaborators. The training element will provide \$254,000. The Operations research includes social, operational and technical activities for malaria and Aedes aegypti control. The funding for operational research is estimated at \$126,000 over LOP. (See Annex 0 for detailed description).

Evaluations for the project are to be performed in FY 1986, FY 1987, and FY 1989 with the first evaluation to be carried out in September, 1986. This evaluation is expected to span approximately two weeks with the primary purpose of insuring that Project support and materials from A.I.D., GOB and PAHO are being provided as planned and that training and operation research are being initiated; and the malaria and dengue epidemics are being contained. All three evaluations are to be joint GOB/AID/PAHO activities with clear terms of reference developed by the GOB. A representative of S and T/Health, A.I.D./W will participate in all evaluations as a team member. A total of \$56,000 is included for evaluation activity support.

A plan of action covering the FY 1985 period will be finalized and approved by the GOB. Each year a specific plan of action will be submitted by October 1 which outlines the following year's planned activity in detail.

#### Water Supply and Sanitation Component

This component of the Project will provide 48 persons months of long term technical assistance and 14 person months of short term assistance.

At the start of the Project in 1985 the procurement of vehicles, drilling rigs, and drilling rig parts will be priority activities. Allowing for a four month turn around on the commodities they should be in the field by August 1985. Delivery time will be approximately 4 months for the handpumps, 3 months for the drilling rigs and 4 weeks for the vehicles.

The Principal PHI will leave for short-term (6 weeks) training and site visits upon the initiation of the project. The schedule of training activities will be specified by a WASH/USAID consultant.

The WS/S long-term Advisor will arrive in Belize in June 1985. This person will be expected to spend 2-3 days in AID/W to be briefed before traveling to Belize. Upon arrival, the WS/S Advisor will immediately initiate activities associated with village assessments, technical assessment of District PHIs maintenance and repair systems and community participation and health education. In October 1985 an Appropriate Technology short-term Advisor (A.T.) will assess water supply and sanitation technology and related social cultural factors. Information from this assessment will be used to develop a handbook to be used in community participation. Upon completion of this assessment this A.T. Advisor will plan and implement workshops. In May of 1985 the construction of storage facility, laboratory, and office building will be initiated. The plans and specifications will be completed prior to that time by the Ministry of Works and the EHS staff. The structure will be built on MOH/EHS property at the Matron Roberts Health Center in Belize City.

During Year 2 of the Project the Senior PHI for Rural Water Supply and Sanitation will begin an out-of-country training program consisting of short courses and site visits to similar handpump and rudimentary system projects in the region. This will be scheduled after the Principal PHI returns from his training.

By August 1985, the new trucks on which the old percussion rigs will be mounted will arrive. The parts for rebuilding the rigs will be available at that time and those drilling rigs will be rebuilt by August of 1985. (One of the new drilling rigs will be made available to CARE/USAID in Orange Walk and Corozal districts).

The first evaluation will occur in September 1985. This evaluation will focus on the procurement process, the village assessments, and community development efforts. Although village assessments and community development activities will occur throughout the life of project, the majority of the community development effort will occur in the first 24 months.

Well and pump maintenance training programs will be initiated in November of 1985 and continue through February of 1986. This activity will complement community development activities and identify village pump caretakers. All of the above activities will be coordinated by the Community Development/Health Education/Training long term Advisor. Methods, techniques, and media appropriate to beneficiaries will be developed and used for training activities.

In September 1985 a short term Drill Rig Specialist will assist the MOH drilling crews in developing maintenance programs, logging techniques, and drilling techniques. In June of 1986 the second Appropriate Technology Advisor will initiate short A.T. courses for a group of villages selected by the Senior PHI for Rural Water Supply and Sanitation.

The second procurement, scheduled for October 1985 will include pumps, generators, laboratory equipment and supplies, and laboratory furniture. Additional procurement is scheduled for October of 1986 and 1987. A Water Quality Laboratory Advisor (WQL) is scheduled for August 1985 and July 1987, for 12 weeks, to assist in setting up the water quality laboratory and in training the local laboratory technician.

Community development workshops be carried out for 16 weeks in FY 1986 and for 20 weeks in FY 87 as communities are identified for projects based upon health factors and self help committment. A three week assignment by an A.T. Advisor is scheduled for June 1986 to contribute to community development workshops and prepare documentation for media development in appropriate technology.

An evaluation in September of 1986 will focus on the technical aspects of the project; these include the implementation of tubewells, handpump installation, latrine construction, rudimentary water systems, and the success of alternative technologies. The third evaluation, scheduled for September 1987 will include technical engineering aspects similar to the second evaluation in addition to assessment of the progress of community development, health education and training activities. The fourth evaluation is scheduled for March, 1989.

Community development workshops will resume for 16 weeks into FY 1988 with increased emphasis on self help and appropriate technology. The well maintenance and pump training activities will continue through the last quarter of the project to insure that village maintenance program is fully operational.

The Senior PHI for Water Supply and Sanitation will go on a second observation/study tour of handpump and rudimentary water systems in the region in FY 1988.

Water and Sanitation Systems To Be Installed

	Year 1	Year 2	Year 3	Year 4	Total
Handpumps					
New	20	70	65	95	250
Replacement	60	70	65	55	250
Rudimentary Systems	3	11	9	3	26
Latrines	-	1,000	1,000	1,000	3,000

TABLE 1  
 PROPOSED PROJECT IMPLEMENTATION SCHEDULE  
 1985-1988  
Malaria - Aedes Aegypti Component

	<u>Technical Assistance</u>	<u>Training</u>	<u>Operations Research</u>	<u>Commodity Procurement</u>	<u>Evaluation</u>	<u>Construction</u>
<u>FY 1985</u>						
Feb		CVC-M(6wk)		1)Procurement		
Mar		CVC-A(6wk)				
Apr						
May	EPI-M1(4wk)					
Jun	EPI-A2(2wk)	US OBS-A(2wk)		1)Arrival		
Jul	ULV (4wk)	US OBS-M(2wk)	(Begin Alt.			
Aug	ENT-M(4wk)//TRN(6wk)	VEH.MEC(6wk)	Control Methods			Const.
Sep	ENT-A(2wk)	LOC.TRN-M(1 day)x200	Study (2yr))			Const.
		LOC.TRN-A(1 day)x17				Const.
<u>FY 1986</u>						
Oct		ENT. Course-M(6mo)				
Nov	MGT-M(4wk)			2)Procurement		Const.
Dec	MGT-A(2wk)		Comm. Attitudes			
Jan						
Feb						
Mar		CVC-A(6wk)x2	CVC-M(6wk)x2	2)Arrival		
Apr	ENT-M(2wk)//RES-M(2mo)					
May	ENT-A(2wk)//RES-A(2wk)	REG OBS-A(2wk)x2	Insecticide Tr.			
Jun	EPI-M(1wk)//ULV(6wk)	REG OBS-M(2wk)x2				
Jul	EPI-A(1wk)//TR(2wk)	LOC TRN-M(1day)x200	DDT. Test			
Aug		LOC TRN-A(1 day)x17	Chlor-Resist.			
Sep		Begin L. Term	Testing			
		Ph.D. Trn (2 Yr)			EVAL.	

1. Malaria Control Program
2. Aedes Aegypti control prog.

	<u>Technical Assistance</u>	<u>Training</u>	<u>Operations Research</u>	<u>Commodity Procurement</u>	<u>Evaluation</u>	<u>Construction</u>
<u>FY 1987</u>						
Oct						
Nov						
Dec	MGT-M(2wk)		Comm. Attitudes	3)Procurement		
Jan						
Feb		CVC-M(6 wk) x2	Larvicide test.			
Mar		CVC-A(6wk)x2		3)Arrival		
Apr		REG OB-M(2wk)x2	Insecticide test.			
May	ENT-M(2wk)//RES-M(2mo)	REG OB-A(2wk)x2	Biocontrol			
Jun	RES-A(2wk)		Chloroquin			
			Resistance test.			
Jul	ENT-A(2wk)//ULV(4wk)	LOC TRN-M(1 day)x360	Fish			
Aug	TRN(2wk)	LOC TRN-A(1 day)x17				
Sept					Evaluation	
<u>FY 1988</u>						
Oct						
Nov	MGT-M(2wk)					
Dec			Comm. Attitudes	4)Procurement		
Jan						
Feb		CVC-M(6wk)	Larvicide test.			
Mar		CVC-A(6wk)	Biocontrol	4)Arrival		
Apr	ULV(4wk)	REG.OB.-M(2wk)x2	Insecticide tests			
May	ENT-M(2wk)//RES-M(2mo)	REG.OB-A(2wk)x2	Chloroquine			
			Resistance			
Jun	ENT-A(2wk)//RES-A(2wk)			5)Final PROC.		
Jul	EPI-M(1wk)//EPI-A(1wk)	US OBS-M(2wk)	DDT. test.			
Aug		US OBS-A(2wk)				
Sep		LOC TRN-M (1 day)x360		5)Arrival		
		LOC TRN-A (1 day)x17				
<u>FY 1989</u>						
Oct						
Nov						
Dec						
Jan						
Feb						
Mar						
Apr						
May						

TABLE 2  
PROPOSED PROJECT IMPLEMENTATION SCHEDULE  
FY 1985 - 1988

Assistance	<u>Technical</u>	<u>Training</u>	<u>Water and Sanitation Component</u>		<u>Construction</u>
	<u>FY 1985</u>		<u>Commodity Procurement</u>	<u>Evaluation</u>	
Feb					
Mar			PROC		
Apr		PHI #1 (6 wk)			
May					
June	RS/CD (3 mo); WS/S 48 (mo); CD/HE/T (36mo)				Const.
July		PHI #2 (4 wk)			Const.
Aug	AT(8wk); WQL (6 wk)	AT (2 wk)	Arrival		Const.
Sep	DRI (4 wk)	PMI (2 wk)		Eval	Const.
<u>FY 1986</u>					
Oct		CD(14wk)	PROC.		Const.
Nov	DRI-(3wk)	WPM(12wk)			Const.
Dec		CD (1 wk)			Const.
Jan					Const.
Feb		CD (1 wk)	Arrival		
Mar					
Apr	DRI-(2wk)	CD (1 wk)			
May					
June	AT-(4wk)				
July	WQL-(6wk)				
Aug	RS/CD (3wk)				
Sep				Eval.	

LEGEND: AT-Appropriate Technology  
DRI-Drill Rig Instructor  
PMI-Project Management Implementation  
WPM-Water Pump Maintenance  
WS/S Water Supply/Sanitation

CD-Community Development  
PHI#1 Senior PHI - Rural Water and Sanitation  
PHI #2 Principal PHI  
RS/CD-Rural Sociology/Community Development  
WQL-Water Quality Laboratory

Table 1, Water and Sanitation Component - page 2

	<u>Technical Assistance</u>	<u>Training</u>	<u>Commodity Procurement</u>	<u>Evaluation</u>	<u>Construction</u>
<u>FY 1987</u>					
Oct		CD(20wk)	PROC.		
Nov					
Dec	DRI-(2wk)				
Jan					
Feb			ARRIVAL		
Mar					
Apr					
May					
Jun	AT-(4wk)	WPM-(10wk)			
Jul	WQL-(6wk)	AT (1 wk)			
Aug	RS/CD(3wk)				
Sep				EVAL	
<u>FY 1988</u>					
Oct		CD(15wk)	PROC		
Nov		PHI #1 (3 wk)			
Dec		AT (1 wk)			
Jan					
Feb			ARRIVAL		
Mar					
Apr	RS/CD(3wk)				
May		WPM(20wk)			
Jun					
Jul					
Aug					
Sep					
<u>FY 1989</u>					
Oct					
Nov					
Dec					
Jan					
Feb					
Mar					
Apr				EVAL	
May					

## C. Evaluation Plan

### I. Malaria and Aedes Aegypti Control Component

In summary, for evaluation purposes, the project foresees (1) a reduction from the approximately 5,000 cases in 1984 to 1400 cases of malaria by EOP; (2) a reduction of P. falciparum malaria from approximately 15% in 1984 to 10% or less of the total cases by EOP; (3) the infected Aedes aegypti localities will be reduced from an estimated 40% of the localities in 1984 to 10% or less of the country's total localities in 1988. Measurement indicators of progress for evaluation of project accomplishments in training, operations research and technical assistance can be calculated by using the PP projections given in detail by year in Annex P of the Project Paper.

In addition to the normal monitoring of the project by the USAID/Belize General Development Officer, a series of Project Evaluation Summary PES and joint GOB/PAHO/AID Reviews will be held over the LOP. The evaluations will be concentrated in three areas; cost effectiveness, impact of the vector-borne disease methodologies and management of the NMCS and AACP programs. A total of \$56,000 has been provided in the Project for these evaluations.

The first evaluation is scheduled for September 1986 and will focus on the start-up inputs to the project in technical assistance, operational research, commodities and training, and their relationship to the subject areas listed above. This evaluation will provide course correction, identify problem areas which are impeding the program and provide recommendations for improvement. This evaluation will be combined PES evaluation and a joint program evaluation carried out by the GOB/PAHO/AID. A total of \$14,000 is provided in FY 1986 for support of this evaluation.

The 1987 and 1988 evaluations will be joint evaluations with GOB/PAHO/AID representatives. The 1987 evaluation is the major project evaluation and \$28,000 has been provided for three U.S. specialists -- epidemiologist, management specialist and operations specialist. The 1989 evaluation will be a combination program and PES evaluation. A total of \$14,000 is provided for the 1989 evaluation effort. The services of the S and T/Health malariologist are expected to be utilized in all these evaluations, but specifically used in the PES evaluation report preparation.

In addition to measuring progress achieved against the specific yearly output indicators for the project, the evaluations will assess and provide recommendations concerning specific aspects of NMCS and AACP which may include but not limited to the following:

1. Staffing and administrative procedures at the national and district levels;
2. Laboratory services, including a review of the number of slides collected; time lags in collection, examination, reporting and treatment; number of slides examined per day per microscopist and cross checking arrangements; condition and maintenance of vehicles, spray equipment and other program equipment;
3. Volunteer collaborator and health institution surveillance operations;
4. Progress of operational research;
5. Utilization of insecticides and other commodities in the project including procurement and supply management systems;
6. Spray operations, including coverage and efficiency;
7. Larvicide and other vector source reduction methods especially in the AACP;
8. Training progress and achievements for AACP and NMCS personnel, voluntary collaborators, public health personnel;
9. Health education and community participation programs;
10. Insecticide handling and safety measures;
11. Progress and activity summary of actions taken towards more integration of AACP and NMCS services into the general health services.

The evaluations will be conducted on the basis of field trips, interviews with personnel at national and district levels, community leaders and reviews of administrative and technical reports available from the AACP and NMCS, PAHO, USAID/Belize, other agencies of the GOB and concerned private organizations.

Approximately \$56,000 in grant funds are available to the project for the described evaluations for the 1985-1988 period.

## II. Water and Sanitation Component

The evaluation of the Water Supply and Sanitation component will consist of the following activities. The first evaluation will be made of the management and educational aspects of the project. This evaluation will focus on the system developed for the purchase, storage, and transfer of commodities from source to project sites. An evaluation of the commodity management system will concentrate on the inventory system for parts, equipment and supplies.

The second year evaluation will focus heavily on the technical aspects of the project. Technology selection, quality of workmanship and materials, drilling techniques and equipment maintenance, and hydro-geological considerations will be studied. The educational element of the project will also be evaluated. Specifically, the evaluation will focus on the identification of health education and technical training needs, the development of training materials, the integration of the health education and training into the project process with an emphasis on the sociocultural relevance of health education material for communities. An initial review of the project implementation, as it supports community participation, will be evaluated at this time. Project outputs will be reviewed relative to the proposed timetable. The evaluation will update the schedule of activities and outputs based upon project progress to date.

The third year evaluation will include the technical and educational aspects of the second year evaluation and will include evaluation of the Project's impact on the Ministry of Health. Institutional consideration such as a personnel workload, operating costs, and organizational realignments due to Belize's three donor funded water projects will be considered at this time.

The final evaluation will include all elements of the project, water supply and sanitation technologies, user acceptance, health education, management system, social and economic impact, and institutional impact.

### Water Quality Laboratory and Monitoring

Two evaluations are planned for this element of the water supply and sanitation component of the project. An evaluation in September, 1986 will focus on the physical aspects of the laboratory, operating status, sampling techniques and sample preservation. The second evaluation will focus on the training of laboratory personnel and on quality control of analytical techniques and record keeping.

## V. CONDITIONS, COVENANTS, AND NEGOTIATING STATUS

### A. Conditions

In addition to the standard conditions and covenants and in order to ensure timely implementation of the Project, the Mission recommends that the Project Authorization include the following conditions:

1. Conditions Precedent to Initial Disbursement for Malaria Control and Aedes Aegypti Control Component.

Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for activities under the component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.; a detailed, time-phased Action Plan for project activities to be carried out by both the Aedes Aegypti Control Program (AACP) and the National Malaria Control Service (NMCS) for Belize Fiscal Year 1984-85. The Action Plan should include the GOB budget for Grantee-financed project activities.

2. Conditions Precedent to Subsequent Disbursement for Malaria Control and Aedes Aegypti Control Component

Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made after March 31, 1985 for activities under the subject component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

- (a) by March 31, 1985 a detailed, time-phased Action Plan for project activities to be carried out by both the AACP and the Malaria Control Service for Belize Fiscal Year 1985-86; and written evidence that the Government has budgeted an amount adequate to finance Grantee-provided project resources, including residual insecticide.
- (b) by March 31, 1986 a detailed, time-phased Action Plan for project activities to be carried out by both the AACP and the Malaria Control Service for Belize Fiscal Year 1986-87; and written evidence that the Government has budgeted and amount adequate to finance Grantee-provided project resources, including residual insecticide.

- (c) By March 31, 1987 a detailed, time-phased Action Plan for project activities to be carried out by both the AACP and the Malaria Control Service for Belize Fiscal Year 1987-88; and written evidence that the Government has budgeted an amount adequate to finance Grantee-provided project resources, including residual insecticide.

3. Conditions Precedent to Initial Disbursement for the Water Supply and Sanitation Component

Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for activities under this component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D., a detailed, time-phased Plan of Action for project activities to be carried out by the Environmental Health Service in Belize Fiscal Year 1984-85. The Plan of Action should include the GOB budget for Grantee financed project activities.

4. Conditions Precedent to Subsequent Disbursement for the Water Supply and Sanitation Component

Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made after March 31, 1985 for activities under the subject component, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

- (a) by March 31, 1985 a detailed, time-phased Plan of Action for project activities to be carried out by the Environmental Health Service for Belize Fiscal Year 1985-86 which will include the establishment of a Senior Public Health Inspector position in charge of the water and sanitation Program; and written evidence that the Government has budgeted an amount adequate to finance Grantee-provided project resources for Belize FY 85-86.
- (b) by March 31, 1986 a detailed, time-phased Plan of Action for project activities to be carried out by the Environmental Health Service for Belize Fiscal Year 1986-87 which will include the establishment of a Water Quality Analyst position; and written evidence that the Government has budgeted an amount adequate to

finance Grantee-provided project resources for Belize FY 86-87.

- (c) by March 31, 1987 a detailed, time-phased Plan of Action for project activities to be carried out by the Environmental Health Service for Belize Fiscal Year 1987-88; and written evidence that the Government has budgeted an amount adequate to finance Grantee-provided project resources for Belize 87-88.

#### 5. Conditions Precedent to Disbursement for Construction

(a) Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for the construction of physical facilities, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D., certification that the Government of Belize has title to the site upon which each facility will be constructed.

(b) Prior to any disbursement, or to the issuance of any documentation pursuant to which disbursement will be made for the construction of a water quality laboratory, the Grantee shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D., evidence that a water quality analyst position has been established to develop and coordinate the rural water supply surveillance and monitoring program.

#### B. Covenants

Except as A.I.D. may otherwise agree in writing, the Grantee-Government of Belize covenants to:

- (1) Beginning in Belize FY 1986, carry out a yearly GOB/PAHO/AID program evaluation for the National Malaria Control Service (NMCS) and the Aedes Aegypti Control Program under the terms of reference prepared jointly by GOB, PAHO and A.I.D;
- (2) Enforce health and environmental safeguards throughout the life of the project especially with regard to the application of insecticides, and including training in environmental and health safeguards;
- (3) To make available to the NMCS adequate spray personnel to carry out the planned activities of

this project;

- (4) Beginning in Belize FY 1985, initiate a study of the equitability of the salary schedules for a given educational requirement as it specifically relates to the ability of the Public Health Inspectorate to retain adequate staff necessary for project implementation;
- (5) Beginning in Belize FY 1986, carry out a yearly program evaluation for the Rural Water Supply and Sanitation program, including a status report of rural handpumps, latrine coverage, drinking water quality and health education/community development/training activities;
- (6) Beginning in Belize FY 1985, establish a National Action Committee on Water Supply and Sanitation;
- (7) Make every reasonable effort to ensure that each participant trained overseas under this Project works in water and sanitation and vector control activities in Belize for a length of time in accordance with Government General Orders for Training; and
- (8) Assign one Belizean health educator/community development/trainer as a full-time counterpart to work in close collaboration with the project financed health education/community development/training advisor.

