PD-ABC-245

AMENDMENT TO THE IPTBH
PROJECT NO. 505-0018

AUGUST 1989

August 11, 1989

ACRONYMS

AID	Same as USAID
CARE	Cooperative Americans for Relief Everywhere (a PVO)
CHW	Community Health Worker
CD	Community Development
CDSS	Country Development Strategy Statement
CHE	Chief Health Educator
DCC	District Core Committee
DHE	District Health Educator
DHT	District Health Team
DT	District Trainer
EHS	Environmental Health Service
GOB	Government of Belize
HE	Health Education
HECOPAB	Health Education and Community Participation Bureau
IFB	Invitation For Bids
IPTBH	Improved Productivity Through Better Health Project
MNR	Ministry of Natural Resources
MOAg	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MOLSS	Ministry of Labor and Social Services
NGO	Non-government Organization
PHC	Primary Health Care

Acronyms (Cont.)

PHI	Public Health Inspector
PT	Principal Trainer
PVO	Private Volunteer Organization
RHN	Rural Health Nurse
RWSSP	Rural Water Supply and Sanitation Program
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations International Children's Fund
USAID	United State Agency for International Development
VC	Village Council or Vector Control
VHC	Village Health Committee
WASA	Water and Sewerage Authority

August 12, 1989
File: ISummary

I. SUMMARY AND RECOMMENDATIONS

A. Recommendation

USAI/Belize recommends the amendment to the IPTEH Project No. 505-0018 to: a) incorporate the activities described herein as the bilateral component, and b) add the funding made available by this amendment. The project assistance termination date will remain unchanged at June 30, 1991 but the anuthorized life of project funding will be increased to $2.3 million U.S. in USAID funds.

THIS WAS DRAFTED BY SAM. THE DATE APPEARS TO REFER TO THE VLWS PROJECT. WE PROBABLY OUGHT TO SAY THAT THE DATE IS BEING EXTENDED TO JUNE 30, 1991.

B. Project Description and Financial Plan Summary (BY USAID)

1. Project Summary
2. Summary Financial Plan

C. Project Issues

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

1. Institution Building

In order to improve its capacity to plan, implement and evaluate rural water supply and sanitation programs, RWSSP needs to fill the position of National Coordinator for Rural Water Supply and Sanitation with qualified staff who will work in collaboration with the Rural Water and Sanitation Program Manager.

Management information systems need to be developed within WASA/RWSSP (for progress reporting, inventorycontrol, costing and cash flow, hydrogeological information and water quality) for more efficient and effective planning, implementation and evaluation of rural water and sanitation activities.

A backup Water Quality Analyst should trained in the MOH/EHS in

order strengthen the capacity and stability of this national Water Quality Control Laboratory.

As MOE integrates hygiene education into the core primary school curriculum, WASA/RWSSP District Health Educators should serve as resource persons to teachers in specified areas rather than as initiators of classroom teaching.

RWSSP District Health Educators should collaborate with District Health Teams and District Core Committees in strengthening district-level support to VHCs (and CHWs where they exist). This collaboration will facilitate a broader focus on health-related problems of concern to communities.

Institutional capacity in health education in the GOB will be strengthened by further training of the RWSSP Chief Health Educator. Scholarship support will be provided for a one year Masters in Public Health program at the University of the West Indies in Jamaica during the second year of Project extension.

RWSSP will need to prepare for the departure in September 1990 of the CHE for a one-year study leave.

2. Community Development and Health Education

The MOH needs to define clearly the long-term objectives of its PHC strategy; assess the strengths and weaknesses of the health education/community development approaches being used to achieve these objectives; and more clearly identify the approaches and staffing (in terms of numbers, qualities and training) necessary, and possible, to the achievement of its objectives. The project will provide technical assistance to this effort.

RWSSP management needs to examine reasons for high turnover of its DHEs and take appropriate steps to reduce such turnover in the future.

3. Well Drilling

The number of wells needed in the proposed program is within the demonstrated capacity of the existing well drilling equipment. The well drilling capacity should improve due to improved maintenance management that is being supplied through this project, and possibly due to receipt of additional well drilling equipment received through other projects. If, however, mechanical breakdowns are more extreme than previously experienced and additional drill rigs are not furnished, it is possible that the available well drilling equipment will not be capable of constructing the required number of successful wells.

The project will provide hydrogeological and well drilling technical assistance to improve local technical capabilities in dealing with salt water intrusion.

4. Miscellaneous Technical Issues

The use of ferro-cement water storage tank technology offers the opportunity of reducing the cost of water storage to less than half of the cost of conventional storage technologies both for rainwater catchment systems and for RWSs. The lower cost will increase the sustainability of both these types of water supply systems. The project includes a further demonstration of ferro-cement technology.

D. Project Development Team

Mosina Jordan, USAID Representative to Belize
Mellen Duffy Tanamly, General Development Officer, USAID/Belize
Sam Dowding, USAID Health Project Manager (Through July 31, 1989)
Bibi Essama, USAID Health Project Manager (After July 31, 1989)
Bonneau H. Dickson Jr., Sanitary Engineer Consultant, Team Leader
Suzanne Plopper, Health Education and Community Development Consultant.

August 11, 1989
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IMPROVED PRODUCTIVITY THROUGH BETTER HEALTH
PROJECT NO. 505-0018
PROJECT PAPER AMENDMENT
WATER AND SANITATION ACTIVITIES

TABLE OF CONTENTS

6

III. PROJECT ANALYSES

A. Institutional Analysis

1. Institutional Background and Organization
2. Management Analysis

B. Financial Analysis (BY USAID)

1. Financial Plan
2. Recurrent Costs

C. Social Soundness Analysis

1. Project Beneficiaries
2. Cultural Feasibility of Community Involvement
3. Community Organization and Participation
4. Impact on Women

D. Technical Analysis

1. Technical Assistance

a. Hydrogeologist
b. Drilling Technical Assistance
c. Maintenance and Inventory Management Technical Assistance
d. Management Technical Assistance

2. Handpumps and Wells

a. Requirements for Wells
b. Well Drilling Capabilities
c. Community Development Constraints
d. Rehabilitation of the Nitco Rig
e. Recommended Water Supply Program

3. Rudimentary Water Systems (RWSs)
4. Drill Rig Parts and Tools
5. Ferro-Cement Tank Technology Demonstration
6. Rehabilitation of Maintenance Buildings
7. Rehabilitation of Mile 10 Storage Depot

E. Environmental Analysis

F. Observations on Existing Programs

1. Water Quality Laboratory Data
2. Composting and Raised Latrines

Table II-1. Illustrative Program Inputs

1.	Technical Assistance	$128,000 U.S.
	a. Health Educator Technical Assistance, 18 weeks	$68,000
	b. Hydrogeologist, 1 month	$15,000
	c. Drilling Technical Assistance	$30,000
	d. Maintenance and Inventory Management Technical Assistance	$15,000
2.	Training	$70,000 U.S.
	a. In-country health education, community development, and management/problem solving for RWSSP district health educators and MOH (PHC & HECOPAB) personnel.	$35,000
	b. Training for Master Driller	$15,000
	c. MPH for Chief Health Educator at University of the West Indies	$12,000
	d. Training for the Backup Water Quality Analyst,	$5,000
	e. Six Local Seminars	$3,000
3.	Commodities	$767,000 U.S.
	a. Health Education Materials	$7,000
	b. Casing and Handpumps for 60 Wells	$60,000
	c. Six RWSs	$570,000
	d. Completion of Four Pump Houses	$20,000
	e. Drill Rig Parts and Tools	$95,000
	f. Materials for Ferro-Cement Tank Demonstration	$10,000
	g. Water Quality Laboratory Supplies	$5,000
4.	Construction	$35,000 U.S.
	a. Rehabilitation of District Maintenance Facilities	$20,000
	b. Rehabilitation of Mile 10 Storage Depot	$15,000
	Grand Total	$1,000,000 U.S.

August 12, 1989
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Table II-2. Status of Rudimentary Water System (RWS) Projects Funded Through the IPTBH Project, Phase 1

	Village	Casings, Pump, Generator, Etc.	Tank	Pump House
1.	Georgeville	Funded	Funded	Funded
2.	Silk Grass	Funded	Funded	Funded
3.	San Antonio	Funded	Funded	Not Funded
4.	Maskall	Funded	Will be Available (Reserved)	Not Funded
5.	Independence	Funded	Funds Available	Not Funded
6.	Blackman Eddy/ Ontario	Funded	Will be Available (Reserved)	Not Funded

NOTES:

Funded. Funds were paid through Phase 1 of the Improved Productivity Through Better Health (IPTBH) project.

Will be Available (Reserved). Funds are available in Phase 1 the IPTBH project but must be de-earmarked from other categories and transferred.

Funds Available. Funds are available in Phase 1 of the IPTBH project but have not yet been committed.

Not Funded. No funds are available in Phase 1 of the IPTBH project.

Status of Phase 1 Projects: Georgeville - Complete; Silk Grass- Ready for Final Inspection; San Antonio - Delayed by lack of the Nitco rig; Maskall - Awaiting USAID approval of price for the water tank and commitment of USAID funds; Independence - USAID letter just sent offering funds; Blackman Eddy/Ontario - Awaiting USAID approval of price for the water tank and commitment of USAID funds.

August 10, 1989
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II. PROJECT DESCRIPTION

A. Background

1. Country Setting

The country setting of Belize is presented in the original Project Paper for the IPTBH Project and has not changed significantly.

In brief, the population of the whole country is about 178,000. About one-third of the population resides in the Belize City area, and perhaps another sixth of the population resides in various towns which have conventional urban water supply systems. The remaining half of the population is rural, living in approximately 400 scattered villages.

2. Previous Water and Sanitation Accomplishments

The country of Belize is subdivided in to six districts. From north to south, these are: Corozal, Orange Walk, Belize, Cayo, Stann Creek, and Toledo. Rural water supply and sanitation projects have been conducted in the two northern districts, Corozal and Orange Walk by CARE with partial funding from USAID, in the three central districts by MNR with partial USAID funding, and in the southern district, Toledo, by MNR with partial UNICEF funding. The GOB has made substantial contributions to the projects in all three areas. These projects and the Canadian International Development Agency (CIDA) project which improved the urban water supply and sewerage facilities in Belize City are described briefly below.

a. Village Level Water and Sanitation Project

The Village Level Water and Sanitation Project (VLWS) operates in the two northern districts of Corozal and Orange Walk. The implementing agency is CARE. The project began in July, 1984 and had as an objective the provision of water supplies (either handpumps or rudimentary water systems (RWSs)) and sanitation (latrines) for 16 villages. A list of the included villages is presented in Annex G.

The original project was scheduled to end in December, 1987 but progress was somewhat slower than anticipated and the time for completion was extended. The budget for the original project was $1,200,000 U.S., of which $700,000 was provided by USAID under

Proj. No. 505-0024. The GOB made major casn and in-kind contributions to this project.

The VLWS project is now in a second phase which will end in June, 1991. The USAID funding for the second phase is $500,000. The second phase will finish up the 16 villages started in the original project and extend the program to five additional villages. It has been proposed that UNICEF provide additional funding of approximately $750,000 to CARE. If this is done, it is planned to add eleven additional villages to the project.

Additional information on the VLWS project is available in the CARE quarterly reports and in the following documents:

WASH Field Report No. 147. Care-Belize Water Supply and Sanitation Baseline Survey. Richard Z. Donovan. Arlington, VA. WASH Project, January, 1986.

WASH Field Report No. 193. Report on Technical Assistance to the Village-Level Water and Sanitation Project, Care-Belize. J. Ellis Turner. Arlington, VA. WASH Project, July, 1986.

WASH Field Report No. 206. Mid-Term Evaluation of the CARE Water Supply and Sanitation Project in Belize. J. Ellis Turner and Shirley Buzzard. Arlington, VA. WASH Project, May, 1987.

b. Improved Productivity Through Better Health (IPTBH) Project

The USAID funded IPTBH project authorization was signed on March 21, 1985 in the amount of $7 million U.S. The project contained both a rural water supply and sanitation component for the three central districts of Belize, Cayo and Stann Creek and a national vector control component. A list of the villages which were included in the project is presented in Annex G. The USAID project number is 505-0018. The project was scheduled to run for four years, i.e., until March 31, 1989.

The IPTBH project was assisted through a consulting joint venture PRAGMA/MCD. They provided professional staff for four long term positions: vector biologist/chief of party, community development/health educator/training specialist, sanitary engineer, and vehicle maintenance specialist. A well drilling trainer was added to the team in July, 1988. In addition, various short term technical advisors were brought in as required. The PRAGMA/MCD assignment ended in April, 1989, however, the well drilling technical advisor had a 14 month assignment that is scheduled to end at the end of September 1989.

More information on the IPTBH project is available in various reports produced by the project and in the following documents:

> WASH Working Report. Belize: Redesign and Technical Assistance for the IPTBH Project. Ralph E. Preble and Joseph Haratani. Arlington, VA. WASH Project, August, 1987.
>
> John Snow Inc. Report. Final Evaluation - Increased Productivity Through Better Health Project. Jesse Hobbs, Joseph Haratani, and Wilbur Hoff. John Snow, Inc. Boston, MA (?). January, 1989.

c. UNICEF Project

UNICEF has been funding a rural water supply and sanitation project in the southernmost district of the country, the Toledo District, using MNR/RWSSP as the implementing agency. The project objectives were 145 handpump wells and 450 latrines. Seven RWSs were initially included in the project but were later eliminated.

The project began in December 1985 and included the furnishing of a Canadian-made Canterra CT 211 air rotary well drilling rig. As noted in Annex G, the project covered 14 villages. The project ended in _____.

d. The Belize City Urban Project

The governments of Canadian and Belize funded a major rehabilitation of the water system in Belize City and a completely new sewerage system for the same area. The total Canadian funding for the project was in excess of $40 million Canadian. The Canadian funding is in the form of a loan which must be paid off by the year 2020. WASA assumes the payments on the loan starting in 1991. The GOB contributed $9 million Belizean dollars. In addition to providing conventional water, sewerage, and solid waste disposal facilities in the urban area, the project included a considerable amount of institution building for WASA, the GOB agency which was in charge of implementing the project.

GOB has funded the hiring of a Program Manager for the RWSSP. The person assigned, Mr. Douglas Wilson, worked on the Canadian project and thus is familiar with Belize and with WASA. He has a two year contract, which started in July 1989. There is a possibility that his contract will be extended for an additional one or two years.

B. Project Description

1. Goal and Purpose

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

The Purpose is three fold:

- To improve the effectiveness of the GOB to ensure adequate water supply and sanitation conditions in the rural communities of the country by strengthening its institutional capacity;
- To increase community participation and health education in the improvement of water supply and sanitation conditions in their communities; and
- To expand coverage of potable water supplies and improved sanitation facilities in rural communities in three districts and to improve the national water quality control program.

2. End of Project Status

The objectively verifiable indicators which will be used in evaluating whether the Project purpose has been achieved at Project closure in 1991 are:

- Organizational charts and job descriptions developed by RWSSP reflect organizational structure and staffing necessary for the management (planning, implementation and evaluation) of GOB rural water supply and sanitation programs.
- Organizational charts and job descriptions in MOH reflect organizational structure and staffing necessary to support community-based efforts to improve environmental sanitation and to undertake other health-related activities.
- RWSSP staff structure filled with qualified and trained personnel who demonstrate program management skills.
- MOH selects and trains a health professional as a backup Water Quality Analyst.
- Village Health Committees ensure proper use and care of handpumps in 90 percent of project villages with handpumps.
- Community Boards of Management ensure proper management

of rudimentary water systems (RWSs) in all project villages with such systems.

- o Potable water supplies and improved pit latrines developed in approximately 16 additional project villages in three districts, selected according to mutually agreed upon criteria.

- o MNR maintenance teams insure an 85 percent handpump working status for all public pumps in the three districts, including those previously installed on potable water sources.

- o All approved rural water supplies tested by MOH Water Quality Control Lab at least twice a year and corrective action taken, where necessary, according to MOH water quality protocols.

3. Project Activities

Project activities are focussed in three general areas: 1) institution-building; 2) community development and health education; and 3) construction of water supply and sanitation facilities.

a. Institution Building

Institution-building is being addressed in several ways.

- o The need for institutional strengthening within the RWSSP is being addressed by the recent hiring by the MNR of an experienced Canadian engineer as the Program Manager for the RWSSP for at least the next two years.

  The RWSSP National Coordinator position has been vacant since January 1989 with the departure of the National Coordinator for project-supported long term study in the U.S. RWSSP will be unable to fill this position with a qualified person in the immediate future, but will await the return of the National Coordinator. Many of the duties of the National Coordinator will be covered in his absence by the newly hired Program Manager.

  The RWSSP Program Manager, in collaboration with the Chief Health Educator and Administrator will develop necessary management tools for the purpose of improving RWSSP's capacity to plan, implement and evaluate rural water and sanitation programs. Such tools will

17

include: clear lines of authority, communication and reporting; functional job descriptions; management information systems for quarterly and annual progress reports, the inventory and control of equipment and materials, costing and cash flow information, historical hydrogeological information, and water quality data; policies and procedures governing program activity; and quarterly, annual and long term plans.

As certain management procedures are instituted, there may be need for short term training of project personnel in specific aspects of office procedure and/or development and use of management information systems. These needs can be met by local training institutions. Both project funds and CIDA funds may be used to support such training.

- A National Coordinating Committee on Water Supply and Sanitation has been established for the purposes of:

  Coordinating financial, technical and human resources in order to ensure adequate and equitable clean water and sanitation coverage to the rural population of Belize;

  Sharing information on technical, administrative and policy matters arising from implementation of individual projects or originating from donor organizations that are of interest to other members;

  Studying implementation issues common to all projects or affecting the national program which arise during project implementation, and to recommend solutions to the GOB and donors;

  Collaborating, to the fullest extent feasible, on baseline data gathering, program monitoring, and evaluation with the intention of developing comparable indicators and data to measure national progress.

  This committee is chaired currently by the Chief Executive Officer (CEO) of WASA and is comprised of representatives from the GOB, donor agencies and PVOs involved in water and sanitation projects in Belize. This committee needs to review its mandate and its intended outputs and assess its effectiveness in achieving them.

- All improved rural public water supplies (handpumps and RWS's) will be tested at least twice a year (once in

the rainy season and once in the dry season). Protocols will be established by the National Coordinating Committee for Water and Sanitation for follow-up and correction of contaminated systems. Water systems found to be contaminated will be followed up in according to established protocols to assess possible sources of contamination; contamination will be corrected according to these protocols. The project extension will fund necessary laboratory supplies for FY 90 and FY 91.

- The sustainability and institutional capacity of the Water Quality Control Laboratory of the MOH/EHS requires the training of a backup Water Quality Analyst which might be a new or an existing government employee. The Project will fund short term technical training for this person.

- The GOB (MOH and MNR) will undertake an analysis of its PHC strategy and HE/CD activities. This analysis will be aimed at developing a plan of action to maximize the effectiveness of these programs and strengthen the institutional capacity of the MOH to provide sustained support for them. Work will focus on the definition of long-term objectives; identification of structural strengths and weakness of current approaches used to achieve stated objectives; identification of changes needed; identification of available and necessary resources, including staffing, for meeting long-term objectives; and elaboration of a plan of action which reflects the needs of the population and the most effective and efficient use of resources for meeting these needs. The project will provide up to four person months of technical assistance to this analysis and elaboration of a plan of action.

  From this study, specified health education activities may be identified for further project support.

- Institutionalization of health education activities will be furthered by additional training for the project Chief Health Educator (at the Masters level: a one-year program to be completed during the final year of the Project). He is currently the only GOB health educator with Bachelors-level training in health education. There are no health educators with Masters-level training.

b. Community Development and Health Education

The community development and health education component of the project will continue to focus on the introduction of the Project to community leaders, assessment of community interest and commitment to contributions of labor and maintenance of proposed water supply and sanitation facilities, monitoring the mobilization of community participation necessary during the construction phase of water and sanitation facilities and continued support of community efforts in health-related activities. They will be supported in these activities by the District Coordinator.

The Chief Health Educator will continue to provide technical leadership and support to all aspects of community participation and health education, including pre-service training, supervision and evaluation of RWSSP District Health Educators, technical assistance to district implementation teams in areas related to community participation and the planning of in-service training as performance needs indicate.

District health educators will serve increasingly as resource persons to primary school teachers, rather than actively teaching, in the area of water and sanitation as teachers assume more responsability for hygiene education in their schools.