### C. Negotiating Status

This Project has been jointly developed with representatives of the Government of Belize. Enthusiasm for the Project is high among technical personnel, and the Project is a high priority of the GOB at the highest levels. The above Conditions and Covenants have been discussed with and agreed to by the Government of Belize. During Project Agreement negotiations, USAID/Belize will incorporate into the agreement appropriate language to cover these terms and conditions.

VII. WAIVERS

1. Sole Source Waiver for Procurement of Spray Pumps and Spare Parts

Spray pumps and spare parts will be procured for the project with grant funds at a cost of \$16,000. These pumps are required for the field operations to apply residual insecticides.

A sole source waiver is required to purchase these spray pumps from the H.D. Hudson Manufacturing Company, 500 North Michigan Ave., Chicago, Illinois 60611. The reason for this sole source waiver is that all MOH field spray pumps are from this source and to purchase pumps from another source would complicate the program's standardization schedule, enlarge the spare parts inventory, increase costs and require a large amount of retraining.

H.D. Hudson pumps are in standard use worldwide in malaria control programs. For over thirty years, this Company has furnished thousands of pumps and spare parts for those pumps. The quality of the Hudson pump is unmatched for the difficult field operations in malaria control programs. In addition, the H.D. Hudson Company provides these pumps at a special discount rate to A.I.D.

Therefore, a sole source waiver is requested for up to \$16,000 for the purchase of these spray pumps in accordance with Chapter 12 of Handbook I., Supplement B.

2. Sole Source Waiver for Procurement of ULV Machines (Aedes Aegypti Control Program)

Sole source waiver is requested for three skid mounted LECO ultra-low volume (ULV) spray units with flowmeter. (Source: Lauenders Engineering Co. 125 Blanchard Street, Baldosta, Ga. 31601.) The total cost of these units is estimated at \$17,000. The reason for this waiver is that the two existing ULV machines in Belize are LECO ULV units and to change source would require retraining in calibration, maintenance and repair. The GOB is following a standardization policy for its equipment and this request is in accord with this policy.

Therefore, a sole source waiver is requested for up to \$17,000 for the purchase of these ULV machines in accordance with Chapter 12 of Handbook I., Supplement B.

### 3. Proprietary Procurement of Vehicles and Spare Parts

The MOH has requested that the vehicles procured under this Grant be of a specific manufacture, thereby requiring a proprietary procurement waiver. The items in that category are as follows:

Make	Type	Proprietary Procurement Number	Total Cost(\$US)
FORD	BRONCO	2	\$25,000
FORD	Pick-up 3/4 ton	1	21,000
FORD	Pick-up 1/2 Ton	13	211,000
FORD	Pick-up 1/2 Ton (2 Wheel Ranger)	2	25,000
FORD	Pick-up 1/2 Ton (4 Wheel Drive Ranger)	3	50,000
FORD	1 1/2 Ton Chassis Truck	4	85,000
	TOTAL	25	\$417,000

The waiver is justified by the following factors:

a) the GOB has begun to standardize its truck fleets around the US manufactured Ford Motor Company line of trucks. The Ministry of Works, the Ministry of Natural Resources and the Ministry of Trade and Industry have, for example, upon retirement of trucks of other manufacturers, purchased Ford equipment as replacements. The GOB has set this policy based on its experience with local costs, availability of parts and service, and their desire to reduce spare parts and specialized tool inventories to a minimum.

b) The local Ford dealer is the only US manufacturers' representative to provide maintenance and repair services.

In light of the above factors, the Mission requests a waiver for proprietary procurement for Ford vehicles and spare parts.

### 4. Waiver for Procurement of Motorcycles and Spare Parts

Up to 39 motorcycles (125 cc trailbikes) will be procured for the Project with grant funds at a cost of \$65,000. These motorcycles are principally required for field activities for Aedes Aegypti Inspectors, Malaria Control Evaluators and District Public Health Inspectors.

A proprietary procurement waiver is required to purchase these motorcycles from Honda.

The reason for this waiver is lower unit cost, ease of obtaining spare parts, more cost effective operation and reliability and such motorcycles are already being procured in Belize with A.I.D. funds in another project.

In light of the above factors, the Mission requests a waiver for proprietary procurement for motorcycles and spare parts.

5. Sole Source and Source Origin Waiver for Procurement of UNICEF "MARK II" Handpumps and Spare Parts

Handpumps and spare parts will be procured for the Project with grant funds at a cost of \$175,000. These handpumps are required for the potable water systems to be installed in rural communities.

The pumps will be confined to those which have their source and origin in Code 899 countries. Under the provision of Chapter 12 and Chapter 5 of Handbook 1B, the AA/LAC has the authority for approval of such waivers.

The GOB has adopted the UNICEF MARK II handpump as their standard pump. Their on-going rural water and sanitation projects with UNICEF and CARE have standardized with the MARK II.

In accordance with the authorities set forth in Handbook 1B (Section 12C4a (2) (C 2)), a sole source waiver may be issued when "special design or operational requirements, such as equipment standardization, require a product or services available from only one source." Based on the facts discussed above this standard is met.

Because UNICEF procures MARK II handpumps India, a 899 country, a source/origin waiver to Code 899 is required, since the authorized geographic code for this project is currently 941. A waiver of the authorized geographic code is permitted by HB 1B, Ch 5b4a(7), for "such other circumstances as are determined to be critical to the success of project objectives". These criteria are met for the reasons discussed above. The AA/LAC has the authority to approve this waiver since it is less than \$3 million.

## 6. Shipping

There is no ocean freight service to Belize from the US on US registered bottoms or by US shipping firms. While one-Miami based shipping firm maintains a biweekly container schedule to Belize, it is incorporated in Grand Cayman. Further, project procurement will not be made in such a coordinated fashion to make it feasible to hire an entire vessel for a single shipment.

Given these constraints, it will be necessary to grant blanket certification on non-availability of US flag vessels and a waiver to permit payment for shipment on vessels registered in AID Geographic Code 899 countries, subject to reexamination if a US flag vessel becomes available at a later date.

## 7. Third Country Training

A limited amount of the training needs defined by the Project Paper design team is expected to be best met through third country training opportunities. Such training is expected to include two persons for six months of entomological training in Mexico, Panama or in Central America. In light of this, the Mission requests a waiver for third country training since the U.S. does not have a similar course for sub-professional entomology personnel. The project also plans 12 observation tours within Latin America/Caribbean to Mexico or possibly Haiti or Venezuela. The U.S. cannot offer similar experiences for field malaria programs and a waiver is requested.

## 8. A.I.D. Financed Participant Travel

Chapter 15 of the A.I.D. Handbook 10 requires that the international travel of A.I.D. financed participants be paid by the host country, the participant, or other sponsor unless waived by the USAID Director in the case of USAID funded programs.

As described in Part III, Financial Plan, grant funding training is envisaged under the project. USAID/Belize considers that A.I.D. funding of international travel costs is justified based on the overall substantial Host Country contribution planned for the project, and current foreign exchange difficulties of the GOB. Accordingly, the USAID Director, in approving this Project Paper waives the requirement of Host Country funding of participant travel under the Project. This Project Paper serves as the required notification.

## Annex A

## GLOSSARY OF TERMS

Active Case Detection (ACD) is a part of surveillance activities in which malaria personnel actively search for malaria cases through the collection of blood slides and epidemiological investigations.

Activated Passive Case Detection (APCD) is part of surveillance activities in which malaria personnel are assigned to health institutions and collect blood slides from patients attending the institution. Slides may be collected only from fever cases, from specific age groups or from all patients, depending on instructions provided to the personnel assigned.

Annual Parasite Incidence (API) is the proportion of cases of malaria detected on an annual basis in relation to the unit of population in which malaria occurs.

Biological Control is a method of controlling mosquitoes using living vertebrate or invertebrate predators, genetic control, or parasites.

Chemoprophylaxis is the use of drugs before infection with the aim of preventing disease.

DDT is the common abbreviation of the name Dichlorodiphenyl Trichloroethane, a chlorinated hydrocarbon type of residual insecticide.

Endemicity is a term applied to malaria when there is a constant measurable incidence in an area over a succession of years.

Epidemic is a term applied to malaria when the incidence of cases in an area rises rapidly and markedly above its usual level.

Epidemiology in a broad sense is the study of the environmental, personal, and other factors that determine the incidence of disease.

Focal Spraying is residual insecticide house spraying around a malaria focus.

Incidence is the number of cases of disease occurring during a given time period in relation to the unit of population in which they occur.

Larvicide is a substance used to kill the aquatic larval stage of the malaria mosquito by ingestion, contact, or respiratory blockage.

Malaria Control is an operation aimed at reducing the prevalence of malaria to a level at which it is no longer a major public health problem.

Malaria Control Service (MCS) refers to the national malaria control effort of the Government of Belize.

Malaria Eradication is the ending of the transmission of malaria and the elimination of the reservoir of infected persons in a time-limited campaign, to the degree that when the effort comes to an end there is no resumption of transmission.

Malaria Focus is a defined and circumscribed locality situated in a currently or formerly malarious area and containing continuous or intermittent malaria transmission.

Malariogenic Potential is the degree to which an area is conducive to malaria, based on cumulative epidemiological data collected from each area regarding the parasite load, vector density, water-logging, climatic conditions, population movement, and other factors.

Malathion is an organophosphorus residual insecticide.

Malaria Parasite is a colloquial term for any of the protozoan organisms causing malaria infections.

Parasite Rate is the percentage of persons showing malaria parasites by blood smear examination.

Passive Case Detection (PCD) is a part of the surveillance activity in which the public health and medical services other than the regularly constituted malaria service assist surveillance activities by the collection of blood slides from persons requesting treatment.

P. falciparum Malaria is a severe type of malaria caused by Plasmodium falciparum, a species of malaria parasite.

Presumptive Treatment is initial drug treatment given to an expected malaria case at the time when a blood sample is taken for examination.

Residual Insecticide is an insecticide which when suitably applied on a surface, maintains for a considerable period of

time its insecticidal activity by either contact or fumigative action.

Surveillance is that part of a malaria program aimed at discovery, investigation, and elimination of continuing transmission and the prevention and cure of infections.

Total Spray Coverage is the application of residual insecticide during one spraying cycle to all sprayable surfaces in all sprayable houses within a given operational area.

Ultra Low Volume (ULV) Spraying is a method of insecticide dispersion by special air or ground equipment using very small amounts of finely dispersed particles of insecticide.

Vector is an infected non-vertebrate host which serves as a vehicle for transmission of a disease from infected man to uninfected man. A biological vector is one in which cyclic development of the disease organism within the host is required before the host can transmit to man the infective form of the agent of disease.

Vector in malaria is any species of Anopheline mosquito in which the malaria parasite completes its sexual cycle within the host mosquito and which is thus able to transmit the disease.

Vector Density (in the context of malaria) is the number of female Anopheline mosquitoes in relation to the number of specified shelters or hosts or to a given time period, specifying the method of collection.

Vector Susceptibility represents the resistance status of a species of mosquito to the effects of insecticides.

Water Management as it relates to malaria control involves the reduction or elimination of sources of mosquito breeding through filling, draining, digging, changing water levels, flushing, canal trimming, and other engineering methods.

## Annex B

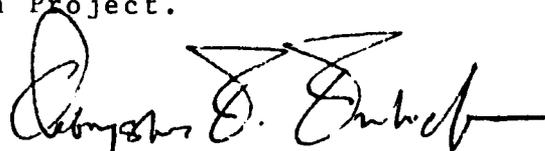
### LIST OF ABBREVIATIONS

ABER	Annual Blood Examination Rate
ACD	Active Case Detection
AI	Actual Insecticide
APCD	Activated Passive Case Detection
API	Annual Parasite Incidence
CLC	Centers for Disease Control
DDT	Dichlorodiphenyl Trichloroethane (insecticide)
EOP	End of Project
EPA	Environmental Protection Agency
ERR	Economic Rate of Return
GDP	Gross Domestic Product
GOB	Government of Belize
IEE	Initial Environmental Examination
IMG	International Monetary Fund
KAP	Knowledge, Attitudes, Practice
LOP	Life of Project
MCS	Malaria Control Service
MDA	Mass Drug Administration
MOH	Ministry of Health
MPH	Master's Degree in Public Health
OP	Organophosphorus (class of insecticide)
PAHO	Pan American Health Organization
PCD	Passive Case Detection
PHC	Primary Health Care
SPR	Slide Positivity Rate
TA	Technical Assistance
ULV	Ultra Low Volume
VBD	Vector Borne Disease
VC	Volunteer Collaborator
WDP	Water Dispersable Powder
WHO	World Health Organization

**AGENCY FOR INTERNATIONAL DEVELOPMENT  
UNITED STATES A. I. D. MISSION TO BELIZE  
EMBASSY OF THE UNITED STATES OF AMERICA  
BELIZE CITY, BELIZE, CENTRAL AMERICA**

CERTIFICATION PURSUANT TO SECTION 611 (E) OF THE  
FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Neboysha Brashich, the Principal Officer of the Agency for International Development in Belize, having reviewed the Project Paper and having taken into account, among other factors, the maintenance and utilization of Projects in Belize previously financed or assisted by the United States, do hereby certify that in my judgement the Ministry of Health, Labour and Sports has both the financial capability and human resources capability to effectively maintain and utilize the proposed Increased Productivity through Better Health Project.

  
Neboysha Brashich  
USAID Representative to Belize

Annex E.

DRAFT PROJECT AUTHORIZATION

Name of Country: Belize

Name of Project: Increased Productivity through Health

Number of Project: 505-0018

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Increased Productivity through Better Health project for Belize involving planned obligation of not to exceed Seven Million United States Dollars (\$7,000,000) in Grant Funds ("Grant") over a four year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is four years from the date of the initial obligation.

2. The project ("Project") will control the incidence of malaria and dengue fever, extend the coverage of potable water and sanitation systems in rural communities and villages in three districts and improve the national water quality program.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

A) Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Grant shall have their source and origin in Belize or in the United States, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have Belize or the United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the grant shall be financed only on flag vessels of the United States or countries included

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in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing.

B) Conditions Precedent to Disbursement

Prior to any disbursement, or the issuance of any commitment documents under the Project Agreement, other than for technical assistance, the Government of Belize (GOB) shall, except as A.I.D. may otherwise agree in writing:

1) Conditions Precedent for Malaria Control and Aedes Aegypti Control Program Component

a) Prepare a Plan of Operations for both the Malaria Control Service and the Aedes Aegypti Control Program which has the approval of the GOB and the Pan American Health Organization (PAHO) and is favorably reviewed by A.I.D.

b) Assure A.I.D. that adequate and appropriate residual insecticides are to be available to the Malaria Control Service to meet GOB FY 1985/86 requirements.

c) Prior to the beginning of each GOB Fiscal Year (April 1-March 31), prepare and submit to A.I.D. a detailed annual Plan of Action covering the activities for both the Aedes Aegypti Control Program and the Malaria Control Service. The first such plan covering the period 1985/86 is to be submitted by March 1985 to A.I.D.

d) Prior to disbursement of the 1986 funding, assure A.I.D. that adequate residual insecticide is available for the 1986/87 spray operations.

e) Prior to the disbursement of the 1987 funding, assure A.I.D. that adequate residual insecticide is available for the 1987/1988 spray operations.

f) Provide suitable space for the construction of an office for the Aedes Aegypti control staff, for the construction of three small basic storerooms (one each in Cayo, Stann Creek and Corozal), and for the construction of a simple vehicle repair facility at the National Malaria Control Program Compound in Belize City.

2) Conditions Precedent for the Rural Water and Sanitation and National Rural Drinking Water Monitoring Component

a) Prepare a Ministry of Health Plan of Operations for water and sanitation, which is reviewed favorably by A.I.D.

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b) Provide suitable space (1300 sq. ft.) for the construction of the national rural drinking water laboratory.

c) Restructure the Environmental Health Service to establish a position for a Senior Health Inspector in charge of water and sanitation programs exclusively, and dedicate one Public Health Inspector and Environmental Health Assistant from each of the three districts involved in the Project.

d) Identify a water quality analyst candidate in GOB FY 85 and establish and fill the position by FY 86 in order to develop and coordinate the rural water supply surveillance and monitoring program.

e) Prior to the beginning of each GOB fiscal year, prepare a Project Plan of Action covering the activities of the Environmental Health Service in rural water and sanitation. The first such plan covering the period 1985/86 is to be submitted to USAID/Belize by March 1985.

C) Covenants

The Government of Belize covenants that, except as A.I.D. otherwise agrees in writing:

a) Beginning in GOB FY 1986, a yearly GOB/PAHO/AID program evaluation for the Malaria Control Service and the Aedes Aegypti Control Program will be carried out under the terms of reference prepared jointly by GOB, PAHO and AID. The project foresees three such evaluations over the life of the project.

b) Health and environmental safeguards will be in effect throughout the life of the project especially with regard to the application of insecticides. Specific training in environmental and health safeguards will be a part of every operational training schedule for spraymen, supervisors and Environmental Assistants.

c) Adequate spray personnel will be available to the NMCS to carry out the planned activities of this project.

d) Beginning in GOB FY 1985 the GOB covenants to initiate a study of the equitability of the salary schedules for a given educational requirement as it specifically relates to the ability of the Public Health Inspectorate to retain adequate staff necessary for project implementation.

e) The GOB will carry out a yearly program evaluation for the Rural Water Supply and Sanitation program. This evaluation

will include a status report of rural handpumps, latrine coverage, drinking water quality and health education/community development/training activities.

f) Beginning in GOB FY 1985, the GOB will establish a National Action Committee on Water Supply and Sanitation.

g) The GOB will make every reasonable effort to ensure that each participant trained overseas under this Project works in water and sanitation and vector control activities in Belize for a length of time in accordance with Government General Orders for Training.

h) That one Belizean health educator/community development/trainer will be assigned as a full time counterpart to work in close collaboration with the project financed health education/community development/training advisor.

D) Waivers

1) Competition in the procurement of goods is hereby waived and a single-source negotiated contract is hereby authorized in order to permit the procurement of spray pumps and spare parts from the H.D. Hudson Manufacturing Company with a value of approximately \$16,000.

2) Competition in the procurement of goods is hereby waived and a single-source negotiated contract is hereby authorized in order to permit the procurement of three skid mounted LECO Ultra-Volume (ULV) spray units with flowmeter from the Launder's Engineering Company with a value of approximately \$17,000.

3) Competition in the procurement of goods is hereby waived and a single-source negotiated contract is hereby authorized in order to permit the procurement of approximately 25 Ford vehicles and spare parts with a value of approximately \$417,000.

4) The requirement for competitive procurement is hereby waived and proprietary procurement from Honda Japan or their local agent in Belize is hereby authorized for 39 motorcycles and spare parts with value of approximately \$65,000.

5) The requirement for competitive procurement and source origin is hereby waived. UNICEF Mark II handpumps and spare parts will be procured for the Project at a cost of \$175,000. The procurement will be limited to Code 941.

6) The requirement for shipping by US flag vessels is hereby waived. The waiver will permit payment for shipment on vessels registered in A.I.D. Geographic Code 899 countries.

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7) The requirement for training in the U.S. or the host country is waived. Third country training is anticipated for Mexico, Panama, Haiti, Venezuela or another Central American country.

8) The requirement for host country funding of A.I.D. financed participant travel is waived.

\_\_\_\_\_  
Assistant Administrator

\_\_\_\_\_  
Date

COUNTRY CHECKLISTA. GENERAL CRITERIA FOR COUNTRY  
ELIGIBILITY

1. FAA Sec. 481; FY 1984  
Continuing Resolution. Has it  
been determined or certified  
to the Congress by the  
President that the Government  
of the recipient country has  
failed to take adequate  
measures or steps to prevent  
narcotic and psychotropic  
drugs or other controlled  
substances (as listed in the  
schedules in section 202 of  
the Comprehensive Drug Abuse  
and Prevention Control Act of  
1971) which are cultivated,  
produced or processed  
illicitly, in whole or in  
part, in such country or  
transported through such coun-  
try, from being sold illegally  
within the jurisdiction of  
such country to United States  
Government personnel or their  
dependents, or from entering  
the United States unlawfully? No
  
2. FAA Sec. 620(c). If assist-  
ance is to a government, is  
the government liable as  
debtor or unconditional  
guarantor of any debt to a  
U.S. citizen for goods or  
services furnished or ordered  
where (a) such citizen has  
exhausted available legal  
remedies and (b) the debt is  
not denied or contested by  
such government? No

3. FAA Sec. 620(e) (1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities? No
4. FAA Sec. 532(c), 620(a), 620(f), 620D; FY 1982 Appropriation Act Secs. 512 and 513. Is recipient country a communist country? Will assistance be provided to Angola, Cambodia, Cuba, Laos, Vietnam, Syria, Libya, Iraq, or South Yemen? Will assistance be provided to Afghanistan or Mozambique without a waiver? No
5. ISDCA of 1981 Secs. 724, 727 and 730. For specific restrictions on assistance to Nicaragua, see Sec. 724 of the ISDCA of 1981. For specific restrictions on assistance to El Salvador, see Secs. 727 and 730 of the ISDCA of 1981. N/A
6. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction by mob action of U.S. property? No
7. FAA Sec. 620(l). Has the country failed to enter into an agreement with OPIC? No

8. FAA Sec. 620(c); Fishermen's Protective Act of 1967, as amended, Sec. 5. (a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters? No
- (b) If so, has any deduction required by the Fishermen's Protective Act been made?
9. FAA Sec. 620(q); FY 1962 Appropriation Act Sec. 517. (a) Has the government of the recipient country been in default for more than six months on interest or principal of any AID loan to the country? No
- (b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the appropriation bill appropriates funds?
10. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the amount of foreign exchange or other resources which the country has spent on military equipment? (Reference may be made to the annual "Taking into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.) N/A

11. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption? No
12. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? (Reference may be made to the Taking into Consideration memo.) Current
13. FAA Sec. 620A; FY 1982 Appropriation Act Sec 520. Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed an act of international terrorism? Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed a war crime? No
14. FAA Sec. 666. Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA? No
15. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? No

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Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device, after August 3, 1977? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.)