District health educators and/or district coordinators will participate regularly in District Health Team meetings and District Core Committee meetings for the purposes of better coordination, understanding, and being able to respond to community concerns and contributing to DCC activities.

c. Construction of Facilities

i) Handpumps and Wells

As discussed in Section III. E. 2., the rate at which villages can be equipped with handpumps and wells appears to be constrained by the well drilling capacity that is available and the rate at which it is possible for the District Implementing Teams to do the necessary community development. Based on these constraints, it is planned that the project extension provide handpump service to about 10 additional villages, i.e., about 60 additional handpumps.

It is expected that there will be considerable minor variation within these numbers, e.g., that the costs to USAID may vary from the estimate above (either up or down), and that larger or smaller villages with more or less than six handpumps will be selected. These adjustments will be made as the project is executed with the expectation that the total cost of this project element will remain approximately as projected above.

A set of selection criteria will be developed for selecting which villages will be served by the project. The criteria will be mutually agreed upon by the GOB and USAID.

ii) Rudimentary Water Systems (RWSs)

The project extension will fund approximately six additional RWS. It is recognized that there is considerable variation in costs among the RWSs, depending especially on the size of the village and whether the system is entirely new or involves rehabilitation of an existing system.

Funds are available in the previous project to fund all of the RWSs which have been started except for the pump houses at San Antonio, Maskall, Independence, and Blackman Eddy/Ontario. The costs of these four pump houses has been included as a separate category.

iii) Drill Rig Parts and Tools

A part of the drill rig maintenance problem which was discussed above is the inability of the GOB to procure replacement parts quickly for the drill rig. The project extension will establish a means of ordering parts and having them shipped quickly, by air freight if necessary. This may be done through a local supplier, who has lines of credit in the U.S., or by setting up such lines of credit for WASA/RWSSP. This service may be included as a part of the contract with the maintenance technical advisor. A budget of $95,000 U.S. has been included, which will include development of an inventory of commonly used items.

iv) Ferro-Cement Tank Technology Demonstration

It is proposed that three rainwater catchment and one larger tank for a RWS be constructed to demonstrate ferro-cement technology. The RWS in which the tank is built can be one of those that has been funded through the project. An important part of this program element will be documenting the quantities of materials and labor required and the costs and disseminating this information widely.

v) Rehabilitation of Maintenance Buildings

The project extension will improve run down maintenance buildings in order to facilitate drill rig maintenance.

vi) Rehabilitation of the Mile 10 Storage Depot

The Mile 10 Storage Depot will be rehabilitated. The work will include especially construction od work benches and storage racks. This depot is the main point for handling the well casing and screens, handpumps, and other commodities included in this project.

4. Project Outputs

Project outputs will be as follows. These outputs will be the result of project activities described above, implemented through the means of project inputs described in the following section. Specific indicators for the achievement of these outputs are presented in the Logical Framework.

- Program management practices are institutionalized in RWSSP for the management (planning, implementation and evaluation) of rural water supply and sanitation services in Belize.

- Program management practices are institutionalized in the MOH, providing for a comprehensive approach to primary health care at the community level.

- Communities are actively involved in planning, construction and maintenance of water systems and latrines in project villages.

- Community health workers, where trained, collaborate with village health committees as facilitators of community involvement in environmental improvements and other activities benefiting the community.

- Construction of approximately 60 tubewells and installation of handpumps in approximately 10 rural communities with populations of less than 450 in three districts.

- Construction of approximately six rudimentary water systems in rural communities with populations of more than 450.

- Construction of ventilated improved pit latrines in rural communities benefitting from improved water supplies.

- Maintenance of rural public handpumps in the three project districts.

- o Management of rudimentary water systems by community-based Boards of Management.

- o Testing and treatment of approved rural water supplies by the MOH Water Quality Control Laboratory.

- o Ferro-cement water storage tank technology will be better documented and more widely disseminated in Belize.

5. Project Inputs

The project inputs by USAID are summarized in Table II-1, which is at the end of Section II, and are discussed below. The GOB will make significant cash and in-kind contributions through its on-going activities which support this project.

a. Technical Assistance

i) Health Education

Health education technical assistance will be provided for up to four person months to assist the GOB in 1) analyzing its PHC strategy and HE/CD needs, and 2) developing a long-term plan of action to maximize the effectiveness of these programs and strengthen the MOH institutional capacity to provide sustained support for them.

ii) Hydrogeologist

A hydrogeologist technical advisor will be provided for one month to assist in siting wells for the RWSs and to do some technical training.

iii) Drilling Technical Assistance

Two person-months of well drilling technical advisor time will be provided. One of these person-months will train the Belizean well drilling crews in the use of the Nitco air-rotary rig. The other person-month will train the local well drilling crews in how to set casing to seal off saline aquifers.

iv) Maintenance and Inventory Management

A technical advisor will be provided for one month to assist the RWSSP in establishing and learning to use a maintenance management system and an inventory management system.

b. Training

i) Master Well Driller

To increase the technical expertise available in Belize, the Trainee Master Driller will be sent to the United States for a three month period of training with a well driller. This training will be on-site, hands-on, practical drilling, not formal schooling. The training should emphasize drilling in unconsolidated formations, using both percussion and air rotary drill rigs. If practicable, the Trainee Master Driller should obtain a well driller's license through this work.

The trining in the United States should take place at a time when the well drilling technical advisor is not present in Belize so that the Trainee Master Driller does not miss the opportunity to learn from the technical advisor while the advisor is in-country. In addition, it is desirable that the training period for the Trainee Master Driller not occur during the peak drilling season, which is the dry winter period. The optimum time for this training appears to be the summer of 1990.

ii) MPH for Chief Health Educator

The project will fund long-term training (Masters in Public Health at the University of the West Indies in Jamaica) for the project Chief Health Educator during the final year of the project.

iii) Backup Water Quality Analyst

A backup Water Quality Analyst for the MOH/EHS Water Quality Control Laboratory will receive approximately six weeks of technical training. The training site has not been determined; preference would be a technical training institution in the Caribbean.

iv) Local Management Seminars

To increase the management skills of the RWSSP personnel, the project extension will fund up to six seminars by local institutions. The topics, time, duration and attendees will be selected by RWSSP.

Likely topics include: performance appraisal; supervisory management; program budgeting; maintenance management; inventory management; scheduling; interpersonal relations; use of computers; typing; or accounting. The Belize Institute of Management (BIM) is a potential supplier of the management seminars. Glessima Research and Services, a local company, has the capability of providing seminars on computer topics.

c. Commodities

i) Health Education Materials

The project will provide funds for preparation of health education materials such as fotonovelas, flannelographs, video and TV spots, etc. to support RWSSP health education activities.

ii) Well Casings and Handpumps

The project will pay for the cost of materials for approximately 60 handpump wells to serve about 10 villages.

iii) Rudimentary Water Systems (RWSs)

The project will include the materials for approximately six RWSs. These materials include well casings, pump, generator or engine if permanent power is not available, pump house, storage tank, and the pipes for the distribution system. All labor will be furnished by the local community.

iv) Pump Houses

The project will pay for four pump houses for RWSs which were included in the previous IPTBH project. The rest of these systems have already been funded. The status of funding of the RWSs in the previous project is presented in Table II-2, which appears at the end of Section II.

v) Drill Rig Parts and Tools

RWSSP will be provided with an inventory of spare parts for the drilling equipment. This will include some small tools as required to repair and maintain the drilling equipment, and some miscellaneous well drilling supplies such as extra drill bits.

vi) Materials for Ferro-Cement Water Storage Tank Demonstration

Materials will be furnished for demonstrating ferro-cement water storage tank technology, for documenting the costs and labor requirements, and for dessiminating this information. Labor will be provided by Peace Corps or by villagers as a part of one of the other project elements, or the work might be let to a private contractor.

vii) Water Quality Laboratory Supplies

In order to continue the program of analyzing all improved water sources twice per year, the project extension will fund additional laboratory supplies. A list of needed supplies is being prepared by the Water Quality Analyst for presentation to USAID.

d. Construction

i) District Maintenance Facilities

Funds will be provided to rehabilitate district maintenance facilities to facilitate the well drilling and RWS construction programs.

ii) Storage Depot

Funds will also be provided for improving the main maintenance facility and storage depot, which is located at Mile 10, not far from Belize City.

6. Financial Plan

TO BE DEVELOPED BY USAID.

C. Project Relationships

1. Relationship to GOB Plans

The GOB has placed responsibility for planning and implementing all rural water and sanitation projects in the MNR. GOB strengths in planning and implementing health education /community development interventions lie in the MOH/Division of Primary Health Care. The IPTBH project has strong components of both physical water supply and sanitation facility construction and health education/community development. This Project Amendment proposes to support these activities according to the existing strengths and resources of the GOB. In this sense, the institutional strengthening goals of the project are consonant with GOB objectives of coordinating these types of programs through appropriate government agencies which are properly equipped to undertake long term responsibility. Collaboration will be required between the MNR and the MOH in order to strengthen the support to communities which is necessary to long-term sustainability of project inputs. Such long-term support will likely come from the PHC strategy involving the training of CHWs, organization of VHCs, and interventions of DHTs and DCCs.

Participation of project DCs and DHEs in DHT and DCC meetings will facilitate this coordination of activity.

2. Relationship to USAID Plans

The draft CDSS for 1991-1995, prepared in March 1989, focuses on the same two priority areas as the GOB, agriculture and tourism. These two areas are Belize's principal foreign exchange earners, the areas in which domestic and foreign private investment are concentrated, and in which growth potential is greatest. If poorly managed, however, they pose the greatest threats to Belize's natural resource base. The Mission's goal is sustainable economic growth, driven by private sector investment, with special emphasis on resource planning and management. The strategy is to help the GOB develop the capacity to rationally plan and manage its resources to guide economic growth, while continuing to address key constraints to growth -- lack of roads, shortage of managerial and technical skills, and a narrow export base. The program thus aims to maximize job creation and government revenue while protecting the resource base.

This strategy signifies phasing out support for many social institutional areas, including primary education, health and population. The proposed two-year extension of the IPTBH project is recommended in order to: 1) strengthen GOB institutional capacity in the management of its rural water supply and sanitation program; 2) assist the MOH in strengthening its institutional capacity to manage its primary health care and health education/community development programs; and 3) strengthen these capacities through continuing project activity.