No

16. ISDCA of 1981 Sec. 720. Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Session of the U.N. of Sept. 25 and 28, 1981, and failed to disassociate itself from the communique issued? If so, has the President taken it into account? (Reference may be made to the Taking into Consideration memo.)

No

17. ISDCA of 1981 Sec. 721. See special requirements for assistance to Haiti.

N/A

18. FY 1984 Continuing Resolution. Has the recipient country been determined by the President to have engaged in a consistent pattern of opposition to the foreign policy of the United States?

No

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

- a. FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy?

No

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has it been determined that the country has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can the country made such significant improvements in its human rights record that furnishing such assistance is in the national interest? N/A

b. ISDCA of 1981, Sec. 725(b). If ESF is to be furnished to Argentina, has the President certified that (1) the Govt. of Argentina has made significant progress in human rights; and (2) that the provision of such assistance is in the national interests of the U.S.? N/A

c. ISDCA of 1981, Sec. 726(b). If ESF assistance is to be furnished to Chile, has the President certified that (1) the Govt. of Chile has made significant progress in human rights; (b) it is in the national interest of the U.S.; and (3) the Govt. of Chile is not aiding international terrorism and has taken steps to bring to justice those indicted in connection with the murder of Orlando Letelier? N/A

PROJECT CHECKLISTA. GENERAL CRITERIA FOR PROJECT

1. FY 1982 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).  
 (a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that amount)?  
 Congressional Presentations  
 Yes
2. FAA Sec. 611(a) (1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?  
 Yes
3. FAA Sec. 611(a) (2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?  
 None required
4. FAA Sec. 611(b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973?  
 Yes

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project? Yes
6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. No
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.
- a) No
  - b) N/A
  - c) No
  - d) N/A
  - e) Yes, by improving productivity of the labor force through improved health
  - f) No

8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise). U.S. private sector will participate as source of technical assistance, training, equipment and supplies (e.g. pharmaceuticals)
9. FAA Sec. 612(b), 636(h); FY 1982 Appropriation Act Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars. All local currency costs will be financed by host country contribution
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? No
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? Yes
12. FY 1982 Appropriation Act. Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? No

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|--|-----|
| 13. <u>FAA 118(c) and (d)</u> . Does the project comply with the environmental procedures set forth in AID Regulation 16?  | Yes |
| Does the project or program take into consideration the problem of the destruction of tropical forests?  | Yes |
| 14. <u>FAA 121(d)</u> . If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)? | N/A |

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

a) The project water and sanitation activities will be primarily carried out in rural areas, while the vector control activities will be nation-wide. Project technicians will work with communities to select the most appropriate water and sanitation technologies for their particular situation. The most appropriate U.S. institutions will be involved in implementing the components of this project.

b) No

c) Community development is an integral part of this project. Communities will be encouraged and assisted to participate in all phases of this project.

d) Women play an active role in the community councils, which will participate in decision making on water and sanitation problems and solutions.

e) Third country training is envisioned under the project.

b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used? Yes

c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)? Yes

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the cost of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)? Yes

e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (M.O. 1232.1 defined a capital project as the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than \$100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character. No

f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

Yes

g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.

A significant proportion of the project resources are to be used for training host country professionals at central and field levels. Part of this training will be in community development skills to enable the technicians to effectively involve the people. Communities will be asked to express their needs and desires related to environmental sanitation and water system.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.

N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N/A

c. ISDCA of 1981, Sec. 724(c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624(g)?

N/A

3. Economic Support Fund  
Project Criteria

a. FAA Sec. 531(a). Will this assistance promote economic or political stability? To the extent possible, does it reflect the policy directions of FAA Section 102? N/A

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities? N/A

c. FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives? N/A

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? N/A

STANDARD ITEM LISTA. Procurement

- |   |                                  |
|---|----------------------------------|
| 1. <u>FAA Sec. 602.</u> Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?   | Yes                              |
| 2. <u>FAA Sec. 604(a).</u> Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?  | Yes                              |
| 3. <u>FAA Sec. 604(d).</u> If the co-operating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?  | N/A                              |
| 4. <u>FAA Sec. 604(e); ISCCA of 1980 Sec. 705(a).</u> If off-shore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.) | N/A                              |
| 5. <u>FAA Sec. 604(a).</u> Will construction or engineering services be procured from firms of countries otherwise eligible under Code 941, but which have attained a competitive capability in international markets in one of these areas?  | No. Belizean firms will be used. |

6. FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per cent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates? No
7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs? Yes
8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? Yes
9. FY 1982 Appropriation Act Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? Yes

B. Construction

- |   |     |
|---|-----|
| 1. <u>FAA Sec. 601(d)</u> . If capital (e.g., construction) project, will U.S. engineering and professional services to be used?  | Yes |
| 2. <u>FAA Sec. 611(c)</u> . If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?  | Yes |
| 3. <u>FAA Sec. 620(k)</u> . If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed \$100 million (except for productive enterprises in Egypt that were described in the CP)? | N/A |

C. Other Restrictions

- |  |     |
|--|-----|
| 1. <u>FAA Sec. 122(b)</u> . If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?  | N/A |
| 2. <u>FAA Sec. 301(d)</u> . If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?   | N/A |
| 3. <u>FAA Sec. 620(h)</u> . Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? | Yes |
| 4. Will arrangements preclude use of financing:  |     |

- formance or involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion? Yes
- b. FAA Sec. 620(q). To compensate owners for expropriated nationalized property? Yes
- c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? Yes
- d. FAA Sec. 662. For CIA activities? Yes
- e. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? Yes
- f. FY 1982 Appropriation Act, Sec. 503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel? Yes

- g. FY 1982 Appropriation Act, Sec. 505. To pay U.N. assessments arrearages or dues? Yes
- h. FY 1982 Appropriation Act, Sec. 506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)? Yes
- i. FY 1982 Appropriation Act, Sec. 510. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields? Yes
- j. FY 1982 Appropriation Act, Sec. 511. Will assistance be provided for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights.? No
- k. FY 1982 Appropriation Act, Sec. 515. To be used for publicity or propaganda purposes within U.S. not authorized by Congress? Yes

Department of State

TELEGRAM

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GCI-01 PFCO-01 FID-01 STHE-01 CASI-01 LS-01 HELD-01  
STHP-01 HAOI-01 LAG-03 /ULS AS 276

INFO GCI-00 IB-05 AKA-00 L-03 /D11 R

DRAFTED BY AID/IC/DR. VOFFEN: CNJ: 22368  
APPROVED BY AID/AA/LAG: VIVRIVERA  
AID/DA/LAG: HUNTSMAN  
AID/LAG/DR. ILEVY/DJOHNSO  
AID/GC/LAG: PJOHNSON (DRAFT)  
AID/PFC/PDPR: MLENIC (DRAFT)  
AID/ST/H: ENCJUNJIN (DRAFT)  
AID/LAG/DP: JSLAFY (DRAFT)  
AID/LAG/DR: FFEENEY (DRAFT)  
AID/LAG/DP: JHESTER (DRAFT)

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E.O. 12356: N/A

TAGS:

SUBJECT: INCREASED PRODUCTIVITY THROUGH HEALTH PROJECT  
565-0016

1. THE DAEC REVIEWED AND APPROVED THE SUBJECT PID ON OCTOBER 12, 1984, AND PLANS TO REVIEW THE PP PURSUANT TO THE SCHEDULE PROVIDED IN THE PID. MAJOR ISSUES DISCUSSED AND GUIDANCE FOR PP DEVELOPMENT FOLLOWS.

2. POLICY ISSUES. THE GOB'S FINANCIAL AND ORGANIZATIONAL CAPABILITIES TO CARRY OUT PROJECT ACTIVITIES WERE SERIOUS CONCERNS. THEIR ABILITY AND WILLINGNESS TO CONTINUE FUNDING FOR KEY COMMODITIES AND MAINTENANCE AFTER THE PROJECT WERE CLOSELY RELATED CONCERNS. THE MISSION SHOULD CONSIDER THE FOLLOWING POINTS DURING IT DESIGN TO ASSURE THAT ADEQUATE RESOURCES ARE ALLOCATED TO THE PROJECT.

--A. RESOURCE ALLOCATION. THIS PROJECT INITIATES CERTAIN ACTIVITIES WHICH WILL HAVE TO BE CONTINUED AFTER PROJECT COMPLETION, IF A DEVELOPMENT IMPACT IS TO BE ACHIEVED. THIS WILL REQUIRE, NOT ONLY A GOB COMMITMENT, BUT ALSO A RATIONALIZATION OF THE HEALTH MINISTRY'S OPERATIONS SO THAT IT WILL HAVE AVAILABLE THE NECESSARY ORGANIZATIONAL AND FINANCIAL RESOURCES. TECHNICAL

ASSISTANCE TO THE MINISTRY IN THE AREA OF ORGANIZATIONAL STRUCTURE AND POLICY PLANNING SHOULD, THEREFORE, BE INCORPORATED INTO THE PP.

--B. USE OF ESF. WHILE STATE 312530 TREATS MORE FULLY THE ISSUE OF PROGRAMMING ESF LOCAL CURRENCY RESOURCES, IT WAS SUGGESTED BY THE DAEC FOR THIS PROJECT THAT THE MISSION MAY WISH TO CONSIDER THE USE OF LOCAL CURRENCY SET UP UNDER THE PROPOSED ESF PROGRAM TO HELP FINANCE THE GOB CONTRIBUTION TO THIS PROJECT SINCE CURRENT PROGRAMMING OF ESF RESOURCES DOES NOT, HOWEVER, FORESEE ANY ESF BEYOND FY 85. ALTERNATIVE LOCAL CURRENCY FINANCING MUST BE IDENTIFIED FOR ON GOING COSTS.

--C. RECURRING COSTS. SINCE PURCHASE OF DRUGS AND

INSPECTORIES WILL BE A CONTINUING REQUIREMENT AFTER THE PROJECT, THE PP FINANCIAL PLAN SHOULD PROVIDE THAT THE GOB BEGIN FINANCING THESE COSTS DURING LATER YEARS OF THE PROJECT SO THAT AT THE CONCLUSION OF THE PROJECT THERE WILL BE REASON TO EXPECT THAT THE GOB WILL FULLY FUND SUCH COSTS.

3. LOAN VERSUS GRANT FUNDING. THE DAEC DISCUSSED THE JUSTIFICATION FOR FUNDING THE ENTIRE PROJECT BY GRANT. IT WAS DETERMINED THAT, WHILE FOR MUCH OF THE PROJECT GRANT FUNDING IS APPROPRIATE, COMMODITY PROCUREMENT AND CONSTRUCTION SHOULD BE LOAN-FINANCED.

4. ORGANIZATIONAL ISSUES. THE FOLLOWING POINTS PERTAINING TO GOB AND COMMUNITY ORGANIZATION WERE ADDRESSED:

--A. VECTOR CONTROL ORGANIZATION. BECAUSE OF MANAGERIAL EFFICIENCY AND THE FACT THAT THE BELIZEAN NATIONAL HEALTH PLAN CALLS FOR INTEGRATION OF ALL VECTOR CONTROL ACTIVITIES INTO ONE ORGANIZATION, THE PP SHOULD CONTAIN THE REQUIREMENT THAT THE GOB COMBINE THE NATIONAL MALARIA CONTROL SERVICE AND THE AEGES (EGYPT) CONTROL SERVICE INTO ONE ORGANIZATIONAL UNIT. WE WOULD PREFER THIS TO BE SET FORTH AS A C.P. TO THE THE FIRST DISBURSEMENT. AS AN ALTERNATIVE, IF THE C.P. IS NOT POSSIBLE, WE WILL ACCEPT A COVENANT REQUIRING SUCH ACTIONS WITHIN A SPECIFIED TIME, SUCH AS A YEAR AFTER THE PROJECT AGREEMENT IS SIGNED.

--B. RURAL WATER ORGANIZATIONS. THE PID INCLUDES A COVENANT TO ESTABLISH A NATIONAL ACTION COMMITTEE ON WATER SUPPLY AND SANITATION. THE PP SHOULD CLARIFY THE PURPOSE OF THIS COMMITTEE. IN THE VIEW OF THE DAEC, THE

COMMITTEE COULD PERFORM A USEFUL FUNCTION IF IT ADDRESSES THE RATIONALIZATION OF NATIONAL WATER POLICY AND ORGANIZATIONAL REFORMS, SUCH AS INTEGRATION OF ALL RURAL WATER RESPONSIBILITIES INTO ONE ORGANIZATION. THE COVENANT SHOULD BE EXPANDED TO REQUIRE THAT THIS NATIONAL ACTION COMMITTEE BE ESTABLISHED BY THE BEGINNING OF GOB FISCAL YEAR 1986.

--C. COUNTERPART PROJECT MANAGEMENT. THE MISSION SHOULD CLARIFY HOW THE GOB PROJECT DIRECTOR WILL BE GIVEN EFFECTIVE AUTHORITY OVER INDIVIDUALS CARRYING OUT DIVERSE PROJECT ACTIVITIES WHEN THEY MAY NOT BE DIRECTLY RESPONSIBLE TO HIM IN THE ORGANIZATIONAL HIERARCHY.

--D. COMMUNITY ORGANIZATION. THE DAEC EXPRESSED SERIOUS CONCERN THAT THE PID SHOWED LITTLE ATTENTION TO COMMUNITY INVOLVEMENT IN FINANCING, MAINTENANCE AND RELATED RESPONSIBILITIES. THE PP SHOULD INCLUDE A PLAN FOR COMMUNITY INVOLVEMENT IN THESE ACTIVITIES AND ALSO SHOW HOW THE REVOLVING FUND WILL FUNCTION AND HOW COMMUNITY HEALTH EDUCATION, IN SUCH AREAS AS WATER STORAGE TECHNIQUES AND IMPORTANCE OF PIT LATRINE USE, WILL BE PROVIDED.

5. INSTITUTIONAL ANALYSIS. THE INSTITUTIONAL ANALYSIS IN THE PP SHOULD EXAMINE CONTRACTING OPTIONS AND ABILITY OF THE HOST COUNTRY TO APPLY A.I.D. PAYMENT VERIFICATION PROCEDURES.

--A. CONTRACTING. THE MISSION SHOULD EXAMINE ITS OWN AND THE HOST COUNTRY'S CAPACITY TO CARRY OUT THE REQUIRED MULTIPLE PROCUREMENT ACTIONS AND CONSIDER THE USE OF OUTSIDE ASSISTANCE IN THIS ELEMENT OF THE PROJECT. BESIDES EXAMINING THE ALTERNATIVES OF HOST COUNTRY OR A.I.D. DIRECT CONTRACTING, THE PP SHOULD REFLECT

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CONSIDERATION OF THE USE OF A PROCUREMENT SERVICE AGENT, AID/W ASSISTANCE, AND USE OF THE REGIONAL CONTRACTING OFFICER, IF AVAILABLE. HOW THE PROCUREMENT FOR GOODS AND SERVICES WILL BE CARRIED OUT SHOULD BE CLEARLY DESCRIBED.

USE OF SA FIRMS AND OTHER SMALL DISADVANTAGED FIRMS SHOULD BE DISCUSSED IN A SEPARATE SECTION ADDRESSING THE REQUIREMENTS OF THE CRAY AMENDMENT.

--B. PAYMENT VERIFICATION. THE ASSISTANCE OF THE CONTROLLER IN UCAID/HONDURAS HAS BEEN REQUESTED BY THE LAC BUREAU CONTROLLER FOR PREPARATION OF THE PAYMENT VERIFICATION POLICY MATRIX AND A DETERMINATION OF THE CAPABILITY OF SA AGENCIES TO MANAGE A.I.D. FUNDS.

6. TECHNICAL ISSUES. THE FOLLOWING TECHNICAL ISSUES SHOULD BE ADDRESSED IN THE PP.

--A. HANDPUMP SELECTION. AS THE MISSION IS AWARE, A.I.D. HAS A LONG HISTORY OF INVOLVEMENT WITH HANDPUMP ACTIVITIES AND INFORMATION AND EXPERTISE IS AVAILABLE. INFORMATION ON SOME HANDPUMPS WILL BE SENT SEPARATELY. HANDPUMP SELECTION SHOULD BE ANALYZED IN THE PP ACCORDING TO SUCH CRITERIA AS RELIABILITY, PROJECTED LIFE, CONTINUAL AVAILABILITY OF SPARE PARTS, AND INITIAL COST.

-B. ENERGY SOURCES. WHERE HANDPUMPS ARE NOT USED AND THERE IS NO ELECTRICITY GRID, ALTERNATIVE ENERGY SOURCES FOR PUMP SHOULD BE EXAMINED, SUCH AS DIESEL, WIND, OR SOLAR POWER.

\*-C. NEEDED DATA AND ANALYSIS. HYDROGEOLOGICAL AND METEOROLOGICAL DATA ARE NEEDED TO SPECIFY THE PROJECT DESIGN AND PERFORM THE ECONOMIC ANALYSIS FOR THE PP. THE MISSION SHOULD DEVELOP THIS INFORMATION ALONG WITH THE ASSOCIATED ENGINEERING AND COST DATA. WITH THIS INFORMATION, THE MISSION SHOULD BE ABLE TO ESTIMATE THE COST OF WATER PROVISION THROUGH DRILLING NEW WELLS, INCLUDING A FACTOR FOR DRY OR BAD WATER WELLS. THE MISSION SHOULD COMPARE THIS TO THE COSTS OF RAINWATER HARVESTING AND REPAIR OF EXISTING WELLS AND SELECT THE MOST APPROPRIATE COMBINATION OF ACTIVITIES FOR EACH PROJECT SITE.

--D. WATER MONITORING. THE CAPABILITY OF THE WATER AGENCY TO CONDUCT INSPECTIONS AND CLEAN UP CONTAMINATED WELLS SHOULD BE EXAMINED AND, IF NECESSARY, IMPROVED BY ADDING TECHNICAL ASSISTANCE FOR STRENGTHENING THEIR CAPABILITY. THE PROJECT'S SURVEILLANCE COMPONENT SHOULD EMPHASIZE SANITARY SURVEYS WITH THE OCCURRENCE OF E. COLI BACTERIA AS THE PRIMARY INDICATOR; HOWEVER, PESTICIDE RESIDUE TESTING SHOULD BE ARRANGED FOR WATER IF A PARTICULAR AREA HAS A HISTORY OF HEAVY AGRICULTURAL PESTICIDE USE.

-E. LINKAGES. IN ORDER TO ENSURE THAT THE WATER COMPONENT OF THE PROJECT DOES NOT NEGATIVELY IMPACT THE VECTOR CONTROL COMPONENT, ADEQUATE DRAINAGE AND SAFE WATER STORAGE SHOULD BE DESIGNED INTO THE PROJECT AND PROMOTED THROUGH HEALTH EDUCATION.

--THE PID SEEMS TO SUGGEST THAT NOT ALL COMMUNITIES PROVIDED WITH WELLS WILL ALSO BE PROVIDED WITH PIT

LATERIES. THIS MAY CREATE HEALTH HAZARDS. THE PP SHOULD EXAMINE THIS POSSIBILITY AND EITHER MODIFY THE PROJECT DESIGN ACCORDINGLY OR DOCUMENT THE REASONS WHY NO CONTAMINATION WILL RESULT.

--F. AGRICULTURAL PESTICIDE INTERACTIONS. THE OPERATIONS

RESEARCH COMPONENT OF THE PROJECT SHOULD LOOK AT AGRICULTURAL INTERACTIONS. ALTHOUGH VARIOUS INSECTICIDES COULD BE USED FOR AGRICULTURAL PURPOSES, OFTEN THE SAME ONES THAT ARE USED FOR MEDICAL PURPOSES ARE UTILIZED IN AGRICULTURE AS WELL. FEWER OPTIONS ARE AVAILABLE FOR MEDICAL USE, AND PROBLEMS MAY RESULT IF MOSQUITOS DEVELOP RESISTANCE TO THESE SUBSTANCES. THE RESEARCH ENTOMOLOGIST ON THE PP TEAM SHOULD DISCUSS THIS PROBLEM WITH THE MINISTER OF AGRICULTURE TO DETERMINE WAYS TO MINIMIZE AGRICULTURAL USE OF KEY MOSQUITO-CONTROL INSECTICIDES, SUCH AS MALATHION AND FENITROTHION. AGRICULTURAL USE OF INSECTICIDES IN THE UPCOMING AGRICULTURAL DIVERSIFICATION PROJECT SHOULD BE COORDINATED WITH MEDICAL USES.