3. Relationship to Other Donor Plans

The only other donor of significance in rural water supply and sanitation is UNICEF, whose water and sanitation activities have concentrated in the Toledo district. The implementing agency has been the MNR. UNICEF is planning modest support of future water and sanitation activities in four northern districts in which the USAID-funded IPTBH and VLWS projects are working, responding to needs unmet by this project. It is understood that the UNHCR is planning some water activities in the Toledo district but targeted specifically at refugees.

UNICEF is also the only other donor of significance in health education/community health although there are a number of PVOs also assisting the GOB in this area (including CARE, Project HOPE, Project Concern International, Medecins sans Frontiers). UNICEF and the PVOs have indicated that training planned for the purpose of strengthening sustainability of project activities in

community health would serve well to complement their on-going assistance to the GOB.

From 1985-1989, the Canadian International Development Agency (CIDA) funded a major rehabilitation of the water system in Belize City, a new sewerage system for the same area, and a solid waste disposal system. Some remaining funds are planned to be used for institution-building activities at WASA and for supplies and equipment which will facilitate WASA's operations and maintenance activities.

August 11, 1989
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III. PROJECT ANALYSES

A. Institutional Analysis

1. Institutional Background and Organization

The GOB is the major provider of rural water supply and sanitation services and of health care and disease prevention services. The MNR has been responsible for rural water and sanitation services since June 1986, at which time the Rural Water Supply and Sanitation Program (RWSSP) was transferred from the MOH to the MNR. The MOH is responsible for health care and disease prevention services.

Within the MNR, the Water and Sewerage Authority (WASA) has traditionally had responsibility for urban water and sewerage systems in Belize. WASA is a parastatal organization. It is responsible for the development, operation and maintenance of all urban water and sewerage systems. It collects fees for its water and sewerage services and is responsible for its own operational and system maintenance costs; the GOB supports capital construction costs.

The RWSSP was transferred by the GOB from the MOH to the MNR in June 1986. Within the MNR, it is responsible directly to the Permanent Secretary but for administrative convenience it reports through the CEO of WASA. RWSSP personnel include, at the central level: 1) a Project Manager (a Canadian sanitary engineer who previously worked with WASA, under a CIDA contract, on the rehabilitation of the water system and construction of the new sewerage system in Belize City), 2) a National Coordinator (a position which has been vacant since January 1989 when the Coordinator departed for long term project-funded studies in the U.S.), 3) a Chief Health Educator, 4) an Administrator, 5) 4 office personnel, 6) 2 mechanics, and 7) a master driller, responsible for technical assistance to the drilling teams. At the field level, in each of the three districts in which the IPTBH project functions, there is a district implementation team composed of 1) a District Coordinator, 2) a District Health Educator, 3) a Carpenter-Foreman, and 4) a three-man drilling team. The RWSSP organizational chart is in Annex O.

The MOH operates a health services delivery system through a network of one secondary/tertiary hospital in Belize City; six district hospitals offering mainly secondary care; 28 health centers throughout the country providing mainly immunizations, maternal and child health services and minor curative care, from

which nurses operate mobile health clinics, visiting surrounding villages approximately every six weeks each; and an emerging PHC system based on Village Health Committees (VHCs) and Community Health Workers (CHWs). There are currently about 60 VHCs distributed among all six districts, though it is not known whether all are currently active. Over 90 CHWs are now in place and functioning in all six districts, with an additional 86 currently being trained.

The PHC strategy for strengthening and sustaining community-based PHC efforts is based on the following structure. At the central level, the PHC Division is staffed by a Director of PHC and a Principal Trainer (PT). At the district level, there are District Health Teams (DHTs) and District Core Committees (DCCs). DHTs are made up of district-level program managers from ministries responsible for a range of community health and development-related services (for example MOH, MOE, MOLSS, MNR, & MOAg), representatives of district-level government administration, CHWs, VHC members and representatives of NGOs working in PHC activities in the district. DCCs are subgroups of DHTs and are made up of program managers from participating ministries who serve on the DHT. The DHT serves as a problem-identification and problem-solving forum for priorities identified by communities or by other government agencies. The DCC implements the plans of the DHT, responding to identified needs. It also has responsibility for the training of CHWs.

Also under the PHC Division is the Health Education and Community Participation Bureau (HECOPAB), the MOH office responsible for health education/community development activities. HECOPAB works closely with DHTs and DCCs.

The Improved Productivity Through Better Health (IPTBH) Project Agreement was signed with the GOB March 26, 1985. The project was composed of two components: 1) malaria and Aedes aegypti control, and 2) rural water and sanitation. The rural water and sanitation component supports RWSSP activities in the three central districts of the country of Belize: Stann Creek, Cayo, and Belize District. The implementing agency for both components of the project was the MOH. With the GOB transfer of responsibility for the RWSSP to the MNR in June 1986, the water supply and sanitation component of the IPTBH project, except for the Water Quality Control Laboratory, was moved to the MNR. Personnel formerly with the RWSSP under the MOH were transfered to MNR.

2. Management Analysis

Key management issues addressed in this Project Amendment include: 1) institution-building capabilities, 2) supervision of district-level personnel, and 3) health education/community

development activities of the project, including the role of RWSSP district health educators, the sustainability of their inputs, and other alternatives for strengthening this component.

Under the original project, planning and implementation functions were assured by the resident long-term technical assistance teams rather than by GOB staff. This was due, at least in part, to a lack of clarity regarding appropriate roles and responsibilities of technical assistance, and to a lack of identified counterparts. This situation contributed to wide spread frustration and did little to contribute to upgrading program management skills of senior program staff. In the remaining two years of project activity, there will be no long-term advisors; needs for short-term advisors will be determined by program staff in consultation with the USAID Health Project Manager.

Program management and institution-building capacity has been weakened since January 1989 by the vacancy in the position of National Coordinator for RWSSP. This vacancy occured with the departure of the National Coordinator to the U.S. for long-term studies supported by the project. The lack of a qualified person in this position has led to 1) a lack of project leadership and direction of field activities, 2) inadequate supervision of program staff, 3) lack of attention to procurement problems, and 4) extra demands being made on the Chief Health Educator who is responsible for all aspects of health education and community participation in the RWSSP. This problem has been somewhat relieved, at least in the immediate future, by the hiring of an experienced Canadian sanitary engineer as Program Manager. However, this is only a partial and interim solution. In order to build and sustain MNR's ability to manage the rural water supply and sanitation program, it is necessary that the position of National Coordinator be filled immediately so that the new National Coordinator develop his management skills through close collaboration with the Program Manager in all aspects of program management.

Problems of supervision have been mentionned by RWSSP personnel. District level staff have not received adequate supervision from central staff. Lines of communication and authority are not clear. District Health Educators have not provided adequate support to village health committees once the villages have completed their water systems and latrine construction (other than to give health talks). Positive, competent and consistent supervision, based on clear lines of communicatoin and authority, and on the needs of the supervisee, is crucial to the performance of staff as well as, in most cases, the continued functioning of VHCs. While lack of transport may be a constraint to regular supervision, management needs to examine carefully the organizational strucrure through which supervision is carried out and the performance and productivity of its personnel, and give priority to correcting identified weaknesses.

A major management issue concerns the role, training and performance of District Health Educators (DHEs) and the potential for sustainability of their interventions. The Project Paper called for 1) ambitious target numbers of tubewells, rudimentary water systems and latrines to be constructed, 2) active community participation in the planning and construction phases of activity and in the long term maintenance of the systems, and 3) a "strong community development/health education/training element" in the design of water and sanitation components. It did not specify what was meant operationally by this last element.

The role of DHEs has been to provide health education to project communities and to ensure the community participation necessary to accomplish the project's physical targets. DHE responsibilities include 1) introducing the project to communities, 2) assessing community interest, 3) encouraging communities to form a village health committee (if one does not already exist) to serve as a liaison between the project and the community, 4) training/orienting VHC members to the role and functions of the VHC, and 5) obtaining community commitment for participation needed during the construction phase and for long-term maintenance of facilities. DHEs are also to do health education in the primary schools and in the community to promote improved health practices and a healthier environment and to foster community development activities which benefit the community.

Performance of DHEs with regard to informing communities about the project and fostering community participation appears to be quite satisfactory. Community participation, with a few exceptions, has been quite active in so far as the input required during the construction water and sanitation facilities.

There are questions, however, concerning: 1) the role of DHEs in terms of the intended outcome of broader health education /community development efforts and the approach currently being used; and 2) the potential for sustainability of efforts of health educators employed on an "open vote" (temporary) basis under the Ministry of Natural Resources and attached to a parastatal organization which is by definition a self-sustaining institution with a need to bill for all but the capital costs of its services.

The long-term effectiveness of health education/community development inputs is generally agreed to depend upon their responsiveness to felt needs of the target audience. Their effectiveness is based on their responsiveness to locally-identified priorities and existing beliefs, on joint problem-solving, and on communication to identify local perceptions of problems, causes and possible solutions. Health education is generally aimed at behavior change. This may further contribute

to participation in certain community activities and the development of any range of facilities, organizational structures etc benefitting the community and at the same time improving community capacity to assume responsibility for its own development. This necessarily implies that the health educator approach health education, or community development, in any community by assisting the community in identifying its health-related, or community development-related, priorities and finding solutions which are feasible and practical for them. This approach has not been used within this project for at least three reasons. First, given that the project has a specific focus and physical targets to reach, what it has to offer communities is at least partly pre-determined. Secondly, a health education /community development approach based on community-identified (versus project-identified) needs is a slower and more time consuming process (though it contributes to more sustainable results). The project lacks the resources and time to devote to this approach, given its physical target objectives.

Thirdly, a "bottom-up" community-based approach aimed at increasing the community's problem-solving capacity requires a strong organizational commitment which is communicated through training driven by that philosophy and through organizational support for the long-term impact to be realized. Through the project, a set of six modules were developed for use in training DHEs in participatory methods of facilitating community development.

Given the focus of the project, the targets to be met, the turnover of DHEs, and thus the drain on time and resources to train new DHEs and the resulting brief training and low experience level of DHEs, the above approach may not be practical. RWSSP by definition, is not an organization which can support such an approach. It has physical targets to meet and needs certain kinds of community participation in order to achieve its targets. The efforts of DHEs are directed toward achieving these targets. RWSSP necessarily has other very real organizational/management needs which conflict with the potential output of DHE efforts: in two recent cases, the strongest and most experienced DHEs were promoted to positions of District Coordinator. While these promotions serve well RWSSP management needs, they contributed to the continuing turnover among DHEs, a problem which in a very practical sense influences the level of training and experience of DHEs and thus role the project can expect to play in health education and community development in project villages.