7. ENVIRONMENTAL CONCERNS. THE ICE WILL NEED REVISION DURING PP DESIGN. THE PESTICIDES TO BE INCLUDED AND THE RATIONALE FOR THEIR USE SHOULD BE STATED PRECISELY. CLOSE ATTENTION SHOULD BE PAID TO EXISTING RESISTANCE, AND A HIGHER TOXICITY PESTICIDE SHOULD NOT BE APPROVED WHEN ONE LESS TOXIC WOULD DO THE JOB. FOR EXAMPLE, IF Aedes Aegypti MOSQUITOS ARE NOT RESISTANT TO MALATHION, WHY PROPOSE USE OF FENITROTHION? PRACTICAL USE OF THE NON-CHEMICAL PESTICIDE HTI SHOULD BE CONSIDERED. ABATE OR A SIMILAR PRODUCT SHOULD BE USED AS A LARVICIDE INSTEAD OF MALATHION. THE RESEARCH ENTOMOLOGIST PROPOSED FOR THE PROJECT TEAM SHOULD BE ABLE TO CARRY OUT THIS ACTIVITY WITH THE ASSISTANCE OF THE OPERATIONS ENTOMOLOGIST.

8. ADDITIONAL CLARIFICATIONS. THE FOLLOWING POINTS SHOULD BE CLARIFIED IN THE PP.

--A. INTERDONOR COORDINATION. WHILE THE PID TEAM REPORTS THAT COORDINATION WITH OTHER DONORS HAS BEEN GOOD IN DESIGN OF THE PID, THE PP SHOULD INCLUDE A COORDINATION MECHANISM TO ENSURE THAT CLOSE CONSULTATIONS ARE CONTINUED IN SUCH AREAS AS A COMMON APPROACH FOR ORGANIZATIONAL REFORM AND COMMUNITY INVOLVEMENT, SETTING STANDARDS, AND SHARING TECHNICAL INFORMATION.

--B. EVALUATION PLAN. THE EVALUATION PLAN IN THE PP SHOULD CLARIFY THE PROVISIONS FOR AN INDEPENDENT OUTSIDE EVALUATION IN ADDITION TO THE PAHO AND GOB EVALUATIONS.

--C. TRAINING. THE TRAINING PLAN IN THE PP SHOULD CLARIFY THE NUMBER OF DIFFERENT TYPES OF WORKSHOPS TO BE INCLUDED IN THE PROJECT.

--D. ECONOMIC ANALYSIS. THE ECONOMIC ANALYSIS IN THE PP SHOULD BE DESIGNED TO DEMONSTRATE THE MOST COST-EFFECTIVE APPROACH AMONG THE OPTIONS FOR WATER SUPPLY AND DISEASE CONTROL. LAC/DR WILL INCORPORATE THESE MODIFICATIONS INTO THE SCOPE OF WORK FOR THE ECONOMIC CONSULTANT. SMULTZ

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## INITIAL ENVIRONMENTAL EXAMINATION

I. Project Location Belize

Project Title and Number Increasing Human  
Productivity through Health (505-0018)

Estimated Funding - LOP (\$000) A.I.D. \$4,000 (Grant)  
G.O.B. \$1,860  
P.A.H.O. \$ 140

Life of Project Four Years (FY 85-88)

Project Assistance Completion Date May 31, 1989

IEE Prepared Lawrence T. Cowper, AID/W, S&T Health  
Health Science Administrator and  
Robert Gearheart, Ph.D., Senior  
Consultant, WASH Project

Date Prepared August 24, 1984

Threshold Decision: Pursuant to the authority delegated to the USAID Director and based on an Initial Environmental Examination for the proposed use of A.I.D. project funds to support a targeted anti-malaria and Aedes aegypti control program involving intradomiciliary spraying, drug distribution, larviciding, source reduction and natural biological controls and assistance to Belize's rural water and sanitation program as described herein, I recommend the following negative determination:

"The proposed action is not an action which will have a significant effect on the human environment over and above that described below and is, therefore, not an action for which a more detailed Environmental Impact Statement or Assessment will be required under this project."

Mission Director's Concurrence

  
Neboysa Brashich  
A.I.D. Representative  
August 24, 1984  
Date

## INITIAL ENVIRONMENTAL EXAMINATION (IEE)

### I. Project Description

This project will provide technical assistance, support for applied research in malaria control, training, and commodities to assist the Government of Belize (GOB) to implement its Plan of Operations for a nationwide malaria control, *Aedes aegypti* control and rural water supply and sanitation programs. The project will provide funding to be used in effective malaria and dengue control, water supply and sanitation programs focusing primarily on the rural population of Belize, thus enhancing economic and social development in the fields of health and agriculture. The project will enhance the quality of the environment in those areas where source reduction and water management practices are made a part of the malaria control program. Insecticides will be used in the malaria and *Aedes Aegypti* program, but these chemicals which have been used in Belize with no adverse effects in the past will be applied in a manner which is not detrimental to the environment. Health safeguards are presently in place in the field program for application of DDT and limited ULV spraying of malathion, and careful attention will be paid to training and supervision in the handling of additional insecticides which may be applied over the life of the project. The National Service for Malaria Control and the *Aedes Aegypti* Control Program have applied limited organophosphorous (O.P.) insecticides previously without serious case of insecticide intoxication.

The water supply and sanitation portion of the project will include planning, training, technical assistance and construction elements.

Large segments of the proposed project relate to education, technical assistance and training and are categorically excluded from an EA or EIS.

### II. Evaluation of Environmental Impact

#### A. General

The A.I.D. Environmental Impact Statement (EIS) included an in-depth review of the impact of malaria programs on the environment. The conclusions of the EIS were that the major insecticides used in world-wide malaria control programs such as DDT, malathion, and Abate have a favorable risk-benefit impact on the environment due to their method of application in public health programs, i.e. within the house structure. This project will apply standard application techniques for organophosphorous (O.P.) and chlorinated hydrocarbons (DDT) insecticides as in the past. One of the

purposes of the comprehensive EIS submitted by A.I.D. and accepted by the Environmental Protection Agency (EPA) was to avoid duplicating environmental review efforts for projects of a similar nature in countries with comparable conditions. Environmental studies which have been made on malaria control programs within the last five years in India, Thailand, Nepal, Haiti, Ecuador and Pakistan have all reached favorable risk-benefit environmental conclusions. The points of similarity between this project and previous environmental studies, both for O.P. and chlorinated hydrocarbon insecticide use and the other methods of malaria control, obviate the need for another analysis. All the above reports are available in AID/Washington, S&T/Health.

It has been concluded that the project will not have any significant impact regarding the change of the character or the use of the land or causing irreversible or inefficient commitments of natural resources. The project interventions will preserve water quality, both ground and surface, without altering the ecological balance. As a result of this project, impacts will be made on health, sociocultural and economic sectors of Belize. The increased health benefits and decreased time spent acquiring potable water afforded to the target population will increase productivity and decrease expenditures on health services.

## B. Insecticides to be Used in the Project

### 1. Chlorinated Hydrocarbons (DDT)

The major insecticide procured by the GOB for its anti-malaria activities is DDT. While the A.I.D. project will not be procuring DDT for this program a summary review of its environmental implications is presented in this IEE.

The effectiveness of DDT as an insecticide was discovered in 1939 but it was first synthesized in 1874. Initially it was used to protect military areas and personnel against vector borne disease such as malaria and typhus. In 1945, DDT was released for commercial use. That year 15,079 tons were produced in the United States. Use in the U.S. increased until 1959 and then declined gradually. Concern developed in the late 1960's that DDT might have adverse environmental effects not previously expected. However, in developing countries of the world where malaria was a serious problem, the continued use of DDT was necessary.

In January of 1971 a statement entitled "The Place of DDT in Operations Against Malaria and Other Vector borne Diseases" was presented at the forty-seventh session of the executive board of the World Health Organization (WHO). The statement points out that DDT is being replaced for control of many vector-borne diseases by other insecticides and the use of DDT

is declining. However, for the present, no economic alternative to DDT is available and the epidemiological, operational, and financial consequences of the withdrawal of DDT would be very grave. The statement reviews the effects of DDT on man and wildlife and discusses environmental contamination from its use in anti-malarial campaigns. It concludes that:

1. "Indoor spraying of DDT in routine anti-malarial operations does not involve a significant risk to man or to wildlife. The withdrawal of DDT from the malaria programmes would be fraught with great danger and is unjustifiable in the light of present knowledge. The Organization should do everything in its power to ensure that DDT remains available for this purpose.

2. Outdoor use of DDT should be avoided as far as possible.

3. Further research is needed on substitute insecticides...

The use of DDT in Belize's anti-malaria program is confined to spraying the inside of houses and other buildings at the rate of 2 gm. per sq. meter. In this situation it appears that only insignificant amounts will get into the environment utilized by wildlife and the relevant consideration must be the possible effects on humans.

The environmental impact of using DDT in malaria control programs has been thoroughly considered by AID, the Pan American Health Organization (PAHO), and the U.S. Public Health Service as well as by the GOB. These agencies are all in agreement that DDT is the safest and most effective insecticide for use in malaria control and does not threaten the environment when it is applied by the standardized methods recommended by PAHO and A.I.D..

1. The DDT is sprayed only on surfaces where it will not wash away, i.e. on the inside walls of houses and on sheltered areas of adjacent buildings. Thus, it is unlikely that any appreciable amounts of DDT can escape into the soil and subsequently into groundwater or streams. In Belize, there will be two applications of DDT applied each year at a rate of two (2) grams per square meter which is standard dosage in a malaria control program.

2. DDT is characterized by low volatility and none of it escapes into the atmosphere.

3. Regional and Washington-based PAHO advisors are available to ensure proper spraying and storing of the DDT.

PAHO and the U.S. Public Health Service both have responsibilities in the broad field of human health and have available to them the world's leading experts in the field of pesticide use, toxicology of pesticides and the safe handling and proper use of pesticides. Both organizations are on record to the effect that DDT is the cheapest, most effective and the safest insecticide available for use as a residual wall spray to control malaria mosquitoes.

Dr. Steinfield, former Surgeon-General of the United States Public Health Service in testifying before the EPA hearings on DDT stated, "The safety record for the use of DDT in the malaria eradication program is nothing short of phenomenal. Although billions of pounds have been used in anti-malaria programs during the past quarter of a century, there is no record of illness attributable to DDT resulting directly from the normal spraying operations among either the hundreds of thousands of sprayers or the hundreds of millions of occupants of DDT treated homes."

In a WHO publication entitled, "The Place of DDT in Operations Against Malaria and Other Vector-Borne Diseases," an assessment of environmental contamination from the use of DDT in antimalarial operations is given as follows:

"Whereas damage to wildlife has sometimes followed the application of DDT in agricultural and forestry practice, the same risks do not now accompany the use of DDT in anti-malaria operations. Since the vast majority of the DDT used in the control of malaria is applied as a residual spray indoors, only a small fraction of the insecticide is likely to involve any direct contamination of the environment. This, however, may take place during the process of spraying the houses with DDT, when a certain amount of contamination of the floor and immediately surrounding soil outside does take place. Some measurements have indicated that about 6% of the spray is deposited on the floor inside and some 2% on the outside soil around the houses. The deposit outside houses, if calculated for rural areas with an average of 100 inhabitants per square km, as in parts of tropical Africa, would amount to a DDT input of 10 gm per hectare; it will be seen that this is 200 times less than a standard DDT application of 2 kg. per hectare as employed on cotton crops. Moreover, whereas only one or two applications are made to houses per year, multiple applications are made to cotton during its growing season. The DDT sprayed on the inside walls and falling to the floor is held by those surfaces. Hence, provided the insecticide is used indoors as in the case of anti-malaria operations, it would appear that there is little possibility of the insecticide contaminating the surrounding local vegetation and water sources that would endanger wildlife."

Since the use of the DDT in malaria eradication or control

programs is exclusively used as a residual on the inside of buildings and it is not used as a larvicide, the amount getting into the outside environment is minimal. Nevertheless, since DDT has aroused considerable controversy and emotion, a brief review of some environmental effects is presented. DDT tends to persist in the environment for relatively long periods of time and does accumulate in the tissues of animals and concentrations tend to magnify in some organisms over a period of time. DDT in soil has an average half life of three (3) years (Edwards, 1973). In Maryland occasionally cropped soil had 40% of the DDT applied after 17 years (Nash and Woolson, 1967).

At the present time a vast literature exists on the effects of DDT on the environment. A review of the total literature is not practical here but the following presents the essential elements of it. There is widespread disagreement over the use of DDT and it has been banned in a number of developed countries even though scientists favor continuation of its essential uses. In the United States DDT is banned but is allowed when necessary to protect human health. It was used in California in 1976 for control of plague (R.F. Peters, Pers. Com.).

Because of the overriding necessity for DDT in malaria eradication and control it is still used for that purpose in many areas of the world. However, because of reported serious adverse effects on some forms of wildlife, notably fish and some birds, the use of DDT in malaria control is restricted to indoor residual spraying where the risk of exposing wildlife is extremely limited.

During the course of project documentation, spray teams were observed in the field applying DDT. The spray applications were environmentally satisfactory--food was covered, articles removed from room, correct application procedures. It is believed that the program will continue to apply this insecticide in a satisfactory manner in the residual spray program. There is need for better field storage of the DDT and there are funds provided within the project to improve this aspect.

B. Organophosphorous Insecticides (Malathion, Abate)

In addition to DDT, the Belize malaria program will be applying limited amounts of organophosphorous (O.P.) insecticides, malathion, and Abate in its field operations program in limited areas of the country. At present, O.P. insecticides are only applied as ULV spray (malathion) in limited urban areas and as a larvicide (Abate) in the Aedes Aegypti Program.

Malathion has undergone several environmental examinations in connection with its use in A.I.D.-assisted malaria control efforts in Sri Lanka, Pakistan, India, Nepal and Zanzibar. All of these environmental examinations have concluded that malathion as applied as a residual spray in malaria control programs does not adversely affect the environment provided that (1) strict compliance to A.I.D. specifications for malathion is enforced; (2) proper training and supervision of spray personnel is carried out; (3) adequate protective equipment is provided to spray personnel and (4) periodic cholinesterase testing is done on spray operation personnel.

Over the last five years approximately 90 million pounds of U.S. supplied malathion has been applied in A.I.D.-assisted malaria programs without a single serious intoxication episode. There have been a few moderate intoxication cases but the worst cases only required a brief overnight stay in a hospital. This remarkable record was accomplished by strict enforcement of health safeguards, adequate training and a high quality technical insecticide. Belize has applied only limited amounts of malathion in the past years. The methods of application by the National Malaria Control Service (NMCS) were in conformity with worldwide health standards and there were no incidences of human insecticide intoxication. If malathion is to be applied as a NLV application in the program over the project period, there is every reason to believe that it will be applied in an environmentally acceptable manner. Susceptibility tests carried out in September and October 1984, indicate that the mosquito vectors of malaria and dengue fever in Belize are completely susceptible to DDT and malathion.

The larvicide, Abate, an organophosphate, is to be used as a control measure in the Aedes Aegypti Control Program during the life of the project. This compound has been shown in studies to be low in toxicity if taken orally and applied dermally. Normal application concentrations of Abate in water under field conditions is about 0.5 ppm. Even if an adult were to drink the water treated directly and if 2 liters were consumed, the maximum amount of Abate imbibed daily would be about 1 mg. This compares with a dosage of 256 mg/man/day fed to human volunteers for 5 days and 64 mg/man/days for four weeks without clinical symptoms or side effects. Through the dermal route, Abate was found to be even less toxic. Abate has a short half-life, is not stored in the body, and produces no known chronic or residue effect. Abate offers little potential for harm to human health (Pg. 224, AID, EIS).

During the course of PP preparation each of the six District Aedes Aegypti Inspectors was visited and work reviewed. Although more training in Aedes surveillance is necessary, each of the Agents understood the environmental implications of their activities.

In addition to the safeguards for insecticide use already existing and being used in the malaria control service, the A.I.D. project is planned to provide experienced short term project funded malaria consultants who will pay particular attention to matters concerning the procurement, storage and application of insecticides.

### C. Biological Control

The project does foresee the continued use of larvivorous fish in the project as a supplemental biological control measure in mosquito control in selected areas. It is planned to increase the use of larvivorous fish for this purpose in the operation. There are no plans to import non-indigenous larvivorous fish,

but to use fish already established in Belize in their malaria and mosquito control programs.

It is also possible that a biological larvicide, BTI, may be experimentally used in specific locations. There are no known adverse environmental implications to this compound and it rapidly bio-degrades in the environment. As a research project, BTI will be carefully evaluated if it is tried in the program and will be supervised by trained AACP personnel.

### III. Discussion of Impacts

#### A. Land Use

The only project activity which will effect land use is the provision of piped water systems in rural communities (250 to 500 people). This will not produce any adverse changes in the use of the land.

1.a) Population Increase: Since the project will improve the health conditions in rural villages a minor increase in population may be expected.

1.b. Extraction of Natural Resources: Small quantities of concrete aggregates and sand will be used on pump pods, standpipes and reservoirs. The effect of this extraction will not be significant.

1.c. Land Clearing: Well drilling and pipe installation will not involve any significant land clearing.

1.d. Changing Soil Character: The nature of the soils will not be affected.

2. Alteration of Natural Resources: No relevant impact.

3. Foreclosing Important Uses: The Project will not introduce changes in the present use of the land.

4. Danger to Man or His Works: Project sites will be evaluated to insure that they will not be subjected to landslides, floods, erosion, etc.

## B. Water Quality

1. Physical State of Water: The project will only include projects in areas in which the availability of water has been proven and where there is no danger of irreversible depletion of scarce water resources.

2. Chemical and Biological States: Project participants will benefit from the increased availability of higher quality water than presently afforded. Groundwater sources and reservoirs will be protected from contamination.

3. Ecological Balance: Water projects will mostly deal with groundwater sources. Surface water projects will only be implemented in areas where adequate water resources are available, consequently the ecological balance will not be significantly affected.

4. Sewage Disposal: All sanitation projects will carefully consider environmental hazards in both their siting and their operations.

## C. Atmospheric Impacts

The traffic associated with this project will not significantly increase the noise level or air pollutants in the project areas.

## D. Natural Resources

Water consumption will be minimal due to the small size of the communities. The groundwater draft will not affect the underground water table in a significant fashion.

## E. Cultural and Socio-Economic Impacts

Water availability will reduce the cost and time spent on satisfying vital needs and domestic tasks. The project will also create the conditions for the establishment and growth of community development activities. Improved living conditions in the rural communities will assist in stemming the migration of rural inhabitants to urban areas.

F. Health Impacts

The provision of potable water will create an environment conducive to improving health conditions. The incidence of gastro-intestinal diseases related to drinking contaminated water will be significantly reduced.

G. Other Impacts

No other environmental impacts or controversial environmental issues are foreseen in relation to any of the proposed project activities.

IV. Recommendation

In view of the above examination of the environmental issues of this project, the project committee recommends a threshold decision for a Negative Determination be made for this program.

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Environmental Impact Checklist

Impact Identification and Evaluation Form

- N - No environmental impact
- L - Little environmental impact
- M - Moderate environmental impact
- H - High environmental impact
- U - Unknown environmental impact
- 1 - Positive impact
- - Negative impact

Impact Areas and Sub-areas

A. Land Use

1. Changing the character of the land through:

- a. Increasing the population N
- b. Extracting natural resources N
- c. Land clearing L
- d. Changing soil character N

2. Altering natural defenses N

3. Foreclosing important uses N

4. Jeopardizing man or his works N

5. Other factors increase agricultural productivity L

B. Water Quality

1. Physical state of water M

2. Chemical and biological states M

3. Biological balance N

4. Other factors       

C. Atmosphere

1. Air additives N

2. Air pollution L

3. Noise pollution N

4. Other factors           

D. Natural Resources

1. Diversion, altered use of water L

2. Irreversible, inefficient, commitments N

3. Other factors           

E. Cultural

1. Altering physical symbols N

2. Dilution of cultural traditions N

3. Other factors           

F. Socio-economic

1. International impacts M

2. Change in population L

3. Changes in cultural patterns N

4. Other factors           

G. Health

1. Changing a natural environment L

2. Eliminating an ecosystem element N

3. Risk of intoxication of MOH staff M

4. Community Health Conditions H

H. General

1. International Impacts M+

2. Controversial Impacts N

3. Larger Program Impact M+

4. Other Factors

AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON D C 20523

LAC/DR-IEE-85-10

Annex H

ENVIRONMENTAL THRESHOLD DECISION

Project Location : Belize

Project Title and Number : Increased Productivity  
Through Health  
505-0018

Funding : \$7,000,000 (G)

Life of Project : 4 Years

IEE Prepared by : Lawrence Cowper  
S&T/Health, AID/W

Recommended Threshold Decision : Negative Determination

Bureau Threshold Decision : Concur with Recommendation

Comments : None

Copy to : Neboysa Braschich, A.I.D.  
Representative, Belize

Copy to : Lawrence Cowper,  
S&T/Health, AID/W

Copy to : Wendy Stickel, LAC/DR

Copy to : IEE File

James S. Hester Date JAN 14 1985

James S. Hester  
Chief Environmental Officer  
Bureau for Latin America and  
the Caribbean

## LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>GOAL</u>			
To improve the health and productivity of the Belizean population.	<ul style="list-style-type: none"> <li>a. Measurable reductions in morbidity and mortality from endemic diseases which are directly attributable to specific health interventions.</li> <li>b. Development of economic sectors such as agriculture will not be adversely affected by losses in worker productivity caused by outbreaks of malaria, dengue fever, and gastro-intestinal diseases.</li> <li>c. The tourism industry will not be adversely affected by reports of outbreaks of the targeted diseases.</li> </ul>	Reports from MOH's, Environmental Health Service, PAHO and other international health organizations. Reports from other affected ministries.	The improvement in environmental health and vector control services will not be offset by other factors such as declining economic conditions, social unrest, etc.
<u>PURPOSE</u>			
<p>COMPONENT I</p> <p>Control the incidence of malaria and dengue fever.</p>	<ul style="list-style-type: none"> <li>a. To control the present epidemic of malaria and dengue fever by 1987.</li> <li>b. To reduce malaria incidence to a parasite incidence to 8 cases/1,000 population or less</li> </ul>	NMCS and AACP surveillance records, case records of public and private hospitals, health centers, validated by: annual assessments, AID mid-term and EOP evaluations, and	<p>Continuing GOB priority given to anti-malaria and <u>Aedes aegypti</u> activities.</p> <p>Adequate GOB budgetary</p>

LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	<p>by EOP.</p> <p>c. To reduce <u>P. falciparum</u> malaria to a point where it represents no more than 5% of the total yearly caseload of malaria by 1988.</p> <p>d. To reduce the total number of reported <u>Aedes aegypti</u> positive localities to less than 10% of the total localities in the country by 1988.</p>	<p>continuous monitoring by short term advisors and consultants.</p>	<p>support.</p>
<u>PURPOSE</u>			
<p>COMPONENT II</p> <p>To expand coverage of water and sanitation in rural communities and villages in three districts and to improve the national water quality control program.</p>	<p>a. To expand the water supply coverage to 90% of the rural population in three districts.</p> <p>b. To expand the coverage of pit latrines to 50% of the rural population in three districts.</p> <p>c. To attain an 85% hand pump working status for all pumps in the three districts including those previously installed.</p> <p>d. An annual report of drinking water quality of rural areas for FY 86-FY 89.</p>	<p>EHS surveillance of rural water supply systems and sanitation devices. System coverage and usage verification by annual AID assessment, EOP evaluation, and continuous monitoring by long-term advisor and consultants.</p>	<p>Continuous GOB priority given to rural water supply and sanitation.</p>

## LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<u>SUB-PURPOSE</u>			
<p>COMPONENT I</p> <p>To improve the effectiveness of insecticide spray operations; institutionalize effective surveillance; introduce alternative malaria and dengue fever control activities which minimize the need for house spraying with insecticides; initiate vector control research; continue <u>Aedes aegypti</u> control program (AACP).</p>	<p>a. NMCs and AACP fully &amp; properly staffed &amp; effectively operating to maintain continuing malaria and <u>Aedes aegypti</u> surveillance and control.</p> <p>b. Increased local involvement and cooperation with other GOB institutions.</p> <p>c. Volunteer malaria workers in place in 360 localities.</p> <p>d. Four vector control and/or other auxiliary or substitute methods for house spraying tested, and, where applicable, implemented.</p> <p>e. Active program in <u>Aedes aegypti</u> control.</p>	<p>Same as above, plus NMCS/AACP annual reports.</p>	<p>Research within Belize and world-wide will define appropriate alternative methodologies to provide viable operational methods for control of malaria.</p> <p>Major malaria epidemic does not occur.</p>
<u>SUB-PURPOSE</u>			
<p>COMPONENT II</p> <p>To improve the effectiveness of the Environmental Health Service by strengthening its institutional capacity and by establishing a national rural water quality surveillance system.</p>	<p>a. The Environmental Health Service (EHS) is fully staffed with trained personnel to maintain a continuing effort to supply water to rural communities and to insure that pumps and systems are maintained.</p> <p>o. The EHS is able to sample and analyze rural water supplies.</p>	<p>Same as above.</p>	<p>Continuing GOB priority given to water and sanitation.</p> <p>Adequate GOB budgetary support.</p>

LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions						
To increase community participation in maintenance of water and sanitation systems and strengthen the role of district-level health teams.	a. All participating communities have an established and functioning health committee which manages the water system. b. The District Health Team meets regularly with community groups to promote self-help activities.	Annual AID assessment, EOP evaluation and continuous monitoring by long-term advisors and consultants.	Continuing GOB support of Community Development and District Health Teams.						
<u>PROJECT OUTPUTS</u>									
COMPONENT I									
1. House spraying with residual insecticides targeted and stratified to provide coverage where and when needed so that total insecticide spraying is reduced.	Reduction in the target house spraying targets in the spray areas.  <table border="1"> <thead> <tr> <th>Area</th> <th>1985</th> <th>EOP</th> </tr> </thead> <tbody> <tr> <td>Perennial</td> <td>17,000</td> <td>10,000</td> </tr> </tbody> </table>	Area	1985	EOP	Perennial	17,000	10,000	1. NMCS and AACP annual reports. 2. Annual multi-donor assessment of operations. 3. Mid-term and EOP AID evaluations. 4. On-going monitoring by short-term consultants.	1. Continued availability of residual & ULV insecticides effective against the vectors. 2. Implementation capacities exist for alternative control methodologies. 3. Household acceptance of insecticide spraying will improve through health education and community involvement.
Area	1985	EOP							
Perennial	17,000	10,000							
2. Functioning, effective and continuous epidemiological, parasitological an entomological surveillance system.	a. Blood slides from all sources including malaria volunteers are examined by NMCS and reported to the District Evaluator within 10 days.	Same as above.	1. Available trained staff 2. Malaria education improved in public and private sectors. 3. MOH actively parti-						

## LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	<ul style="list-style-type: none"> <li>b. Increase to 360 or more village malaria volunteers by EOP.</li> <li>c. Insecticide resistance tests on <u>A. Albimanus</u> and <u>Ae. Aegypti</u> adults completed each year in 4 or more NMCS Districts.</li> <li>d. Minimum of 5 resistance tests completed each year against other <u>Anopheles</u> species and other candidate insecticides.</li> <li>e. Minimum of 1 intensive field investigation for parasite resistance to drugs each year (1986-1988).</li> <li>f. Minimum of 2 research studies in progress to improve existing and/or evaluate new methods of vector control.</li> </ul>		<p>cipates.</p>
<p>3. Active vector control program in place in pilot areas to replace or supplement house and ULV spraying.</p>	<ul style="list-style-type: none"> <li>a. Operational implementation of a project to test feasibility of replacement of total house spraying with alternative control methods in representative areas by EOP.</li> <li>b. A research project to test various methods of vector control under Belize ecological conditions completed by EOP.</li> <li>c. Vector census systems functioning in each District by EOP.</li> </ul>	<p>Same as above.</p>	<p>Suitable methodology available which can be adapted to Belizean conditions.</p>

LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p>4. Active, presumptive prophylactic and radical treatment systems in place and responsive to surveillance data.</p>	<p>a. Maintain an ABER (Annual Blood Examination Rate) at 10% or more each year of the project.                      b. Research investigations initiated on side-effects and acceptance rate by EDP.                      c. Radical treatment initiated within maximum of 14 days after blood sampling.</p>	<p>Same as above.</p>	<p>Anti-malaria drugs are available which continue to be effective against existing parasites.</p>
<p>5. Malaria and <u>Aedes aegypti</u> control education and information programs in place and serving all levels of NMCS, AACP &amp; MOH.</p>	<p>a. Three annual workshops and seminars for NMCS and AACP staff and sprayers completed and publicized.                      b. Appropriate information materials distributed to schools, district health teams and the public in all areas by the end of FY 86.                      c. New <u>Aedes aegypti</u> educational packages developed and distributed.                      d. Appropriate educational presentations initiated in six districts at least four times per year.                      e. Twelve or more annual media placements for informing and educating the public.                      f. One workshop on community involvement completed with each district health team.</p>	<p>Same as above.</p>	<p>Technical and creative skill logically exists for design and production of educational materials.</p>

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## LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
6. Revised, intensified and continuing training programs for staffs of NMCS, AACP and other relevant MOH institutions.	<ul style="list-style-type: none"> <li>a. Annual seminars and work-shops covering all phases of malaria and <u>Aedes aegypti</u> control completed by EOP.</li> <li>b. Included in annual seminars and all NMCS and AACP training courses is a component on social, cultural and behavioral skills necessary to induce changes in behavior.</li> <li>c. Regional short-term training of one AACP and one NMCP employee in vector control as applied to malaria control and <u>Aedes aegypti</u> control. Two by EOP.</li> <li>d. Regional observation training of mid-level personnel: 12 by EOP.</li> <li>e. One U.S. MSc/MPH/Ph.D. course completed by MOH official by EOP.</li> <li>f. Short-term training in the U.S. or region in comprehensive vector control: 12 by EOP.</li> </ul>	Same as above.	<ul style="list-style-type: none"> <li>a. Necessary Cabinet-level support available.</li> <li>b. Appropriate candidates can be identified and cleared.</li> <li>c. Suitable courses on malaria control and <u>Aedes aegypti</u> control will be available in the Latin American/Caribbean Region.</li> </ul>
7. Effective program planning, management, and evaluation.	<ul style="list-style-type: none"> <li>a. Yearly Plans of Action prepared and approved.</li> <li>b. Existing NMCS and AACP Plans of Operations are revised in 1985 and Plans of Operations for 1986-88 prepared by the end of 1985.</li> </ul>	Same as above.	GOB priority for malaria and <u>Aedes aegypti</u> control continues.

## LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	c. Program evaluations completed in 1986, 1987, and 1988. d. AID mid-term and final EOP evaluations completed. e. Indicators for outputs 1-7 achieved in timely, effective manner.		
<u>PROJECT OUTPUTS</u>			
COMPONENT II			
1. Installation of tubewells and handpumps in rural localities.	500 tubewells and handpumps installed in approximately 40 localities.	Reports from MOH, EHS, and other affected ministries and agencies.	EHS reorganization dedication of one full time environmental health assistant per district.
2. Installation of tubewells, submersible pumps, and storage reservoirs in larger rural communities.	20 tubewells, submersible pumps, and storage reservoirs installed in 20 rural communities.	AID mid-term and EOP evaluations and continuous monitoring by long-term advisors and consultants.	Local participation in the operations and maintenance of the water supply system and in the use of pit latrines.
3. Installation of pit latrines in rural localities and communities.	3000 pit latrines installed in rural localities and communities.		
4. Establishment of a functioning national water quality control program.	All rural water supplies sampled & analyzed at least once a year.	EHS water monitoring annual reports validated by AID long-term advisor and by AID evaluations.	

## LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
5. Project management skills institutionalized in EHS.	One two week workshop on project management for members of the EHS with follow up evaluation during LOP.	Same as above.	Reorganization at EHS.
6. Active community involvement in planning, construction and maintenance of water systems.	<ul style="list-style-type: none"> <li>a. Viable health communities established and working in each project community.</li> <li>b. Community labor inputs to each system in accord with their agreement with the district PHI.</li> <li>c. Coordination established between community health committees, district health teams and PHIs; agreements signed with PHIs.</li> <li>d. Active maintenance fund established for each rudimentary water system.</li> <li>e. Community maintenance person designated for all water systems, maintenance kits distributed.</li> </ul>	Same as above.	Continuing GOB support for community involvement and district health teams.
7. Water and sanitation education and information programs in place and serving EHS, district health	<ul style="list-style-type: none"> <li>a. One appropriate technology workshop per year in each of three districts.</li> <li>b. Six workshops (2 per district) on community development and</li> </ul>	Same as above.	Continuing provision of GOB support of the Health Education and Community Participation Bureau,

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## LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
8. Institutional capacity to maintain handpumps, wells and rudimentary water systems.	<p>village level for use in workshops.</p> <p>e. Educational media and demonstration material developed for appropriate technology workshops.</p> <p>a. Four workshops for EHS staff and handpump maintenance crew over the LOP. Workshops to include both technical and training component. Training component directed at the use of these crews to train village pump caretakers and community system managers.</p>	Reports from districts where hand-crews have operated.	Availability of training facility and access to audience.
9. Effective programming, planning, management and evaluation.	<p>a. Yearly Plan of Action prepared.</p> <p>b. Annual Plan of Operation updated and adjusted.</p> <p>c. Evaluation completed - 1985, 1986, 1987.</p> <p>d. AID mid-term and EOP evaluation completed.</p> <p>e. Indicators for outputs on schedule.</p>		GOB priority is given for rural water supply and sanitation.

LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
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PROJECT INPUTS

COMPONENT I

Government of Belize

1. Adequate funds for NMCP and AACP operations of LOP, including purchase of insecticides not provided by AID, with plans for continuing support after termination of AID assistance.

2. Adequate personnel staffing for NMCP and AACP.

3. Adequate facilities for NMCP and AACP programs through in-kind support of GOB health institutions.

- a. <sup>GOB</sup> GOB budget \$2.28 million (equivalent) and funds provided to NMCP and AACP as required.
- b. Approved Plan of Operations exist over LOP.

- a. <sup>GOB</sup> Annual GOB/MOH budget, and budget funds availability.
- b. Staffing lists.
- c. Field visitations.
- d. Provision of support for NMCP and AACP in national planning documents.
- e. Plan of Operations.

<sup>GOB</sup> Adequate official and executive support for the malaria and Aedes aegypti control programs.

LOG FRAME

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
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PROJECT INPUTS

COMPONENT II

Government of Belize

1. Adequate funds for EHS Rural Water Supply and Sanitation operations, including fuel costs for project.
2. Adequate personnel staffing for EHS and reorganization to facilitate project implementation.

- GOB
- a. GOB budget \$1.05 million (equivalent) and funds provided to EHS as required.
  - b. An approved Plan of Operations exists over LOP.
  - c. EHS reorganized.

- GOB
- a. Annual GOB/MOH budget and budget funds availability.
  - b. Staffing lists.
  - c. Field visitations.
  - d. Provision of support for EHS.

GOB

Adequate political and executive support for the rural water supply and sanitation programs in MOH

USAID INPUTS

	<u>USAID</u>		
	FX	LC	TOTAL
1. Technical Assistance	1. 2,627	-	2,627
2. Operations Research	2. 77	72	149
3. Training	3. 227	97	324
4. Construction	4. -	165	165
5. Commodities	5. 2,170	96	2,266
6. Evaluation	6. 116	18	134
SUBTOTAL	5,217	448	5,665
7. Inflation	7. 505		505
8. Contingencies	8. 830		830
TOTAL	6,552	448	7,000

USAID

1. Consultations occur as scheduled.
2. OR project documents.
3. Trained EHS staff and community members.
4. Functional lab exists.
5. USAID and EHS reports.
6. Evaluation reports.

USAID

Availability of funds.

**ANNEX J. Draft Statements of Work for the Project Financed Consultants**

**PROJECT MANAGER**

I. General: The Project Manager of the Increased Productivity through Health Project, Belize is responsible for the implementation, management, and day to day evaluation of the two major project components--(1) Water Supply and Sanitation (WS/S); and (2) Vector Control which consists of malaria and Aedes aegypti control.

The Project Manager will be responsible to the USAID/Belize General Development Officer on matters of project implementation, procurement, training, technical assistance, research and evaluation. This advisor will provide over-all administrative supervision and support to the Water Supply and Sanitation Advisor, the Community Development/Health Education/Training Advisor and the short term advisors.

The Project Manager must be a U.S. citizen, physically able to undertake frequent and difficult field travel, have a minimum of seven years overseas experience in development projects and have demonstrated superior management skills.

II. Educational Requirements: The Project Manager must have a degree in biological science, engineering, physical science, entomology or public health. A Master's level degree or PhD in health sciences will be given preference.

III. Experience: It is mandatory that the Project Manager have at least five years of overseas development experience in the field of health in a responsible management position. The overseas experience must include specifically vector control or responsibilities for a period of at least three years. Additional overseas work experience in water supply is desirable. The Project Manager must have supply procurement and contracting experience. Previous overseas work experience with A.I.D. program requirement and systems is highly desirable.

IV. Specific Responsibilities: Under the over-all supervision of the General Development Officer (GDO), or delegated alternative officer of USAID/Belize the Project Manager will undertake but not be limited to the following duties:

- a) Provide technical and management support to the Increased Productivity Through Health Project to meet the stated objectives of the Project.
- b) Prepare periodic reports as directed on Project activities

for A.I.D.

- c) With the assistance of the USAID water supply and sanitation advisor, national counterparts in the Environment Health Division of the Ministry of Health and the National Malaria Control Service, prepare and finalize commodity procurement requirements and documents, organize and arrange for technical assistance services, insure operational research activities are initiated and evaluated as planned, and insure necessary GOB/USAID program evaluations are carried on as scheduled.
- d) Provide liaison services between A.I.D., PAHO and GOB to insure timely and effective Project activities.
- e) Responsible for the general supervision of the Community Development/Health Education/Training consultant, the water supply and sanitation consultant and the vehicle maintenance consultant.
- f) Provide technical consultation as required to the national directors of Malaria Control, Aedes Aegypti Control and Water Supply and Sanitation of the Ministry of Health on matters related to the Project.
- g) Manages the Project office, initiates and maintains office communication system, supervises office personnel, orders supplies, provides payment on authorized expenditures, establishes vehicle control and insures maintenance of project equipment. Responsible for logistical and support services of short term consultant personnel as authorized by contract arrangements.
- h) Certifies Project expenditures as valid expenditures under the Project, insures vouchers are prepared correctly and transmits vouchers to approving offices within USAID/Belize.
- i) Undertakes field travel to work sites to insure work in progress is on schedule, of satisfactory quality and in accord with AID/GOB agreements. Takes necessary action to correct shortcomings on project activities through on-the-spot corrective action or referred to the General Development Officer.
- j) Other duties as required.

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COMMUNITY DEVELOPMENT/HEALTH EDUCATION/TRAINING SPECIALIST

I. General: The Community Development/Health Education/Training (CD/HE/Training) Advisor is responsible for the development and implementation of the community development/health education/training activities under both the Water and Sanitation and Vector Control components of this project. He/she will be administratively responsible to the Project Manager.

The CD/HE/Training Advisor must be a qualified U.S. citizen or third country national, physically able to undertake frequent and difficult field travel. This person must have a minimum of three years international development experience and have demonstrated organizational community development, training, health education, and communication skills.

II. Educational Requirements: The CD/HE/Training Advisor must have a degree in community development, health education, public health, nursing and anthropology or medical anthropology. A Masters level degree in these areas is preferred.

III. Experience: It is necessary that the CD/HE/Training Advisor has at least three years overseas development experience in community level CD/HE activities. Training design experience at the midlevel is needed. Experience in the design of community level health education and mid level training materials is also needed. Previous work with water and sanitation and vector control programs is highly desirable.

IV. Specific responsibilities: Under the overall supervision of the Project Manager the CD/HE/Training Advisor will undertake but not be limited to the following duties:

- a) Provide technical support to the Increased Productivity through Health Project to meet its stated objectives.
- b) Develop a work plan for the training of water and sanitation, vector control and related health personnel in health education, community development as well as the engineering technical areas.
- c) With counterpart staff, develop community level health education materials and mid level training activities to support water and sanitation and vector control activities.
- d) With counterparts, develop additional baseline information on health habits and practices related to water and sanitation and vector control.

- e) Assist in the design, organization, scheduling and evaluation of technical training programs for Public Health Officers, Vector Control Officers and related District Health personnel.
- f) In collaboration with Operations Research Advisors incorporate new findings, as appropriate, into the training of water and sanitation and vector control program personnel.
- g) Prepare periodic reports as directed on Project activities
- h) Other duties as required

WATER SUPPLY AND SANITATION ADVISOR

I. General: The Water Supply and Sanitation Advisor of the Increased Productivity through Health Project, Belize is responsible for the implementation of the technical, and educational, community participation and construction management elements of the Water Supply and Sanitation component of the project. The Advisor will be responsible for procurement of commodities, coordination with GOB counterpart, specification of short term advisor and evaluation of project outputs.

II. Educational Requirement: The WS/S Advisor must have a degree in environmental or civil engineering with a sanitary engineering emphasis, or public health engineering. A Master's level degree or PhD in environmental engineering will be given preference. The successful applicant must be conversant in Spanish.

III. Experience: The WS/S Advisor must have a minimum of 3 years of overseas development experience in the field of rural water supply and sanitation. The overseas experience must include responsibilities with cable or rotary drilling equipment, deepwell pumps, handpumps, submersible pumps and low cost sanitation methods. Experience in construction management and systems evaluation is desirable. Successful experience working with in-country counterparts is an important consideration for this assignment. U.S. work experience with small community water supply and construction projects is considered highly desirable but not equivalent to overseas experience.