There is, in Belize, another structure whose mandate is to address broader health and development-related priorities identified by communities. This structure, created by the PHC Division of the MOH, is outlined above, under Institutional Background and Organization, in Section III. A. 1.

The PHC structure is still in the development phase. At the central level, a Principal Trainer (PT) has recently been appointed to provide technical assistance and support to the district-level PHC structure. In some districts, there are District Trainers (DT) and District Health Educators (DHE); these positions have been staffed and/or funded, for the most part, by NGOs. DTs and DHEs work with DHTs and DCCs, coordinating the training of CHWs and contributing actively to other activities of DHTs and DCCs. Within the Health Education & Community Participation Bureau (HECOPAB), which is under the PHC Division, there are currently two health educator positions. HECOPAB provides technical assistance to, and support for, health education components of a wide range of MOH services and projects.

This expanding PHC structure, with its focus on a broad range of community-identified concerns, represents the kind of health education/community development focus that the project envisioned but is perhaps not capable of undertaking through the existing RWSSP health education/community development component. Active participation of RWSSP health educators on the DHT and DCC would provide these groups with water and sanitation input and would help broaden the focus of RWSSP DCs and DHEs regarding other health-related community priorities.

At the same time, the PHC strategy has certain weaknesses. Long-term objectives are not clearly defined. Projected personnel needs will be difficult to meet in the near future, given that the MOH currently spends approximately 80 percent of its budget on personnel. At the village level, CHWs and VHCs are poorly supervised and supported. Many CHWs lack incentive to continue in their volunteer roles and many VHCs become relatively inactive after a certain period of time. Thus, while the MOH has a strong commitment to PHC and to HE/CD, there needs to be developed a strong and rational plan of action which responds to the needs of the population and reflects the resources available to respond to these needs.

The MOH needs to assess its PHC strategy and HE/CD activities in light of its long-term objectives, existing structural strengths and weaknesses affecting the achievement of these objectives, and resources available for the achievement of these objectives. From this, the MOH will be better able to develop a long-term plan of action to maximize the effectiveness of these programs and strengthen its institutional capacity to provide sustained support for them. The project will provide up to three person months of technical assistance to this analysis.

A continuing weakness at the community level of the PHC strategy is supervision of CHWs and support to VHCs. This is an area which the PHC Division, in collaboration with the Division for

Public Health Nursing (which is responsible for such supervision), needs to address in order to strengthen the sustainability of these components and their potential for productivity.

Health education/community development efforts in Belize will profit from advanced public health training of both the Director of HECOPAB and the Chief Health Educator of RWSSP. The Director of HECOPAB is scheduled to do a one year Masters program in England during the 1989-90 school year and this project proposes to fund a one year Masters program for the RWSSP Chief Health Educator for starting in the fall of 1990.

B. Financial Analysis (BY USAID. Drafted and mailed by Sam??)

1. Financial Plan

2. Recurrent Costs

C. Social Soundness Analysis

1. <u>Project Beneficiaries</u>

The beneficiaries of this project amendment include approximately 9,000 rural residents of approximately 16 villages of the Belize Rural, Cayo and Stann Creek Districts.

The Belize Rural District population is mainly Creole and engage in small scale farming and ranching. They are in dispersed communities along the major rivers and highways.

The Cayo District is populated by a large number of refugees, along with a large proportion of Mestizos and Yucatec Maya. The economy is based on 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. The Garifuna are mostly settled in villages along the coast and are engaged in susbsistance farming (largely by women), fishing, and migratory wage labor. Community involvement in health and sanitation activities is problematic in areas with citrus and banana plantations due to the existance of a high migrant population and the fact that villages are not owned by their inhabitants.

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 bear the

greatest burden of mortality and/or morbidity from diarrheal diseases and parasitic infection, will benefit the most from the project. They will also benefit the most from not having to carry water long distances. Time saved can be used for income generation and other activities.

Through the support of RWSSP interventions in villages and through short-term technical assistance to the MNR and the MOH, the project will contribute to improved long-term institutional capability in program management, community health education and organization, and to a greater capacity of communities to identify and implement solutions to community problems.

2. Cultural Feasibility of Community Involvement

The project has experienced relatively few problems with community involvement in the construction phase of water supply and sanitation facilities. One of the things RWSSP field staff have had to adjust to, in terms of village commitment to community participation, is the on-going priorities of communities, especially the men's work schedules. While some field staff have expressed frustration at the hours that men have available for water system trenching (in the construction of RWSs) and latrine digging, they have learned to adapt their activities to the on-going commitments of the community. In two cases, communities decided to finance a back hoe for trenching rather than do the labor manually themselves, in one community because of lack of available manpower (as most of the men work far from the village) and in other due to extremely rocky and difficult digging conditions.

On-going activity of village health committees is more difficult to assess. On the one hand, participation in health talks given by DHEs has generally been positive; the outcomes of these talks are harder to assess. On the other hand, there is not widespread active community-based initiation of community development activities. This is understandable given the approach used in health education/community development in this project and the amount of time DHEs have to work with villages once water systems and latrines have been constructed. (See section III. A. 2. above for further details concerning this issue.) The project will support strengthening of long-range broader based health education /community development efforts by providing technical assistance to the MOH in the assessment of health education /community participation strategies and resources necessary to achieve program objectives.

3. 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 who represents their interests directly to the national government. At the district level, each ministry is represented by professional staff responsible for services to the district.

Historically, government has provided most services to the population based on government priorities and influenced by political pressure. Because communities perceive that national government provides for them, community participation and self-help efforts have been limited. Local institutions and councils have been more oriented towards petitioning government officials than acting and organizing themselves to address community needs.

In recent years, the central government has begun to encourage more community participation in the development of community services. The existing village structure for community participation is the Village Council whose members are elected by the community.

Within the RWSSP, targeted communities which have expressed interest in improved water supply and sanitation facilities have been asked, through their VCs, to form VHCs (where they did not previously exist). These committees have been formed in all villages in which the project has functioned. They have been instrumental in mobilizing community participation in the construction phase of project activity. Beyond that, the strengths of these groups and their degree of activity varies, as does the support they receive from RWSSP staff. It is too early to judge their potential for long-term management of water systems and initiation of community development activities.

Given active and consistent support for their responsibility for management of water and sanitation improvements in their communities, and for initiating other activities responding to community priorities, most communities will be able to strengthen their organization and thus their ability to undertake community development activities on their own behalf.

Community participation efforts ultimately rely on continued support from the central government. At present, the MOH has taken the lead in these efforts and has the most experience. The PHC strategy, in the early planning stages at the time the original Project Paper was written, is now being implemented to varying degrees in all six districts, coordinated through DHTs. The number of VHCs has grown, although they have been organized by a number of different organizations and are not yet fully integrated into the PHC system. The number of CHWs trained has likewise grown. The CHW curriculum and the structure for CHW supervision are being increasingly standardized and brought under

the control of the MOH/PHC Division. A major obstacle to the sustainability of the CHW component of PHC concerns incentives for CHWs to continue over time in their volunteer roles.

Problems of political divisiveness continue to impact on these efforts. Care must be taken to try to avoid politicization of health volunteers if they are to be effective in promoting greater community involvement. Furthermore, not all communities may be committed to supporting this strategy. VHCs should be formed, and CHWs selected and trained, on the basis of felt community need and commitment to this strategy as a means of strengthening the community's ability to assume an active role in the improvement of community health and development.

4. Impact on Women

Although the roles of women vary somewhat among cultural groups in Belize, women are usually at a disadvantage relative to men. Virtually all of them, including those in the paid labor force, share the burden of domestic work, including care of the family and care of the ill, as well as often unpaid agricultural labor in the rural areas.

Women have benefitted from the project 1) directly from improved health and reduced fatigue due to more accessible sources of water, and 2) indirectly from the additional time and energy available for other productive activities as well as the opportunity to improve organizational skills by participation in VHCs, management of community water systems and in the organization of community development activities.

In order for benefits to be maximized, it is important that women be actively involved in the VHCs. In areas where women do not form part of the formal community decision-making bodies, their input must be sought via other informal groups which do include women and by allowing communities sufficient time to discuss issues and problems before final decisions are made.

D. Technical Analysis

1. Technical Assistance

a. Hydrogeologist

It is often reported that the success rate in drilling water wells is around 50 percent, but this figure appears to be incorrect. Actual data on the success rate in water well drilling in Belize are presented in Table III-1.

Table III-1. Rate of Success for Well Drilling in the Rural Water Supply and Sanitation Program (RWSSP)

District	Total No. of Wells Drilled	Total No. of Successful Wells	Percent Successful
Toledo	213	144	68
Stann Creek	39	28	72
Cayo	24	16	67
Belize	43	37	86
Orange Walk	58	53	92
Corozal	65	62	95
Total	442	340	77

Source: Roland Rivers, National Coordinator, RWSSP.

The data in Table III-1 apply to all wells, both program and non-program wells, and both handpump and RWS wells, and are believed to include virtually all of the wells which have been drilled since about 1986.

The data presented in Table III-1 require some further comment. It is believed that the rate of success on program wells is higher than the average of all wells, say not less than 85 percent. However, the rate of success on RWS wells, which must produce greater quantities of water and thus are usually larger and deeper, is much lower than the average for all wells. For example, the only successful RWS well in Cayo District is the 290' well at Georgeville, although several other RWS wells have been attempted.

It was reported that some of the "failures" were wells which were stopped at a depth of about 120' because that was the deepest depth that could be served by the India Mark II handpumps that were available. Future orders of handpumps will include a percentage which are suitable for use at depths greater than 100' to 120' (and a percentage which are suitable for use on very shallow wells), thus handpump wells will not be limited to 100' or 120' in the future.

Other causes of "failures" included unacceptable water quality, including excessive salinity and hydrogen sulfide, and gelogical

formations which yielded no water (e.g., several hundred feet of squeezing clay at Santa Familia).

Because of the low success rate with RWS wells, the project extension will fund a hydrogeologist to select sites for wells in the RWS villages. A suggested Scope of Work and statement of required qualifications for the hydrogeologist is presented in Annex H. The hydrogeologist will work with the Master Driller and the National Coordinator, if available.