IV. Specific Responsibilities: Under the supervision of the Project Manager, the WS/S Advisor will undertake but not be limited to the following:

- a) Provide technical and management support to the Increased Productivity through Health (IPTH) Project to meet the stated objectives of the Project.
- b) Work directly with the Senior PHI for Water Supply and Sanitation in program implementation.
- c) Work with the Project Management Team, to insure that coordination occurs at all levels of the Project.
- d) Provide in-service project management training to the District PHIs.

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- e) Provide technical assistance to the CD/HE/T Advisor for community development workshops.
- f) Prepare project reports as required by the Project Manager and GOB.
- g) Monitor the progress of all water supply and sanitation projects by making regular site visits.
- h) Assist the GOB in developing plans and specifications for appropriate rural water supply and sanitation technologies.
- i) Supervise the development of the rural water quality laboratory and assist in training the MOH personnel in monitoring, surveillance, analysis, and information storage and retrieval systems.

## VEHICLE MAINTENANCE SPECIALIST

I. General: The Vehicle Maintenance Specialist (VMS) of the Increased Productivity through Health Project, Belize is responsible for the organization and implementation, of a vehicle maintenance and use system for all vehicles associated with the rural water supply and sanitation, Aedes aegypti, control and malaria control components of the project. The vehicle maintenance and repair program will include vehicle maintenance and care, vehicle control, mechanic and driver training, organization of a parts, equipment and tool inventory system, and organization of a repair facility. The VMS will work closely with the mechanic for the MOH to develop and implement this program. The VMS is administratively responsible to the Project Manager.

II. Education Requirement: The Vehicle Maintenance Specialist must have an AA degree in automotive mechanics and/or a certificate of completion of a motor mechanic's course or an equivalent military proficiency rating.

III. Experience: The VMS must have a minimum of 10 years experience in managing pools of vehicles for government or private business. This experience should include all aspects of vehicle maintenance and use. Preference will be given to candidates for experience in vehicle maintenance systems in developing countries. The types of vehicles to be managed are as follows: (1) 4-wheel drive pick-ups; (2) 2-wheel drive pick-up; (3) double axle trucks, and (4) light motorcycles. Experience with both gasoline and diesel engines is required. Experience in training of foreign nationals is highly desirable.

IV. Specific Responsibilities: Under the supervision of the Project Manager and in coordination with the WS/S Advisor, the VMS will undertake but not be limited to the following word activities:

- a) Provide technical and management support to the mechanics in establishing a vehicle maintenance program for project component activities;
- b) Assess the limitation of the MOH to repair, maintain and control vehicles and recommend a practical maintenance, repair and control program;
- c) Provide training to the users of the vehicles in basic care and maintenance of vehicle;
- d) Develop appropriate schedules and report systems to monitor

- use and maintenance schedules of the vehicles;
- e) Develop and install an inventory systems for vehicle parts and equipment;
  - f) Develop a budget system for determining fuel, part, labor, tool, and tire costs for the vehicle in the Project's components;
  - g) Train MOH mechanics in basic diagnostic and repair techniques. Such instruction should include but not be limited to brake and clutch repair and adjustments, engine timing fuel and water pump replacement alignment of wheels, basic body repair work and electrical repair;
  - h) Prepare a list of spare parts, tools and tires which should be ordered for project component vehicles in FY 1985 and projections for the 1986 procurement; and
  - i) Other work as assigned by the Project Manager.

## SOCIAL SCIENTIST

In order to operate an effective malaria and Aedes aegypti control program, the Ministry of Health must secure a high degree of community and individual acceptance and participation. Essential in this effort is an understanding of present attitudes toward, and awareness, of disease problems, so that the problems can be adequately addressed. The task is especially complicated in Belize by the presence of six major ethnic groups in rural areas, each with a different perception of the disease problem and different customs and attitudes toward treatment.

The specific questions that need to be answered are:

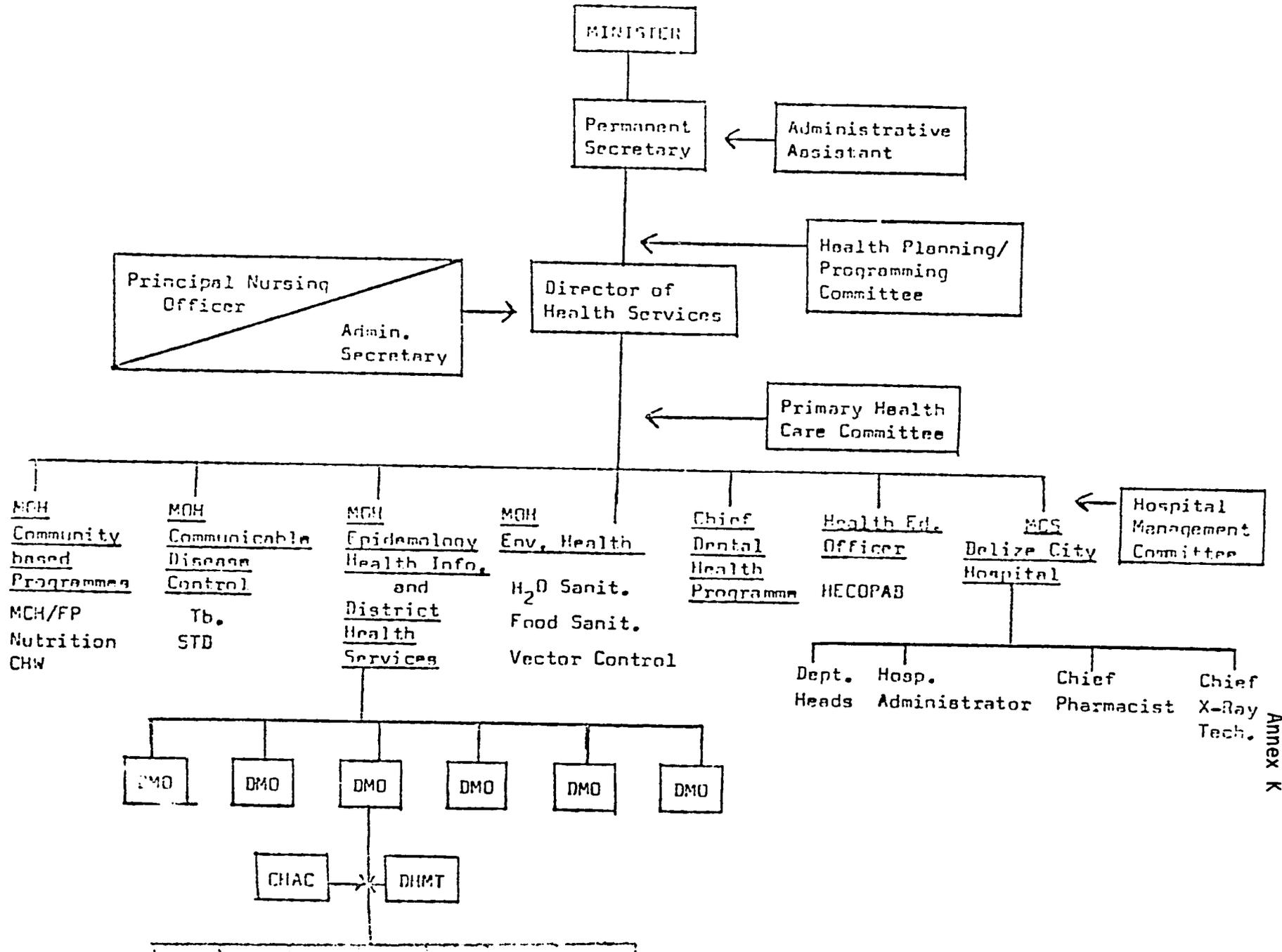
- How do people in each ethnic group presently identify malaria and dengue? Do they recognize them as discrete diseases?
- How do people choose different forms of treatment after diagnosis? Who do they go to?
- Are there any beliefs or customs relating to diagnosis or treatment of malaria or dengue which interfere with control efforts?
- How accepting are people in different areas and groups of spraying?
- How much are voluntary collaborators being used, and how might their effectiveness and acceptance be increased?
- How can public education and training of VCs be improved to increase public participation in the control programs?

The social scientist will work closely with the health education program and will run workshops for malaria sprayers and evaluators and Aedes aegypti personnel in order to improve their effectiveness. The information gathered will also serve as a statistical baseline for use in project evaluation, and an on-the-ground evaluation of present program effectiveness.

This position requires a social scientist, preferably a medical anthropologist, skilled in rapid survey research and interviewing, fluent in Spanish. Familiarity with Latin America and the Caribbean is important but not essential.

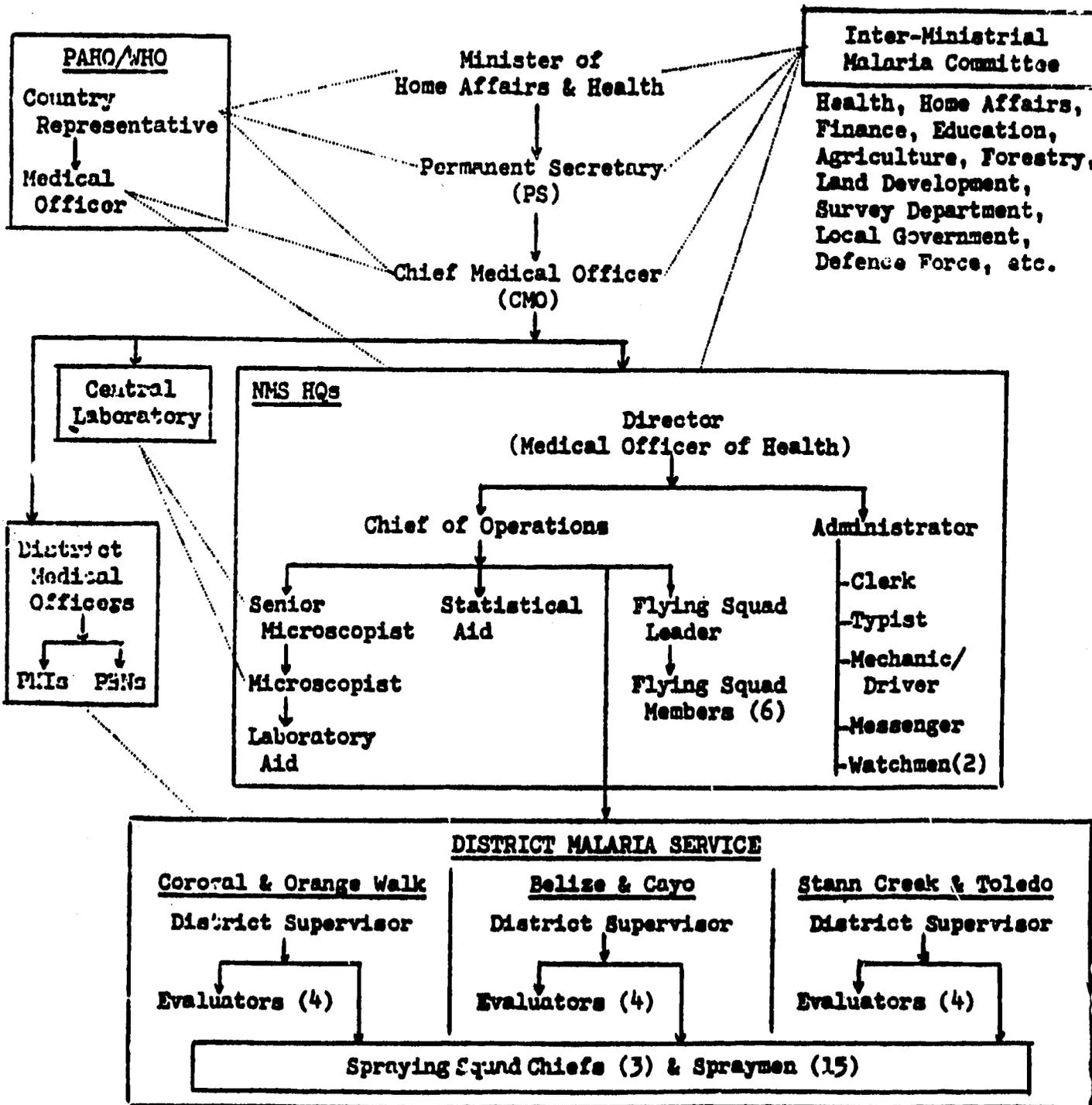
Three months are required. Two months in field research, one

month in data analysis, writing and collaboration with the CD/HE/T Advisor to present the results in a workshop. A final report which includes a package of educational materials specific to each ethnic group in the country must be developed.

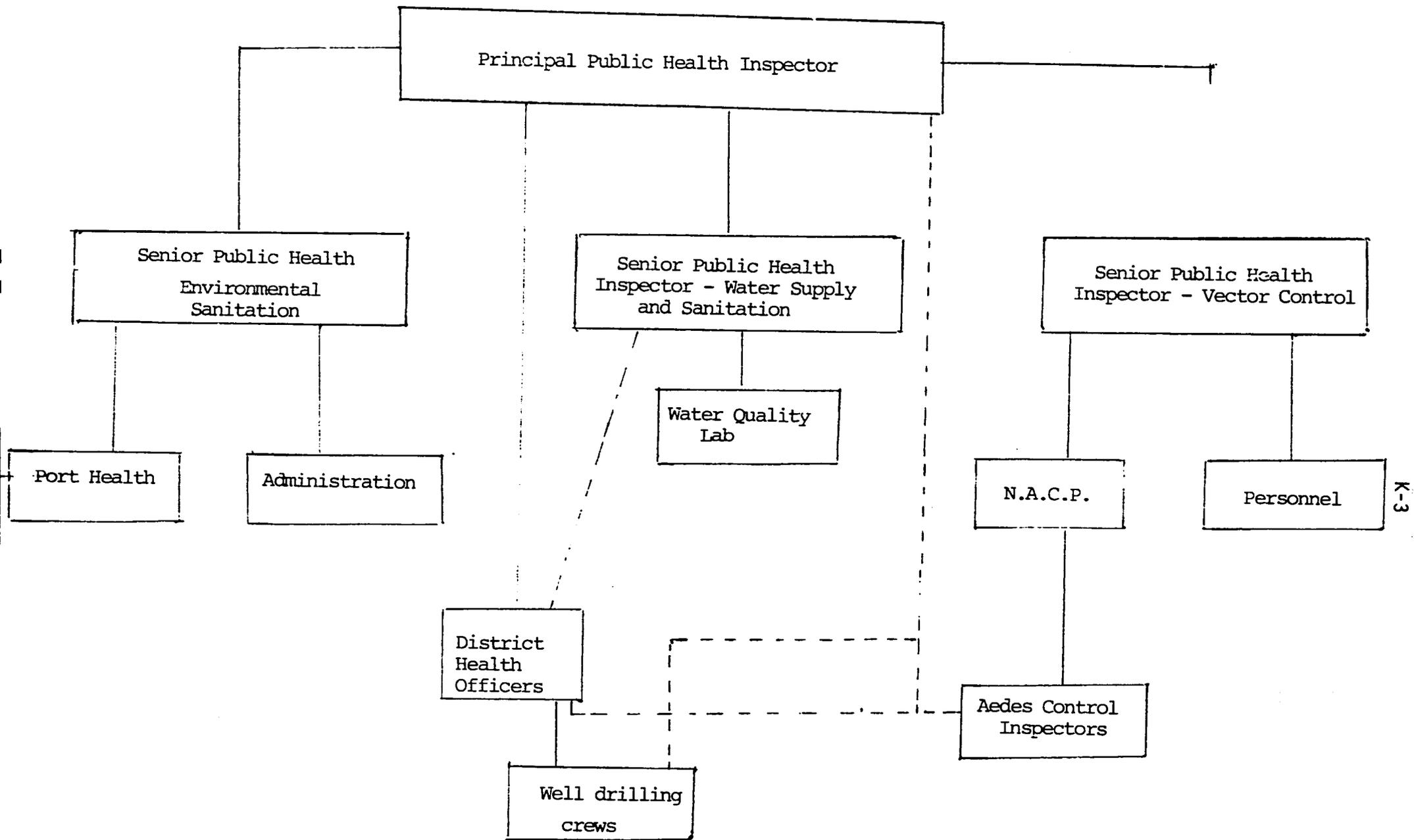


23 July 1979

BELIZE  
NATIONAL MALARIA SERVICE (NMS)



ORGANIZATION CHART PUBLIC HEALTH INSPECTORATE



1/6/73

## Annex L

List of Equipment and Supplies (Malaria and AA control)Description

1A. Sprayers, hand compression, 4 gallon capacity without pressure gauge, Hudson X-Perf Sprayer, Hudson pump No. 67432 BA, AID Decal applied, 2" strap.				
Suggested source: H.D. Hudson Manufacturing Company 500 North Michigan Avenue Chicago, IL 60611				
order: Hastings, Minnesota factory				
Approximate cost: \$85.00 each				
Number required: 2 (AA), 14 (MC) -- 16 units \$1360.00				
<u>Total cost (FAS): \$1360.00</u>				
1B. Nozzle tips, No. 8002 HSS tee-jet to fit Hudson sprayers				
approximate cost: \$2.85 each				
number required: 360				
<u>Total cost (FAS): \$1026.00</u>				
1C. <u>Sprayer Spare Part Kits - Hudson</u>				
No. 148-676 X-perf sprayer spare part repair kit				
approximate cost: \$75.00 each kit				
number required: 5				
<u>Total cost (FAS): \$375.00</u>				
1D. <u>Misc. Spare Parts, Hudson</u>				
<u>Hudson</u>	<u>Description</u>	<u>Unit Cost</u>	<u>No. of</u>	<u>Total (\$)</u>
<u>Number</u>			<u>Unit Req.</u>	
154-0007	Plunger cup	0.51	200	102.00
801-423	Cotter pins	0.11	600	66.00
152-900	Wrench, 1-3/8	3.28	10	32.80
152-901	Wrench, 1-3/16	3.28	10	32.80
152-905	Wrench, 1-1/2	3.60	10	36.00
803-623	Hose clamp	.68	24	16.32
805-307	O-Ring gasket/hose	.11	360	39.60
805-309	O-Ring, valve	.11	360	39.60
805-310	O-Ring, strainer	.11	360	39.60
805-312	O-Ring, dip tube	.11	360	39.60
805-335	O-Ring, valve body	.11	360	39.60
805-312	O-Ring, Ext. tube	.11	360	39.60
805-401	O-Ring, cylinder	.11	360	39.60
152-900	Screwdriver/wrench	1.39	10	13.90
152-829	Shoulder strap	4.18	10	41.80
152-356	Strainer assembly	1.00	156	156.00
149-706	Shut-off assembly	7.11	10	71.11

150-406	Pop-off spring	.22	156	34.32
151-401	Cover gaskets	.96	36	34.56
151-030	Pump cylinder			
	gasket	.11	156	17.16
147-541	Plunger Assembly			
	complete	12.91	6	77.46
129-075	Dip tube only	2.81	12	33.72
116-426	Cover chain	.56	12	6.72
115-902	Hose	2.31	12	27.72
115-950	Hose connector	.27	36	9.72
	(FAS) Total			<u>\$1087.31</u>

1E. PI0/C TotalsCost \$

A. Sprayers, 4-gallon, No. 67432	1360.00
B. Nozzle tips, 8002, HSS	1026.00
C. Sprayer, spare part kits	375.00
D. Sprayer, spare parts	1088.00
	<u>3849.00</u>
25% shipping	962.25
	<u>\$4811.25</u>
PI0/C Total	<u>\$4820.00</u>

NOTE: Costs based on Hudson discount prices to HSG/AID.

2A. Ultra low Volume (ULV) spray units with flowmeter LECO HD Series D-7000-12 or equivalent, skid mounted, Briggs and Stratton or equivalent 1 1/2 HP., gas engine with electric starter, Discharge head adjustable 300 degrees horizontally and vertically. The discharge nozzle capable of producing 84% of the particles less than 20 microns diameter.

Blower size: 250 CFM. Net weight 304 lbs.

dimensions: 41" long, 15" wide, 26" high

Estimated cost: \$4500.00/unit

No. of units: 3

Total cost: \$13,500.00

(25%) freight: \$ 3,375.00

Total: \$16,875.00

Suggested source: Louders Engineering Co.  
125 Blanchard St.  
Baldosta, GA 31601

2B. ULV Sprayers, hand, gas-engine, aluminum frame, tank is pressurized, 32-ounce capacity, 14.5 lbs. weight, adjustable needle valve.

Estimated cost: \$350.00/unit

No. of units: 3

Total cost: \$1050.00 each

25% (Freight): \$265.00

TOTAL \$1315.00

Suggested source: Buffalo Turbine

Agricultural Equipment Co.  
 Industrial Place  
 Gowanda, New York 14070  
 Trade name: "Mity Moe" or equivalent

2C. PI0/C

1.	ULV spray units	\$16,875.00
2.	ULV, hand units	\$ 1,315.00
		<u>\$18,190.00</u>
	<u>PI0/C TOTAL</u>	\$18,200.00

3A. Malathion, ULV concentrate (EPA Reg. No. 241-110-AA)  
 active ingredient - malathion 91.0%  
 inert ingredient - 9.0%  
 100.0%

Shipped in 55 gallon drums  
 Trade name is "Cythion"

Cost per 55 gal. drum -	\$1200.00 each
No. of units	25
Total Cost	\$30,000.00
25% freight	7,500.00

PI0/C \$37,500.00

Suggested source: American Cyanamid  
 Agricultural Division  
 Wayne, New Jersey 07470

3B. Laviciding insecticide, Abate 1-G. (Sand Granules)

Active ingredient - temephos	1%
Inert ingredient	99%
	<u>100%</u>

Used for treating domestic water, packed 50.1 lb. cardboard drums.