It is envisioned that the hydrogeologist will be needed for approximately four weeks. The first week will be spent on orientation. This will include meeting the involved parties, determining what background information exists and finding copies of it, and reviewing available information.

The most important information for the hydrogeologist will be aerial photographs. It is understood that aerial photographs flown in 1964 and 1974 covering the entire country are available at a scale of 1:50,000 in the office of the Chief Draftsman at the Ministry of Natural Resources. While this scale is slightly small, it is nevertheless usable for selecting well sites.

It is understood that topographic maps are also available at approximately the same scale as the aerial photographs. Several sets of these maps should also be made available to the hydrogeologist. The locations of the villages where wells are to be drilled should be marked on the photographs and or maps for the hydrogeologist.

The second most important piece of information will be well logs. It is understood the Drilling Technical Advisor that well logs have been kept on all of the wells that have been drilled in the three central districts since he arrived in August 1988. These logs are available at the District offices but have not been collected in a central location.

Well logs are reported also to have been kept prior to August 1988 but the quality and coverage of these logs, and their current locations, are unknown. It was reported that at one point the Master Driller produced a packet of approximately 50 well logs, but these may have been transcribed from information kept elsewhere.

According to a UNHCR project summary (Ref. , page 7) "some logging of wells (drilled in the Toledo District with the Canterra drill rig) was done in the past, but this has ceased completely." Whatever logs exist from the operation in the Toledo District should be collected, even though this project will not operate in that district.

The hydrogeologist should be authorized to spend a few preparatory days in the United States attempting to get larger scale satellite photographs of Belize, if these are available, and collecting whatever background geological information might be available.

Consideration should be given to having the hydrogeologist inspect the RWS village sites from a small airplane or a helicopter if this can be arranged and if the hydrogeologist thinks it would be useful.

It is estimated that the hydrogeologist will need approximately one day per village to select sites. The sites would be selected during the second week of the consultancy.

During the remainder of the consultancy, the hydrogeologist would be asked to do the following:

Conduct resistivity or other special surveys, if these are likely to improve the probability of finding water. Arrangements would have to be made prior to coming so that the hydrogeologist could bring, or arrange to have shipped, whatever equipment is necessary.

Conduct a seminar on hydrogeology for the well drilling crews, emphasizing the aspects of hydrogeology that are of importance to water well drilling.

Review the available information on water quality, especially salinity and hydrogen sulfide, and write a brief report on how these problems might be avoided.

Review the quality and extent of existing hydrogeological data and prepare a brief letter report suggesting low-cost, practical ways in which these data might be extended and improved.

It is not considered practical for the hydrogeologist attempt to prepare a hydrogeological map of large portions of the country. While such mapping would be useful background for further studies, it is not considered relevant to the needs of this project. Preparation of such mapping probably would require a much larger effort than is envisioned here, say one year of time and a considerable budget for preparation of graphics.

The UNHCR Project Summary (Ref. , page 8) recommends that a hydrogeologist be added to the staff of the RWSSP. The wording suggests that the hydrogeologist might be available for districts other than Toledo. On pages 24 and 25, budgets of $30,000 U.S. for equipment for the hydrogeologist and $45,000 for the hydrogeologist are listed, but no detail is given in the document about how long the hydrogeologist would be in-country or what the

Scope of Work would be. The UNHCR project is unfunded at present but is thought to have a reasonable probability of being funded. Since the timing and scope of hydrogeological services under the UNHCR project is uncertain, it is recommended that this project extension include the services described above. If the UNHCR project develops, the budget for hydrogeological studies in one of the two projects might be curtailed and diverted to some other activity.

b. Drilling Technical Assistance

In the previous project, a training advisor was provided from February 8 through April 11, 1987 and another training advisor was provided for a fourteen month period ending September 30, 1989 to enhance the expertise of the drilling crews. It is reported by several sources that the drilling crews appear to be technically competent at operating the equipment which they are currently using. There does not, therefore, appear to be a need for major amounts of continuing technical assistance for the well drilling crews.

Some short periods of specialized technical assistance for the drilling crews does, however, appear to be beneficial. The project will include one month of technical assistance for the drilling personnel in the use of the Nitco air rotary drilling rig.

In addition to the one month of training on air rotary rigs, one additional month of training will be given to the drilling crews by a well driller technical advisor. The emphasis of this training will be on sealing saline aquifers, using both air rotary and cable drilling rigs. It is desirable that the technical advisor participate in the actual sealing of several wells. This will require that the timing of the technical assistance be carefully chosen so that wells will actually be drilled during the month that the technical advisor is in Belize. The drill rigs will have to be in operation, and all necessary supplies and equipment will have to be available. Some specialized equipment, such as a high pressure grout pump, may be needed. RWSSP is currently conducting an inventory of the equiment which is on hand. The technical assistance should include a preparatory period during which the technical advisor discusses the sites where the wells will be sealed and the equipment and techniques which will be used. Any equipment or supplies necessary for the sealing operation will then be organized by RWSSP or brought by the technical advisor.

The two one-month periods of technical well drilling assistance could be provided by the same technical advisor if an advisor with sufficient breadth of experience can be found. If a single

advisor is used, the period of technical assistance might be one continuous two-month period or two one month-periods.

The well drilling technical advisor(s) will work with and through the RWSSP Master Driller.

c. Drill Maintenance and Inventory Management Technical Assistance

Mechanical maintenance of the drilling rigs is a major constraint on the number of successful wells drilled. Two of the three cable tool rigs in the central districts are approximately 40 years old. The cable tool rig in the northern districts is of approximately the same age and is mounted on a British-made Seddon truck, which is no longer manufactured. To a considerable extent, the Dando rig is being kept in operation by cannabalizing a second Dando rig which is available but no longer operational.

The maintenance situation may improve somewhat over what it has been in the recent past since the three cable tool rigs in the central districts have been or are being rehabilitated under the IPTBH project. Nevertheless, considering the fact that drilling rigs are of necessity subjected to rough treatment, the average age of the equipment in Belize, and the continuous duty to which it is put, a high level of required maintenance is to be expected.

While the Belizean staff apparently is capable of making the required repairs, the repair work is often slow. It is reported that the drill rigs frequently sit idle for weeks at a time awaiting repair. The following factors appear to contribute to the large amount of time lost to repairs:

Lack of Incentive. Neither the drilling nor the maintenance crews have much incentive to make the repairs quickly. The drilling crews may, in fact, find life easier when they are sitting around the shop than when they are working in the field. Ideally, there should be some sort of incentives, positive or negative, for faster work. Positive incentives could take the form of bonusses for meeting and exceeding production targets. A negative incentive could be less pay on days when the crew is not drilling, which might take the form of loss of overtime pay. The lack of incentives is an inherent feature of most government work and is administratively very difficult for government organizations to change.

One possible solution is to turn at least parts of the well drilling operation over to private parties and subcontract work to them. As a minimum, it is recommended that production goals be discussed with the crews and that actual

performance versus these goals be documented and posted on a bulletin board for all to see in order to foster friendly competition among the drilling crews.

Separation of the Maintenance Function. At present, all or most repairs are made by a separate maintenance section. This requires either that the drill rig be brought to the shop or that work be stopped until the maintenance personnel can come to the field. It is believed that many of the minor repairs could be made by the drilling crews, especially if they receive some training.

Lack of Spare Parts. It appears that the major difficulty in effecting rapid repairs is the lack of ready access to spare parts. At present there is little or no inventory of spare parts, including even minor items which can be predicted to require replacement, and purchases of spare parts must go through government channels that are slow. Parts procurement is discussed later in this section.

Lack of Communications. The drilling crews have no direct communication with the maintenance shops, thus the need for supplies or parts cannot be made known quickly. The communication problem may ease somewhat in the future because the telephone company is installing solar powered radio telephones in remote villages. Coverage is not yet complete, however, and the drilling crews are often working in areas where radio telephones have not yet been installed. Consideration was given to including some sort of radio system for the drilling crews but such a system was deemed to be beyond the scope of this project extension.

To improve the maintenance situation, it is proposed to provide a maintenance and inventory management technical advisor through the project extension. The maintenance and inventory management technical advisor should be experienced in organization and management of maintenance crews and work and in inventory control systems. The maintenance advisor would be expected to assist the RWSSP management and the maintenance personnel in setting up a maintenance system and an inventory system and in training the maintenance personnel in the use of these systems. The suggested level of effort is one month, for which a budget of $15,000 is suggested. The suggested Scope of Work and requirements for the position are presented in Annex J.

Consideration should be given to having a followup visit by the maintenance and inventory management technical advisor after the systems have been in operation for a while, if this is deemed to be necessary for evaluation and/or further training.

The maintenance and inventory management technical advisor will

work through the RWSSP Program Manager, National Coordinator (if available), and the Administrator, as appropriate.

As a specific management tool, it is recommended that a report of drill rig downtime be prepared and disseminated to relevant management personnel. The reporting system should require followup reports whenever a drill rig is down for more than say one week. The highest level management attention should be addressed to the causes of lengthy periods of downtime and to solutions which would keep the drilling equipment in operation more often.

d. Management Technical Assistance

Consideration was given to providing general managerial technical assistance to RWSSP, possibly for assistance with conducting an organizational study and preparing an organization chart, or for assitance with other general managerial matters, but was rejected. The Canadian Program Manager of RWSSP has considerable management experience in various Canadian government positions. RWSSP is a relatively small and simple organizational unit and the Program Manager has already prepared an organization chart for it. No specific need for management or organizational technical assistance was identified. Should such a need arise, it is likely that the Program Manager can obtain help through the CIDA program, which is funding his position. Based on this analysis, no general management technical assistance has been included in the project.

2. Handpumps and Wells

a. Requirements for Wells

The status of some of the rural water supply programs in the six districts of Belize is presented in Annex G. This information constitutes the beginning of a rural water supply "needs" survey, i.e., a tabulation of all the rural villages in the country showing which ones already have water supplies and which ones do not. A major use of the needs survey is as a planning tool to help in estimating how many additional rural water facilities are needed. It is recommended that RWSSP expand and improve the needs survey which is started here.

A complete listing of all "villages" is available from the National Malaria Control Program and is the background list presented in Annex F. It appears that the information on most of the villages was updated in 1987 or 1988, thus the list is relatively current. From the view point of the malaria program, any building or group of buildings constitutes a "village" because these buildings need to be inspected and perhaps sprayed.

The populations of numerous "villages" are listed as zero. It appears that these "villages" may in fact be isolated farm buildings which are not normally occupied by people.

In Annex G a list of all RWSSP handpumps is presented. This list was obtained from Ms. Beverly Clare of the Ministry of Health Water Quality Laboratory. The Water Quality Laboratory has been using this list in its attempt to analyze samples from each handpump well twice per year. There are many additions penciled in on the list, apparently indicating that handpumps have been added. This tends to indicate that this list too is relatively up to date and accurate.

Based on a visual perusal of these lists, it was very roughly estimated that there are about 180 villages in Belize without improved water supplies. Assuming approximately five handpumps per village, there is still a need for around 900 wells to meet the water supply needs of all villages. At an average of about 40 people per handpump (six or seven families), this represents about 35,000 persons.

Some of these villages will be served with RWS water supplies. RWS villages require a well with a greater capacity, which usually means a greater depth and thus a greater drilling effort. On the other hand, RWS villages usually have only one, or at most two wells, thus the smaller number of wells tends to offset the greater depth and drilling effort. For planning purposes, it should be sufficiently accurate to consider all villages as if they will have handpumps.

b. Well Drilling Capabilities

The GOB has available a total of five operating water well drilling rigs: a Canterra CT-211 air rotary rig provided by UNICEF and assigned to Toledo District; two old Bucyrus-Erie 22W cable tool rigs and one new Bucyrus-Erie 20 W cable tool rig, the three of which are assigned to the three central districts of Belize rural, Cayo and Stann Creek; and an old British-made Dando cable tool rig assigned to the two northern districts of Orange Walk and Corozal.

It is understood that at one time, the Ministry of Agriculture had some sort of well drilling program but that they no longer are drilling water wells. The Petroleum Unit of the Ministry of Natural Resources oversees exploration for petroleum within Belize but drilling rigs being used for this exploration are unlikely to be available for drilling water wells. As discussed previously, the petroleum exploration unit might, however, provide some hydrogeological information.

40

Private well drilling capability in Belize is extremely limited. The Mennonites have a small cable tool rig. At one time, a private entrepreneur, the Rock Drilling Company (Mr. Tom Marsden), purchased two old broken down government drill rigs and managed to make one operating rig out of them. It is understood, however, that this undertaking is no longer in business.

According to information provided by Kathy Kasprisin of UNICEF, the air rotary Canterra drill rig completed 144 successful wells between the time it was put in service in January, 1986 and June, 1989, a period of 42 months. This is an average of about 3.5 successful wells per month. Ms. Kasprisin stated that about 50 percent of the wells drilled by this unit have been unsuccessful. The success rate presented in Table III-1 was somewhat higher at 68 percent. The recently prepared UNHCR Project Summary (Ref. ___, page 7 reported that the master driller said this rig had drilled more than 500 bores with about 125 being successful. The estimates from these three sources of the number of successful wells agree reasonably closely. The reason for the very high estimate of the total number of wells in the UNHCR paper is not known.

The UNHCR Project Summary notes, however, on page 6 that according to the short term well drilling technical advisor on the project, the existing Canterra CT-211 rig is too light for the required work. The UNHCR Project Summary says the productivity of the rig is low and falling. Since this document was prepared in May 1989, it may more realistically reflect the rate of drilling that is currently being achieved than the average over the whole life of the UNICEF project. This would imply that in fact the rate of drilling successful wells with the Canterra rig is less than 3.5 wells per month.

For planning purposes, it has been assumed that the Canterra rig will average 2.5 successful wells per month, but it is emphasized that this rate of production depends upon whether the machine breaks down or not.

Information supplied by Mr. Anthony Nicasio, the Chief Health Educator in RWSSP, revealed that the three cable tool rigs in the three central districts drilled 31 successful wells during the six month period from June, 1988 through November 1988, and 27 successful wells in the next six months, i.e., 58 successful wells in a recent twelve month period. This is an average of approximately 1.5 successful wells per month per drill rig.

It should be noted that the wells reported above include some that were to serve RWS villages and thus that the monthly production rate that is estimated above represents an average of both handpump and RWS wells.

Assuming that the cable tool rig in the northern two districts has about the same capacity as the three rigs in the central districts, the existing combined well drilling capacity in-country is as follows:

1 rotary rig @ 2.5 successful wells/month =	2.5
4 cable tool rigs @ 1.5 successful wells/month =	6.0
Total capacity, successful wells/month =	8.5

WASA has received a Nitco air rotary rig but the unit has experienced mechanical problems and it is not known when, if ever, it will be available for service. This issue is discussed below. If the Nitco rig is returned to service, it is expected to be somewhat more difficult to maintain than the Canterra rig and thus to have a somewhat lower capacity, say 2.0 successful wells per month.

Douglas Wilson, the CIDA advisor to WASA, is requesting that some of the remaining funds in the CIDA project be used to purchase a Canterra rig which will be able to drill larger and deeper wells to supplement the Belize City domestic water supply. He estimates that there is about a 70 percent chance that this rig will be provided. If so, it might be available at times for use on the rural water supply projects. For planning purposes, it is assumed that this new Canterra rig might provide an equivalent capacity of 2.0 successful wells per month for the rural water supply projects, i.e., about half of its time.

The proposed UNHCR project includes supplying a Canterra CT-311 drilling rig for use in the Toledo District. The existing smaller Canterra CT-211 rig would be turned over to the government for rehabilitation and use elsewhere. As noted before, the UNHCR project is not funded at present but it is considered likely that funding will be provided. For planning purposes, it is assumed that the new Canterra CT-311 rig will have a capacity of about 4.0 successful wells per month.

As noted above, the firm capacity of the five existing drill rigs appears to be about 8.5 successful wells per month. This would be increased to about 10.5 successful wells per month if the Nitco rig can be placed in service, to perhaps 12.5 successful wells per month if some capacity becomes available from the rig being requested through the CIDA program, and to 16.5 successful wells per month if the UNHCR project provides a Canterra CT-311 rig.

Dividing the 900 required wells by the various capacities estimated above yields the following required periods of time to

complete the rural water supply program for all villages throughout the country:

Existing Capacity

900 wells/8.5 wells/month = 106 months or 9 years

Existing Capacity Plus the Nitco Rig

900 wells/10.5 wells/month = 86 months or 7 years

Existing Capacity Plus the Nitco Rig Plus the New Canterra Rig

900 wells/12.5 wells/month = 72 months or 6 years

Existing Capacity Plus Nitco, CIDA Canterra, and UNHCR Canterra

900 wells/16.5 wells/month = 55 months or 5 years.

In terms of number of villages, the above well drilling capacities represent about one and one-half to almost three villages per month, i.e., about 18 to 36 villages country-wide per year, assuming that there are six handpumps per village. This represents three to six villages per district per year as a country-wide average.

c. Community Development Constraints

Another constraint on the rate at which water supplies can be introduced is the need for community development. The necessary community development work is being organized by the RWSSP District Implementing Team. It has been estimated that this team needs to work with the village for a period of six to eight weeks before construction starts to obtain community commitment to the project. Latrine building precedes construction of the water facilities. The District Implementing Team is also supposed to be carrying on followup activities with all villages which have already developed water systems. Considering the various demands on the time of the District Implementing Team, it appears that they probably can, or should, be handling only about one new village at a time. Considering the six to eight week period required, this means that the District Implementing Team can only organize the required community development for six to eight villages per year.

Based on the experience of CARE in the two northern districts, the above estimate of the community development capacity may be optimistic. The CARE project was to provide water supplies in eight villages in each district over a two and one half year period, i.e., about four villages per year. The schedule for this project has been extended so that the actual implementation

rate was even lower. CARE is proposing to finish the villages that were selected in the initial project and add five new villages during a two year extension of their project. While the rate of implementation on the CARE project has been slowed by factors other than ability to organize community development (availability of well drilling equipment and funds being two such factors), their experience nevertheless suggests that an implementation rate of only about four villages per district per year may be more realistic. This rate of implementation approximates the rate that can be achieved with the well drilling equipment that is available or may be available in the near future.

d. Rehabilitation of the Nitco Rig

As a part of the previous project, USAID funded an air rotary well drilling rig. The purchase of the rig was put out to bid and the lowest bidder was Nitco of Austin, Texas. Although Nitco had never manufactured such a rig before, the inflexibilities of the USAID procurement system required that their bid be accepted merely because it was low. The rig arrived in Belize in December, 1988. Since its arrival, the rig has drilled only two shallow wells, the rest of the time having been spent setting the rig up and/or repairing numerous mechanical defects which appeared. The most recent of the mechanical failures was seizure of the air compressor due to overheating which occurred in June, 1989.

At this time, there appears to be no reasonable alternative but to continue to try to put the Nitco rig in service. A replacement air compressor was shipped from Germany late in July, 1989 and is expected to arrive in Belize early in August. It is understood that Nitco has agreed to replace the bearings on the hoisting mechanism at the same time that the air compressor is reinstalled. A suggested course of action for getting the Nitco rig into operation is presented in Annex D. This course of action envisions having an evaluation made of the rig by an independent consultant, then asking Nitco to correct the deficiencies noted to date plus those identified by the consultant.

If this course of action fails, legal action could be taken against Nitco, but the chance of recovering a significant portion of the money spent on the rig through legal action appears to be low.

A problem in trying to put the Nitco rig into service is that because of the numerous problems, the RWSSP staff is understandably disenchanted with the equipment. Because of this disenchantment, it may be difficult for RWSSP to mobilize the degree of commitment that may be necessary to make the Nitco rig

60

work. If RWSSP is unable or unwilling to make the Nitco rig work, one alternative that should be explored is to turn the rig over to a private entrepreneur and contract with this private party for the drilling of wells.

e. Recommended Water Supply Program

It is recommended that the water supply program in the project extension include about 60 handpump wells, which should cover about ten villages in the three central districts, and about six RWSs.

Villages which RWSSP may wish to serve with RWSs include:

Santa Familia
Hopkins
Sand Hill
Crooked Tree
Bermudian Landing
Bullet Tree
Seine Bight
Gale's Point.

It is understood that the RWSSP has criteria and a methodology for selecting the villages which will be included in the program. The methodology includes conducting profiles on the candidate villages and ranking their needs for water supplies and their readiness to participate in the program. The criteria and methodology shall be reviewed with USAID, shall be modified as mutually agreed, and shall be used in selecting the villages for the program.