Cost per 50.1 lb. drum:	\$25.00 (each)
Total drums:	90
Total cost:	\$2250.00
25% freight	565.00
PI0/C:	<u>\$2815.00</u>

Suggested Source: American Cyanamid, N.J.

3C. PI0/C

1.	Malathion, ULV concentrate, "Cythion",	\$37,500.00
2.	Abate - 1-G	2,815.00
	Total	<u>\$40,315.00</u>
	Total PI0/C	\$40,400.00

4. Operational Equipment

A. Fay traps, for collecting adult mosquitoes, (Hock, Model 712) with killing assembly and jar, air-actuated gate system, battery, charger and extra collection bag

Total cost per unit	-	\$280.00
No. of units	-	3
Total cost		\$840.00
25% freight		210.00
Total		<u>\$1050.00</u>

Suggested source: Bioquip  
 Santa Monica, California  
 or John Hock Company  
 P.O. Box 12852  
 Gainesville, FL 32604  
 Phone: (904) 378-3209

- B. Dippers, white enamel (Clarke) for collecting mosquito larvae, approximately 12" handle.
- |                     |   |                 |
|---------------------|---|-----------------|
| Total cost per unit | - | \$6.00          |
| No. of units        | - | 20              |
| Total cost          |   | \$120.00        |
| 25% freight         |   | 30.00           |
| PIO/C Total         |   | <u>\$150.00</u> |
- Suggested source: Bioquip or similar biological supply house
- C. Bioassay Kits (WHO) for testing larva and adult mosquito for insecticide susceptability
- |                    |   |                                       |
|--------------------|---|---------------------------------------|
| <u>No. of kits</u> | - | three (3) larva - DDT, DDT, Malathion |
|                    |   | three (3) adult - DDT, DDT, Malathion |
| Cost per kit       | - | \$150 each, total \$900.00            |
| 25% freight        | - | 250.00                                |
| PIO/C              |   | <u>\$1150.00</u>                      |
- Suggested source: Pan American Health Organization  
 21st Street  
 Washington, D.C.

5. Anti-Malaria Drugs/laboratory Supplies (incomplete)

- 5A. Chloroquine, phosphate, 150 mg. base.  
 1000 tabs per bottle, for malaria treatment. Trade names "Avalon", "Avloclor"
- |                 |   |                       |
|-----------------|---|-----------------------|
| Cost per bottle | - | \$15.00 (1000 tabs)   |
| No. of bottles  | - | 600 of 1000 tabs each |
| Total cost      |   | \$ 9,000.00           |
| 25% freight     |   | 2,250.00              |
|                 |   | <u>\$11,250.00</u>    |
| PIO/C Total     | - | \$12,000.00           |
- 5B. Primaquine phosphate, 15 mg. base and 7.5 mg. base
- |                                |   |                |
|--------------------------------|---|----------------|
| 100 tabs/bottle                |   | \$16.00 bottle |
| No. of bottles of 15 mg. base  | - | 900 bottles    |
|                                |   | Cost \$13,500  |
| No. of bottles of 7.5 mg. base |   | 400 bottles    |

	Cost	6,000
	Est. Total cost	19,500
	25% freight	5,000
		<u>24,500</u>
Total for PI0/C		25,000

- 5C. Microscope, dissecting, bi-nocular, for entomology work with carrying case.  
high and low power  
No. of microscopes - 3  
Cost of microscope - 900.00 each  
Total - 2700.00  
25% freight 675.00  
PI0/C 3375.00  
Total PI0/C 3,400.00

Suggested source: American Optical

- 5D. Microscope, compound, bi-nocular, built-in light source, 60 cycle x 110; high power-low power, lense 10 x 100 oil immersion lense - American Standard or equivalent, with carrying case.  
No. of microscopes - 3  
Cost per microscope - 2,000.00 each  
Total 6,000.00  
25% freight 1,500.00  
PI0/C 7,500.00

#### b. Transport

- bA. Pick-up truck, 1985 model, 3/4 ton, 6 ply tires with tubes, color yellow, HD suspension, no a/c, audio options, 2WD, left hand drive

6-cylinders, manual transmission, locking gas cap, with basic auto repair kit and jack.

Cost per truck -	14,000.00/each
No. of truck -	1
Cost	14,000.00
25% freight -	3,500.00
	<u>17,500.00</u>

Suggested source: Ford Motor Company

- bB. Pick-up trucks, 1985 model, 1/2 ton, 6-ply tires with tubes, left hand drive, 4WD, color yellow, HD suspension, manual transmission, 6-cylinders, locking gas cap, with basic auto repair kit and jack.  
Cost per truck: 12,000.00/each  
No. of trucks: 3

Cost:	\$36,000.00
25% freight:	9,000.00
	<u>\$45,000.00</u>

Suggested source: Ford Motor Company  
"Ranger" model (Similar to F-100)

bC. Motorcycles, 125 cc, trail bike-type, Honda	
Cost per motorcycle	\$1350.00/each
No. of motorcycles - 17 (7 for AACP and 10 for NMCS)	
Total cost -	\$22,950.00
25% freight:	5,740.00
PI0/C	<u>\$28,690.00</u>
Total PI0/C	<u>\$28,700.00</u>

bD. Bicycles, 4 with rack	500.00 total
Tires/spare parts	\$7,500.00
25%	2,000.00
PI0/C	<u>\$10,000.00</u>

This PI0/C needs to be done with AACP/WMCP in depth for tools and spare parts.  
Specifications of pick-ups need to be further developed.

## Component II Water Supply and Sanitation

Commodities

## 1. Vehicles and Spare Parts

Pick-up truck, 1/2 ton, 6 ply tires with tubes color white, HD suspension, standard transmission, no A/C or audio, 2WD, 6 cyl, spare parts.

No. of Trucks	2
Cost per Truck	10,000
Cost	20,000
25% Freight	25,000

Suggested Source: Fort Motor Company

Pickup truck, 1/2 ton, 6 ply tires with tubes, color white, HD suspension, standard transmission, No. A/C or audio, 4WD, 6 cyl. 6 cyl spare parts.

No. of Trucks	3
Cost per Truck	13,000
Cost	39,000
25% Freight	49,000

Suggested Source: Ford Motor Company

Truck - chasis only - 6 ply tires with tubes, color white, HD suspension, standard transmission, No A/C or audio, 2WD, single axle 8 cylinder, 12,000 lb. capacity - suitable for fitting cable drilling rig with I-beam rails - spare parts.

No. of Trucks	4
Cost per Truck	14,000
Cost	56,000
25% Freight	70,000

## Repair Parts

2 wheel trucks	3,000
4 wheel trucks	3,000
chasis only trucks	6,750
25% freight	16,000

Motorcycles, 125CC, trail bike, Honda

No. of Motorcycles	3
Cost per Motorcycle	1,350
Cost	4,050
25% Freight	5,062.50

Suggested Source: Honda Corporation

## 2. Drilling Rigs and Accessories

Tool/Precussion Drilling Rig 5" to 18", max depth 600' - stroke 14" to 40" - strike rate 35 to 65 per minute - diesel engine 64 HP @ 2200 RPM - oil filter, governor, cold starting device equipped with mast, driven sheave, spudder clutch, duty pillow block bearing, bull reel clutch, sandreel friction wheel and jackshaft clutch - all clutches easily accessible. Drilling cable, tools, spare parts.

No. of Rigs	2
Unit Cost	40,000
Total Cost	80,000
Freight 25%	100,000

Spare parts for new rigs rebuild two old rigs plus drilling accessories	60,750
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Freight 25%	81,000
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Suggested Source:	American Loomis Seattle, Washington
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## 3. Handpumps &amp; Spare Parts

Handpump, deepwell-community, India Mark II manufactured to UNICEF specifications and quality control.

No. of Pumps	500
Unit Cost	246
Total Cost	123,000
Freight 25%	154,000

Per Pump	500
Spare Parts	10,000

Suggested Source:	UNICEF Drinking H2O Supply United Nations, NYC, NY 10017
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## 4. Pump Maintenance &amp; Repair Equipment

Tools, presses, drills, power equipment, welding equipment.

Cost	28,000
Freight 25%	35,840

Several different vendors.

201

## 5. Centrifugal Pumps

Submersible pumps - 1/8 to 1/2 HP - maximum depth 200 feet - 3 phase 110- volts - 4-10 gpm.

No. of Pumps	30
Unit Cost	2,400
Cost	72,000
Freight 25%	90,000

Suggested Source: Gould Pump Corporation

## 6. Laboratory Testing Equipment - Thomas Scientific Co.

## 1. Each - Refrigerator

(DxWxH,mm)  
 533x521x537 - Refrigerator 30 to 60C  
 483x356x127 - Freezer Chamber - 120 to 70C  
 1/8 HP (90W) 120 Volts  
 Insulated cabinets - channeled steel exterior  
 Removable chamber shelves - 2 in. plated steel  
 Magnetic vinyl gasket-Bench top, Wt. 300 lbs.

Total Cost	800
Freight 25%	200
	1,000

2 General purpose incubator - range 50C to 650C  
 Sensitivity +.150C, iniformty +1.00C at 37C  
 Gravity convection type  
 Chamber capacity 1 ft<sup>3</sup> 457c457c584 (WxDxH,mm)  
 120 volts, 50/60 Hz, 300 W Wt. 27 lb.

No. of Incubators	2
Unit Cost	1,325
Total Cost	2,450
Freight 25%	3,312

2 General purpose incubators - range 50C to 650C  
 Sensitivity +.150C, iniformty +1.00C at 370C  
 Gravity convection type  
 Chamber capacity 1 ft<sup>3</sup> 457c457c584 (WxDxH,mm)  
 120 volts, 50/60 Hz, 300 W wt. 27 lb.

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No. of Incubators	2
Unit Cost	290
Freight 25%	725

## 1 each Autoclave

Stainless steel and aluminum - hinged door, electrically heated, safety latch, audible signal indicates completion of cycle - 20-40 psi pressure, 270°F held constant +5°F - safety pressure release - 254x406mm chamber - removable tray 203x381x51mm - 120 volts, 60 Hz, 1200 watts.

No. of Autoclaves	1
Unit Cost	2,000
Freight 25%	2,625

## Sterilizer

Hinged lid/removable tray - boiling produced in 25 min. - automatically maintained - stainless steel 330x127x83mm - 120 volts, 50/60 Hz, 800 watts.

No. of Sterilizers	1
Unit Cost	1,400
Freight 25%	1,750

## Balance

Range 0-80g, readability 0.0001g, precision +0.0001g, Taring range 0-80. Integration time selectable 0.5, 1 or 2 sec. - weighting pan 80mm, overall dimensions 167x285x278 mm.

No. of Balances	1
Unit Cost	2,200
Freight 25%	2,750

## Conductive Meter with Temperature

Six position - 0 to 200 umho's - +0.2%  
 Portable, battery operated for field use - rechargeable 12 volt battery, battery charger 120 volts, 50/60 HZ - Full battery charge 24 hours continuous - enameled aluminum housing-carrying handle - with 100 ft. probe - temperature range -50°C+500°C.

No. of Meters	1
Unit Cost	825
Freight 25%	1,031

## Spectrophotometer

Range 320 to 710 nm - 210 to 710 nm with UV accessory - 680 to 1000 nm with near IR phototube - diffraction grating, single-beam monochromator - Ure-operated, solid state power supply and amplifier - N.C. output 1

volt +1.2V, strag light less than 0.5%.  
No. of Spectrophotometers

	1
Unit Cost	1,095
Freight 25%	1,368

2 ph Meters  
Accuracy +0.05ph or +10mV - records output 10mv - 0-14  
range - smaller division 0.1 manual glass temperature  
compensator 00 to 100C in 2C divisions  
saturated and calomel electrodes - 120 volt, 50 or 60  
Hz - 60 watt.

No. of Meters	2
Unit Cost	375
Freight 25%	938

Direct Reading - Field Water Quality Analysis Kit  
Colormetric and volumetric test - alk, hardness,  
CO<sub>2</sub>, ph, Iron, manganese, nitrates, sulphates,  
chlorides, H<sub>2</sub>S, phosphates dissolved oxygen -  
portable - hand carried - rechargeable battery - for  
colorimeter.

No. of Field Kits	3
Unit Cost	825
Freight 25%	3,094

Suggested Source: Hach Chemicals  
Ames, Iowa

Typewriter  
Exchangeable type - electric typewriter - correctable  
Selector.

No. of Typewriters	1
Unit Cost	475
Freight 25%	594

Suggested Source: IBM

ANNEX M  
Technical Assistance

Component            Malaria and Aedes aegypti Control

Malaria -- Entomology

FY 1985 Review current MCP operations at headquarters and district levels. Visit, observe spray team operations to become familiar with all phases of malaria control in Belize. Conduct WHO insecticide resistance tests on A. albimanus using 0.25, 0.5, 1.0, 2.0, and 4.0 per cent DDT concentrations. Plot percent mortality and verify whether vigor tolerance or actual resistance has arisen in Belizean A. albimanus. Perform resistance testing at locations in north and south Belize. Present log - probability plots of results to director MCP and discuss implementing routine insecticide resistance testing in the MCP. Investigate the issue of agricultural use of pesticides, especially aerial spraying programs, and its possible impact on resistance in A. albimanus. Conduct WHO cone bio assay of insecticidal deposits on wall surfaces sprayed at different times in a given spraying cycle and discuss the possibility of using this technique in the MCP for determining the maximum length of the MCP's DDT spraying cycles. Conduct insecticide resistance testing of Aedes aegypti for AACCP. Set up record keeping system for tabulation of resistance/susceptibility data.

FY 1986 Evaluate the manpower available to the MCP versus the number of localities that are sprayed and the severity of the malaria problem (local incidence) in each. Discuss the stratification of malaria control based on these issues with the MCP director. Repeat insecticide resistance testing and encourage the MCP director to develop this capability. Discuss methods of standardizing the work of each spray team member (e.g. methods of consistently applying 2 gms DDT/M<sup>2</sup>) with team supervisors.

FY 1987 Review MCP insecticide resistance and control programs. Check malaria incidence data for 1983-1986 to document the impact of spraying efforts in 1984 and 1985. Conduct sprayed vs. unsprayed hut tests to determine the impact of spraying on the attack rate experienced by the occupants.

FY 1988 Final program evaluation with attention given to insuring the existence of proper insecticide resistance testing

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and record keeping in the MCP.

#### Malaria -- Epidemiology

FY 1985 Review current epidemiology records kept by the MCP. Evaluate the accuracy of the malaria incidence figures based on these records in light of such factors as widespread distribution of anti-malarials by private shops which do not report to the MCP. Consider means of assessing the extent to which these private sources of treatment affect MCP statistics and ways in which their effect might be quantified. Measure the average time between the taking of a blood smear (by a VC or at a local health center) and receipt of a confirmation from the MCP diagnostic center in Belize City. Determine ways to reduce this turn around time.

FY 1986 Evaluate the use of other malarimetric indices such as number/age of infants with first time malaria cases to assess the effect of control operations on transmission.

FY 1987 Review MCP epidemiology effort. Accuracy of record keeping, statistics measured, and inferences made from such figures, should be discussed at length. Problems that may arise as a result of misinterpreting data should be discussed/also be considered.

#### MALARIA -- TRAINING

FY 1985 Meeting with individuals at each level of MCP and identify training needs. Refer to training provision of PP and assist each level in defining what areas can be strengthened by training and where this assistance can best be obtained. Assist in proper scheduling so that training interferes minimally with ongoing control efforts. Provide information on various training programs to the MCP director by arranging for letters of enquiry and requests for literature on various courses to be sent to laboratories and schools which offer this assistance.

FY 1986 Continue developing the MCP training 1987 program by evaluation the amount of training received versus job requirements for each level of the MCP. Acquire additional information on training opportunities and outside schooling contacts for future reference. Report all information to the MCP director for subsequent use in maintaining a well trained staff.

FY 1987 Evaluate the overall contribution of all training to the objective of strengthening the malaria control project of Belize.

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MALARIA -- MANAGEMENT

FY 1986 Assist in developing a complete list of repair parts and expendable supplies needed for malaria control operations. Evaluate manpower needs of MCP based on visits to district level facilities and review of malaria incidence by district. Discuss stratification of malaria control efforts, based on observation of district operations, with MCP operations chief.

FY 1987 - 88 Review manpower needs and MCP supply system. Make adjustments based on shifts in malaria incidence as indicated by changes in malaria case distribution patterns.

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ANNEX N TRAINING

Component Malaria and Aedes aegypti Control

Grant funds totaling \$254,000 will finance long and short term training of MCP and AACP personnel in vector control field operations, epidemiology, entomology and administrative management. Short term in-country training will also be provided to spray team members and voluntary collaborators.

The project will provide the following for the AACP: (1) short term, comprehensive vector control training at the University of South Carolina for six individuals; (2) a six month training opportunity for 1 individual to study entomology at the PAHO laboratory in Tapachula, Mexico; (3) six regional observation tours to Mexico, Honduras or Venezuela to study other vector control programs; (4) two observational tours to U.S. mosquito abatement operations in Florida or Louisiana; and (5) practical training for a vehicle mechanic in Jamaica and local workshop training for spraymen.

Anticipated training for MCP personnel includes: (1) one 2 year PhD program at a U.S. institution; (2) short term comprehensive vector control training (University of South Carolina) for six individuals; (3) regional observation tours to Mexico, Honduras or Venezuela for six people; (4) a 6 month entomology course at PAHO, Mexico for one person; (5) tours of two weeks to mosquito abatement districts in either Florida or Louisiana for two people and workshops, held in Belize City, for volunteer collaborators and spraymen.

ANNEX 0

OPERATIONAL RESEARCH AND SPECIAL STUDIES

Component one - Malaria and Aedes Aegypti Control

<u>Fiscal Year</u>	<u>Description of Operational Research</u>
1985	
A. <u>Aedes Aegypti</u>	1. Implementation of the technical aspects of the <u>Aedes Aegypti</u> control program will require 100% of the AACP personnel's time. Technical studies to be initiated at this time include mapping of control areas, and estimation of adult mosquito population size.
B. Malaria	1. A program to evaluate the benefits of using a locally based malaria control team (3 people) to carry out all of the malaria control activities normally provided by district level personnel will be initiated.
1986	
A. <u>Aedes Aegypti</u>	1. A comparison of various ovitrap systems, for evaluating the effectiveness of control measures and anticipating increases in adult population size. This study will be coordinated with technical assistance efforts that address the issue of quality control.  2. Collection of blood-fed females for determination of blood meal source by precipitin testing, and parity determination (age grading) to estimate longevity of the population.
B. Malaria	1. Initiate limited field testing of alternative insecticides for use in malaria control - wall spraying program. Malathion and fenitrothion will be used for this study.

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Determination of efficacy will be done by the standard WHO Cone bioassay system. The results will be compared with technical assistance insecticide resistance studies.

2. In vitro testing of Belizean P. falciparum isolates for chloroquin and primaquin sensitivity in collaboration with the CDC.

3. A survey to assess awareness of and attitudes about the volunteer collaborators. Interview forms designed with minimum bias by a sociologist and completed by local interviewers (school teachers) will be used to determine the impact of alternative sources of anti-malarial drugs (sold privately in most areas) on malaria surveillance, and the need for more publicity about the VC program.

4. Continue project to evaluate locally based versus centralized malaria control services (1985 B.I.)

1987

A. Aedes Aegypti

1. Commence testing alternative larvicides to augment or replace Abate. Mono layer oils (e.g. FLIT) slow release Bacillus thuringensis (BTI) tablet formulations, and local mosquito fish (Gambusia sp.) will be evaluated by comparison with Abate for ability to reduce larval population density.

B. Malaria

1. An alternative mosquito control method, source reduction, will be evaluated for use in localities where breeding is confined to specific areas i.e., a rice-growing scheme which provides most of the A. albimanus breeding in the dry season. Larvicides from the AACP will be employed.

2. Continued in vitro testing of

Belizean *P. falciparum* as in 1986 (B.2.) Biological control methods will be evaluated for possible use in conjunction with wall spraying. Mosquito fish, *Bacillus thuringensis* and *Salvinia*, an aquatic plant with larvicidal properties, are potential agents for this study. Technical research on larval breeding sites will be used to identify locations where bio-control may be effectively used e.g. places where breeding is confined to a few relatively large bodies of water.

3. A survey to define human behavior patterns during peak biting periods of *A. albimanus*, 6 P.M. - 9 P.M. elsewhere, will be conducted in an effort to assess the role of out-door transmission of malaria.

4. Continuation of project to evaluate locally based centralized malaria control services (1985 R. 1.)

1988

A. *Aedes Aegypti*

1. Based on larvicide testing results prioritize and stratify all larvicides tested according to efficacy and suitability under different environmental conditions.

2. Assessment of the potential value of community participation in source reduction aimed at *Aedes aegypti* breeding sites such as tires, cans, coconut shells and other containers associated with human habitation.

B. Malaria

1. A comparison of the effectiveness of spraying walls only 1 meter from the floor (versus total coverage) will be conducted. If control levels achieved by each plan are similar (as has been suggested in other studies on *A. albimanus*) the GOB may be able to save considerable money necessary for

purchase of insecticide.

2. Repeated testing to confirm continued susceptibility of *P. falciparum* to chloroquin.

3. Additional testing of biological control methods which have been shown to be of benefit in previous work.

ANNEX P

Detailed Estimated Costs for Component I

TRAINING

Aedes Aegypti Control

TOTALS(\$)

6 - short term comprehensive vector control (\$7,000 PM)	\$42,000
1 - 6 month course in Entomology in Mexico/Panama/Region	10,000
6 - Regional Observational Study Tours (\$3,000 ea.)	18,000
2 - U.S. observation course - 2 weeks	3,000
1 - Vehicle mechanic, 6 weeks (Regional)	6,000
Local Training	4,000
	<u>\$83,000</u>

	<u>FY85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>TOTALS\$</u>
Short term CVC	7	14	14	7	42,000
6 months, Region	--	--	10	--	10,000
Observ., Region	--	6	6	6	18,000
Observ., US	1.5	--	--	1.5	3,000
Veh. Mechanic	6	--	--	--	6,000
Local	1	1	1	1	4,000
	<u>15.5</u>	<u>21</u>	<u>31</u>	<u>15.5</u>	<u>Sub-total (A) \$83,000</u>

Malaria Control

1 - MSC/MPH/PhD Ento/Epi (2 years)	<u>TOTALS(\$)</u>
6 - Short term, Comp. Vector Control	50,000
6 - Observation tours, regional	42,000
1 - 6 mos., ento. course (Mexico/Panama/Region)	18,000
2 - U.S. observational tours (2 wks.)	10,000
Local Costs	3,000
	<u>48,000</u>
	<u>\$171,000</u>

	<u>FY 85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>TOTALS(\$)</u>
1 - MSC/MPH/PhD.	--	--	25	25	50,000
6 - ST/CVC	7	14	14	7	42,000
6 - Obs., Reg.	--	6	6	6	18,000
1 - 6 mo. Ento.	--	10	--	--	10,000
2 - U.S. Obser.	1.5	--	--	1.5	3,000
Local Training	<u>12</u>	<u>12</u>	<u>12</u>	<u>12</u>	<u>48,000</u>

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20.5 42 57 51.5 Sub-total(B) \$171,000

SUB-TOTAL (A) \$ 83,000  
 SUB-TOTAL (B) \$171,000  
GRAND TOTAL \$254,000

TECHNICAL ASSISTANCE

Aedes Aegypti

Fiscal Years

	<u>85</u>	<u>86</u>	<u>87</u>	<u>88</u>	<u>TOTAL (\$000)</u>
ENTO	14	7	7	7	35
ULV	14	21	14	14	63
EPI	7	4	-	4	15
MGT	-	7	-	-	7
RESEARCH	-	7	7	7	21
	<u>35</u>	<u>46</u>	<u>28</u>	<u>32</u>	<u>141</u>

Malaria Control

ENTO	14	7	7	7	35
EPI	14	4	-	4	22
TRAINING	21	7	7	-	35
MGT	-	14	7	7	28
RESEARCH	-	28	28	28	84
	<u>49</u>	<u>60</u>	<u>49</u>	<u>46</u>	<u>204</u>

Technical Assistance-Total \$345,000

\*Consultant costs  
 @ \$14,000/mo.

AEDES AEGYPTI CONTROL

Commodities

TOTALS (\$000)

Operational Eqt/Malathion	170,000
Vehicles, vehicle parts (4 + 1 + parts)	80,000
ULV. (3)	30,000
Motorcycles, ( 8 @ \$2,000)	17,000
Other, Microgen, uniforms	11,000
	<u>308,000</u>

FY/Item                      1985              86              87              88              TOTALS (\$)

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Insecticide	30	30	30	30	120,000
Operational Eqt.	20	10	10	10	50,000
Vehicles	60	20			80,000
ULV	20	--	10	--	30,000
Motorcycles/bicycles	14		3		17,000
Other (Micro., unif.)	5	2	2	2	11,000
	<u>149</u>	<u>62</u>	<u>55</u>	<u>42</u>	<u>308,000</u>

	<u>MALARIA CONTROL</u>				TOTALS(000)
Sprayers, parts	6	4	2	4	16,000
Laboratory supplies	4	4	4	4	16,000
Drugs	15	15	15	15	60,000
Vehicle parts	4	4	6	6	20,000
Tires (\$400/unit)	4	4	4	4	16,000
Motorcycles 125cc	15	6	6	16	43,000
Vehicle, 250, 2 WD	18	--	--	--	18,000
Vehicle, PU/4 WD	--	14	42	42	98,000
Boat (08 mtr/trailer)	6	--	2	2	10,000
Workshop tools/Eqt	5	--	5	5	15,000
Camping Eqt., unif.	8	4	8	4	24,000
Health Ed.	6	2	2	4	14,000
	<u>91</u>	<u>57</u>	<u>96</u>	<u>106</u>	<u>\$350,000</u>

Commodities - Total Cost - \$308,000  
 \$350,000  
\$658,000

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OPERATIONAL RESEARCH

<u>Aedes Aegypti</u>	1985		1986		1987		1988		TOTAL (\$000)	
	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>
1. Testing new larvicides	--	--	--	--	2	1	1	2	3	3
2. Precipitan tests on AA	--	--	3	2	--	--	1	1	4	3
3. Local fish as larvicide	--	--	--	--	1	1	--	--	1	1
	<u>--</u>	<u>--</u>	<u>3</u>	<u>2</u>	<u>3</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>8</u>	<u>7</u>
 <u>Malaria Control</u>										
	FY 1985		FY 1986		FY 1987		FY 1988		TOTAL (\$000)	
	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>	<u>FX</u>	<u>LC</u>
1. Testing new insecticides and alternative methods	5	7	5	16	5	16	5	5	20	44
2. Chloroquine-Resistance survey	--	--	7	1	5	1	5	1	17	3
3. Biological Control Research	--	--	--	--	2	1	1	2	3	3
4. Community Attitudes and Practices	--	--	10	1	5	--	5	--	20	1
	<u>--</u>	<u>--</u>	<u>10</u>	<u>1</u>	<u>5</u>	<u>--</u>	<u>5</u>	<u>--</u>	<u>20</u>	<u>1</u>
	5	7	22	18	17	18	16	8	60	51
	<u>\$111</u>									
	TOTAL								<u>\$126,000</u>	

## ANNEX 2 - Agro-medical Pesticide Interaction

Independent conversations with Mr. R. Neil, Acting Principal Agriculture Officer, Ministry of Natural Resources; Mr. James Martley and Mr. Rick Dunn, Peace Corps Advisors for Crop Protection, Central Farms, MOA; and a manager of Prossers, the major pesticide importer in Belize, all confirmed that there is only limited use of pesticides in the agricultural sector. Insecticides are applied sporadically in response to infestation by crop pests. Routine spraying for crops other than vegetables is not cost effective and, therefore, is not done.

Prior use of aldrin for spraying vegetables may have given rise to dieldrin resistance in *A. albimanus*. Malathion, currently the insecticide of choice for vegetables, may cause similar problems. There is no indication that DDT is used in the agricultural sector. It remains the insecticide of choice for malaria control.

Insecticide resistance testing should be done routinely using mosquitoes from areas of Belize where agriculture is most intense. These areas include:

(1) the northern districts of Corozal and Orange Walk where some 45,000 acres are under cane cultivation and where carbamate insecticides such as baygon are currently used.

(2) the Pomona Valley in Stann Creek District where approximately 12,000 acres of land are used for citrus cultivation. Malathion is one of a number of insecticides used on this industry.

(3) Toledo District where 1630 acres of bananas were planted in the 1970s. (The aerial spraying of this crop with fungicides should not impact on the mosquito-resistance problem).

(4) The Hershey cacao plantation, Cayo District, and

(5) the rice producing areas in Toledo and Belize Districts.

The presence of aerial spraying facilities at Big Falls Ranch, a rice growing concern in Belize district and in Toledo district is of interest since repeated aerial spraying should be followed by mosquito insecticide testing.

There are no reports of pesticide use-related human injury in Belize, however, the general feeling of all individuals contacted was that more attention to precautionary training for

those involved in this line of work is needed. The PP provides such training for spraymen in the form of annual workshops and supervision through more extensive training.

Annex R

Potential Peace Corps Involvement re: A.I.D.'s Proposed  
Vector Control and Rural Water Supply and Sanitation Project

Beginning - September, 1985

Number of Volunteers	Specification
1	Malaria laboratory technician a) Assistance in implementing the MOH's laboratory activities re: malaria control
2	Geologist - hydrogeologists - water resource engineer a) Assist in well siting - develop well logging system - instruction drillers in logging b) Assist in preparing ground water maps of rural localities
3	Health Educators - educators/allied health skills a) Assist in developing and implementing health education as it relates to water supply and sanitation b) Assist in mobilizing community in self-help programs
2	Civil engineers - sanitary engineer - hydraulic engineer a) Assist in designing hydraulic systems for rudimentary water systems b) Assist in designing and constructing water storage tanks c) Assist in construction/management of well systems and rudimentary well systems
1	Appropriate technologists in Water and Sanitation a) Assist in developing and implementing a workshop on the use of ferro-cement b) Assist in demonstrating the use of slow/sand filters for treating surface water
1	Biologist - Chemist - laboratory skills for water quality laboratory a) Assist in developing national water quality laboratory b) Assist in training Belize technicians

NUMERO DE CASOS DE MALARIA Y POR ESPECIE EN LOS ULTIMOS14 AÑOS (1970 - 1983)

AÑOS	TOTAL CASOS	P. VIVAX	P. FALCIPARUM
1970	33	33	-
1971	33	33	-
1972	80	80	-
1973	99	99	-
1974	96	96	-
1975	90	90	-
1976	204	204	-
1977	876	876	-
1978	1200	1998	2
1979	1430	1427	13
1980	1608	1574	34
1981	2048	2005	43
1982	3868	3677	191
1983	4595	3963	632

BELIZENUMERO DE LAMINAS EXAMINADAS Y POSITIVASPOR MES 1980 - 1983

MES	1980 L.E. POS.		1981 L.E. POS.		1982 L.E. POS.		1983 L.E. POS.	
ENE	1736	(4) 86	2691	(1) 46	1875	(2) 131	2367	(46)291
FEB	3731	(9) 89	2647	(3) 57	3159	(10) 202	2115	(56)233
MAR	10013	100	2044	(2) 54	3544	(12)353	2354	(2M)(40) 347
ABR	2163	148	3758	(1) 27	1936	(6)234	2147	(1M)(66) 316
MAY	1873	126	1760	(3) 20	2755	(3)278	3747	(13M)(106) 540
JUN	2200	129	4950	(2) 497	3449	(4)122	901	(1M)237 (15)
JUL	2480	181	5065	(4) 192	3315	(11)499	2008	(12)221
AGO	1360	(1) 195	2543	(4) 166	3296	(17)321	2039	(30)241
SEPT	1821	(8) 122	3057	(3) 243	2225	(22)449	3204	(21)266
OCT	2732	(3) 192	2455	(7) 237	1600	(23)357	4649	(54)648
NOV	1040	(2) 62	4257	(6) 242	2380	(34)431	3059	(97)344
DIC	2012	(7) 76	9863	(7) 224	2411	(47)400	2299	(70)311
AÑO	25661	(34) 1506	45090	(43) 2005	31945	(191) 3677	31889	(630) 3995

Número: P. Vivax( ) P. falciparum

(M) Mixta

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## ESTUDIOS DE SOSCEPTIBILIDAD A LOS INSECTICIDAS

CON *A. ALBIMANUS*, 1984

LOCALIDAD	DISTRITO	INSECTICIDAS UTILIZADOS	MORTALIDAD %	EJECUTOR DE LA PRUEBA
CHAN CHEN	COROZAL	DDT 4%	100	HTI*
SANTA ELENA	COROZAL	DDT 4%	100	HTI
SAN JOSE	O/WALK	DDT 4%	100	HTI
BELMOPAN	CAYO	DDT 4%	92	HTI
MAYA MOPAN	S/CREEK	DDT 4%	100	HTI
BLUE CREEK	TOLEDO	DDT 4%	90	HTI
CHAN CHEN	COROZAL	DDT 4%	94	PAHO **
CHAN CHEN	COROZAL	PROPOXUR 1%	100	PAHO
CHAN CHEN	COROZAL	FENITROTION 1%	100	PAHO
CHAN CHEN	COROZAL	BENDIOCARB 0.1%	100	PAHO
PATCHAKAN	COROZAL	DDT 4%	95	PAHO
PATCHAKAN	COROZAL	PROPUPUR 0.1%	100	PAHO
GUINEA GRASS	ORANGE WALK	DDT 4%	93	PAHO
GUINEA GRASS	ORANGE WALK	FENITROTION %	100	PAHO
GUINEA GRASS	ORANGE WALK	BENDIOCARB 0.1%	100	PAHO
SAN PABLO	O/WALK	DDT 4%	97	PAHO
SAN PABLO	O/WALK	PROPOXUR 0.1%	100	PAHO

\*HEALTH TALENTS INTERNATIONAL INC

\*\*PANAMERICAN HEALTH ORGANIZACION

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DDT SPRAYING DURING THE 1ST. CYCLE - 1984

JANUARY 16 - JUNE 29, 1984

DISTRICT	NO. HOUSES TO BE SPRAYED	NO. HOUSES SPRAYED
COROZAL	4602	4164
ORANGE WALK	4352	4031
BELIZE	382	357
CAYO	3936	3327
STANN CREEK	1306	1207
TOLEDO	2962	2729
TOTAL	17,540	15,815

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LOCALITIES AND HOUSES TO BE SPRAYED WITH DDT IN TWO YEARLY CYLES

1985-1988

DISTRICT	POPULATION	EXISTING LOCALITIES	LOCALITIES TO BE SPRAYED	EXISTING HOUSES	HOUSES TO BE SPRAYED
BELIZE	48,825	48	7	10,200	382
CAYO	31,864	114	99	4,169	3,936
COROZAL	23,645	47	47	4,602	4,602
ORANGE WALK	24,157	59	59	4,352	4,352
STANN CREEK	14,009	40	25	3,015	1,306
TOLEDO	10,956	54	54	2,962	2,962
TOTAL	153,456	362	291	29,300	17,540

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B E L I Z E  
LAMINAS EXAMINADAS Y POSITIVAS SEGUN PROCEDENCIA  
1 9 8 3

CUADRO No. 10

MESES	Laminas examinadas						TOTAL	Positivas encontradas						TOTAL
	Pasiva		A c t i v a					Pasiva		A c t i v a				
	Servi- cio médico	Colabo- radores volunta- rios	Mues- treo en fe- briles	Inv. casos y se- guim.	Mues- treo en masa	Muestreo Malaria- métrico		Servi- cio médico	Colabo- radores volunta- rios	Mues- treo en fe- briles	Inv. casos y se- guim.	Mues- treo en masa	Muestreo Malaria- métrico	
Enero	874	278	487	29	699	-	2367	(19) 199	( 3) 61	( 9) 21	(3) 3	(12) 7	-	(46) 291
Febrero	977	202	548	24	364	-	2115	(26) 164	36	(14) 27	-	(16) 6	-	(56) 233
Marzo	1461	382	486	25	-	-	2354	21(28) 243	( 5) 94	( 7) 10	-	-	-	(40) 347
Abril	1312	316	519	-	-	-	2147	(37) 233	M( 8) 67	(21) 16	-	-	-	(66) 316
Mayo	2165	600	588	1	393	-	3747	IM(57) 375	2M(17)133	( 7) 19	-	IM(25)13	-	(106) 540
Junio	1266	322	313	-	-	-	1901	(11) 183	IM( 2) 46	( 2) 8	-	-	-	(15) 237
Julio	1100	433	211	-	264	-	2008	(10) 150	( 1) 66	( 1) 5	-	-	-	(12) 221
Agosto	1225	332	482	-	-	-	2039	(23) 178	( 3) 51	( 4) 12	-	-	-	(30) 241
Septiembre	1199	1165	840	-	-	-	3204	(12) 126	( 7)121	( 2) 19	-	-	-	(21) 266
Octubre	1085	1076	2488	-	-	-	4649	(10) 186	(10)184	(34)278	-	-	-	(54) 648
Noviembre	848	680	1531	-	-	-	3059	(25) 106	(24)118	(48)120	-	-	-	(97) 344
Diciembre	742	606	951	-	-	-	2299	(33) 108	(10)107	(27) 96	-	-	-	(70) 311
TOTAL	14254	6392	9444	79	1720	-	31899	(3M) (291)2251	(90)1084	(176)631	(3) 3	(10M) (53)26	-	(17M) (613)3995

Número: P.vivax ( ) : P.falciparum M : Malaria

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Table 10

Percentage of Households by Type of Water Supply and District

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District	Households	PUBLIC SUPPLY			PRIVATE SUPPLY			PUMP-OUT		Other No. %
		In Dwelling	In Yard	In Dwelling	Fetch.	Stand- Pison	Tank			
BELIZE DISTRICT	10,650	14.5	31.5	9.5	6.2	27.4	0.1	10.1		
Belize City	8,437	17.3	36.4	8.7	2.7	30.1	0.1	4.1		
Belize Rural	2,222	4.3	13.0	12.3	19.4	17.3	0.3	33.4		
COROZAL DISTRICT	4,056	8.1	22.8	3.0	10.5	2.4	0.9	52.2		
Corozal Town	1,322	23.3	50.0	6.6	5.6	1.5	0.1	17.9		
Corozal Rural	2,734	0.7	9.7	1.3	12.9	2.9	1.3	71.2		
ORANGE WALK DISTRICT	4,003	1.9	25.4	6.9	22.4	4.0	1.9	36.6		
Orange Walk District	1,485	4.2	39.7	13.7	11.5	5.5	0.3	25.1		
Orange Walk Rural	2,518	0.6	17.0	2.9	20.8	4.4	2.9	41.4		
STANN CREEK DISTRICT	2,934	11.3	30.7	3.3	18.6	2.6	1.3	32.2		
Dungriga	1,371	21.2	61.0	2.9	0.5	1.1	0.2	13.2		
Stann Creek Rural	1,563	2.6	4.1	3.6	34.6	4.0	2.2	49.0		
TOLEDO DISTRICT	2,289	1.6	8.1	2.0	7.6	14.1	0.4	66.1		
Punta Gorda Town	509	6.4	35.2	4.4	10.0	32.2	0.4	10.4		
Toledo Rural	1,700	0.2	0.3	1.4	6.7	0.9	0.4	02.1		
CAYO DISTRICT	4,196	25.7	29.3	5.0	5.5	10.2	0.7	22.9		
San Ignacio	902	37.0	52.4	1.4	0.1	2.0	0.0	7.1		
Belmopan	669	93.4	0.6	0.6	0.2	0.2	0.0	5.2		
Cayo Rural	2,545	3.5	27.9	0.8	9.1	16.0	1.2	33.6		
TOTAL:	28,137	12.1	27.1	6.4	10.4	14.3	0.7	34.9		

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Percentage of Households By Type Of Toilet Facility And District

DISTRICT	HOUSEHOLDS	PIT LATRINE	W.C. LINKED TO SEWER	W.C. NOT LINKED TO SEWER	OTHER/ NOT STATED
BELIZE DISTRICT	10,659	16.5	2.0	34.1	47.3
Belize City-	8,437	3.6	2.5	37.9	56.2
Belize Rural	2,222	65.7	0.9	19.9	13.5
COROZAL DISTRICT	4,056	79.7	0.3	10.9	9.0
Corozal Town	1,322	67.6	0.4	27.9	2.4
Corozal Rural	2,734	85.5	0.2	1.8	12.4
ORANGE WALK DIST.	4,003	88.5	1.3	5.0	5.3
Orange Walk Town	1,435	80.8	2.9	10.3	6.1
Orange Walk Rural	2,518	93.0	0.4	1.8	10.9
STANN CREEK DIST.	2,934	44.0	2.1	13.7	40.3
Dangriga	1,371	24.8	0.8	22.1	52.3
Stann Creek Rural	1,563	60.9	3.2	6.3	29.7
TOLEDO DISTRICT	2,289	43.1	1.7	1.6	53.4
Punta Gorda	509	61.4	5.3	4.9	28.4
Toledo Rural	1,780	37.9	0.7	0.7	60.6
CAYO DISTRICT	4,196	71.9	15.2	8.8	4.3
San Ignacio	982	77.5	0.1	19.8	2.7
Belmopan	669	2.4	92.6	0.3	4.7
Cayo Rural	2,545	87.8	0.6	6.8	4.9
TOTAL	28,137	49.1	3.6	18.1	29.1