As noted in Table II-2, the original IPTBH project did not cover the cost of pump houses at four of the RWS installations. The costs of these pump houses are estimated at $5,000 U.S. each and will be funded as a part of this project extension. The project will pay only for materials. All labor will be contributed by the communities.

As in the past program, it is recommended that each family in a village that is to be served be required to construct its own pit latrine prior to construction of the water system. This program is a part of the National Policy (see Annex Q).

It is recommended that USAID provide the handpump, the well casing and the screen for each well. The cost of the handpump, including some allowance for tool kits and miscellaneous equipment, is estimated at $500 U.S. The cost of the casing and screen is also about $500, so that the total USAID cost of a handpump well is approximately $1,000 U.S. Various cost data are presented in Annex L.

For planning purposes, in the past it has been assumed that the cost of an RWS is about $90,000 U.S., which includes the cost of the well. This did not include the cost of the pump house, which is about $5,000 U.S. It is recommended that for future planning purposes, a unit cost of $95,000 U.S. per RWS be used. Obviously, there is a large variation in the cost of the RWS depending in particular on the size of the village and whether the system is a rehabilitation of an existing system or completely new. The numbers used in this report are for planning purposes only. When information is available for the specific villages which RWSSP intends to serve, the program should be adjusted accordingly. If larger villages are selected, a lesser number may have to be included to keep within the available budget. If smaller villages are selected, the available budget may cover a larger number of villages.

3. Drill Rig Parts and Tools

As discussed above, the shortage of spare parts has been a major factor in limiting the rate at which successful wells are completed. In addition to technical assistance on maintenance and inventory management, the project extension will include the supply of spare parts and small maintenance tools for the drilling equipment.

The exact list of parts to be ordered will depend on what parts break in service, and on the recommendations of the maintenance and inventory management technical advisor. Eldo Gideon, the RWSSP Chief Mechanic, prepared a list of needed parts which might serve as a starting point for the technical advisor. The parts should be both for the drill rigs and for the trucks on which the rigs are mounted, should include extra drill bits, and should include enough basic inventory to minimize down time for maintenance.

A budget of $95,000 for parts and tools has been established for planning purposes but it will not be possible to determine whether this is in fact an appropriate amount until the maintenance and inventory management technical advisor has reviewed the system.

5. Ferro-Cement Tank Technology Demonstration

Rainwater catchment systems may be the only cost effective technology for obtaining a water supply in some cases, especially where there is no potable groundwater or the groundwater is extremely difficult to reach, for small groups of users (say only one or two houses, or houses which are only occupied seasonally), and for remote areas which cannot be conveniently reached with

drill rigs (say the mountains or the cayes). Since the major cost of a rainwater catchment system is the storage tank, anything which reduces the cost of storage tanks increases the appropriateness of this technology and the likelihood of it being used and sustained.

In addition, storage tanks are a major cost component of RWS systems. Anything which reduces the cost of storage tanks increases the number of RWSs that can be built with the available funds and the likelihood that villagers will extend existing systems and provide more storage as the needs of the system grow.

Ferro-cement tank technology appears to offer the opportunity to reduce the cost of storage to somewhat less than half of the cost of conventional storage in galvanized steel tanks or in conventionally built concrete tanks. As can be noted in the cost data provided in Annex L, small galvanized steel tanks cost in the range of $0.60 to $0.72 U.S. per U.S. gallon and the USAID funded ground-level conventional concrete tank for the Georgeville RWS cost $0.76 U.S. per U.S. gallon. By contrast, reported prices for ferro-cement tanks are in the range of $0.22 to $0.31 U.S. per U.S. gallon.

Ferro-cement water storage tanks have been built at several places in Belize, but the technology has not yet been popularized to the point that it is regularly considered when water systems are being planned. The Peace Corps is reported to have built an 8,000 gallon ferro-cement tank at Crique Sarco and a 3,000 gallon tank at Laguna village in Toledo District. A Peace Corps Volunteer named David White is said to have been doing some ferro-cement tanks out of Punta Gorda.

Mr. Be Meyer of MSF/Holland has a series of slides of 800 and 1500 gallon ferro-cement tanks built by a Belizean contractor. This contractor had built a reusable set of wooden forms for use in building these two tank sizes, and claimed to have built a 16,000 gallon tank.

A ferro-cement water storage tank technology demonstration will be included in the project extension to dessiminate practical information about this promising technology. The program will include the construction of perhaps three small tanks for rainwater catchment and one larger tank for a RWS. This tank could be a part of one of the RWS already proposed for inclusion in the project extension.

An important part of the ferro-cement demonstration will be the careful documentation of the materials and labor requirements to build tanks of various sizes and the publishing of a small information package on how to build ferro-cement tanks. Pictures should be made of the demonstration tanks under construction in Belize and large signs should be posted at the sites explaining

what is being done. After construction is complete, a sign should be posted noting that the tank is made of ferro-cement and giving cost information.

While it probably is possible to build an elevated ferro-cement tank, this appears to be much more difficult than a ground-level tank. It is recommended that an elevated storage tank not be included in the demonstration project.

A budget of $10,000 has been included for purchasing the materials for the ferro-cement tanks and for preparing and publishing documentation on the use of this technology.

6. Rehabilitation of the Maintenance Buildings

The project extension will include a modest budget of $20,000 U.S. for rehabilitating the maintenance facilities at San Ignacio and Dangriga. The local well drilling operations in the three central districts are staged out of these maintenance facilities, and supplies and equipment not needed at the drilling site are stored there.

7. Rehabilitation of the Mile 10 Storage Depot

The main facility for the well drilling operation is at the Mile 10 depot, which is near Belize City. A budget of $15,000 U.S. has been included in the project extension to improve the facility. The work will include construction and modification of storage racks and work benches, reroofing, extension of a building, and installations of showers and a changing room for the staff.

E. Environmental Analysis

The environmental impacts of the original IPTBH project were considered when the project was prepared and are discussed in Appendix H of the original project paper. Most of the environmental comments focussed on the use of pesticides in the vector control componenet of the project. After consideration, a negative declaration was issued.

The activities in this project extension involve relatively small amounts of construction in villages, i.e., in areas already disturbed by human activity. Since the proposed activities are merely a continuation of activities that were undertaken in the previous project, for which a negative declaration was issued, it is concluded that the proposed activities will have no significant environmental impact and there appears to be no need for further environmental reviiew.

F. Observations on Existing Programs

1. Water Quality Laboratory Data

The Water Quality Laboratory has as an objective analyzing two samples per year from every well in the program, one during the wet season and one during the dry season. Samples are analyzed both for chemical constitutents (such as chlorides, flourides, sulfates, alkalinity, etc.) and for bacteriological contamination (total and fecal coliforms on all wells plus fecal strept on RWS wells). Beverly Clare, the analyst, estimates that the laboratory has a capacity for performing about 1,500 samples per year. There are currently almost 680 wells in the program, so at two samples per year, the lab just barely has sufficient capacity for the present number of wells. The Water Quality Laboratory is also being asked to perform an increasing number of samples as a part of a coastal monitoring program.

Because of a lack of transport, obtaining samples quickly enough for the laboratory results to be valid is a major problem.

According to Fred Smith, the Chief Public Health Inspector, if a sample is found to be contaminated no action is taken at present for fear of causing the population to abandon the source in favor of an even more contaminated source.

The Water Quality Laboratory has not yet actually reached the estimated output of 1,500 analyses per year. The usefulness of running the chemical analyses on wells other than those with some specific problem is questionable. This information might be of some long-term, general use on groundwater quality studies of large areas but it is of little immediate benefit to the water supply program. Consideration should be given to eliminating or at least curtailing the chemical analyses and having the laboratory concentrate on the bacteriological analyses. Elimination of the chemical analyses would approximately double the number of analyses that can be performed per year.

To obtain samples, consideration should be given to using the National Malaria Control Program personnel. These personnel are in the villages on a regular basis and are generally better equipped with transport than the Public Health Inspectors who usually collect the samples.

The laboratory analyses are of relatively little value unless action is taken when wells are found to be contaminated. The point is valid that villagers may become wary of the well if they are told that the government laboratory has found it to be contaminated. They are likely to view the laboratory with some awe and to be frightened by "contamination". A likely response

is to return to the previously used sources, which may be creeks or puddles which are several orders of magnitude more contaminated than the well.

Nevertheless, some action should be taken on wells that are found to be contaminated. This should include at least a visit by the District Coordinator and/or the Public Health Inspector to look for obvious sources of contamination. While it is possible for contamination to reach a well by moving through the soil, this is rare. Most contamination reaches a well by flowing down the inside or outside of the casing. If there are obvious defects at the well such as a cracked slab, poor drainage, animal droppings, etc., the Village Health Committee should be notified and asked to take action. In all cases, a second sample should be taken and analyzed. Abandonment of a well should be considered only after obvious sources of contamination have been corrected and multiple samples are found to be contaminated.

2. Composting and Raised Latrines

The villagers contacted did not have a clear understanding of the purposes of raised latrines and of the difference between a raised latrine and a composting latrine.

To prevent movement of contamination in groundwater, the bottom of the pit of a latrine should be a minimum of one meter above the highest seasonal groundwater level. In areas where the groundwater level is high, i.e., near the surface of the ground, the latrine may have to be built upward to maintain the minimum separation from the bottom of the pit and the groundwater level.

It may also be desirable to build upward if the ground is rocky or otherwise difficult to dig.

A composting privy is intended to hold the excreta for a long period of time (usually a minimum of one year) to allow most of the pathogens to die off so that the residue can be safely used as a fertilizer and soil amendment. A composting privy often takes the same form as a raised latrine but the purpose is different.

There are some public health risks associated with the use of night soil on crops. Some pathogens can survive for more than one year and unless the use of the privy is carefully controlled, someone may use it during the year that it is supposed to be standing idle.

The use of night soil usually is economically justified only in very poor societies where the fertilizer value is relatively high. The use of composting privies has usually been successful only in societies that have long histories of utilizing night

soil. Belize is relatively affluent and has little or no tradition of handling night soil, hence neither of these conditions seems to apply. It is the prediction of the sanitary engineering author of this project paper amendment that there will be no significant reuse of the compost. This will cause no particular harm since the "compost" privy will merely serve as a raised latrine.

3. Handpump Maintenance

The three tier handpump maintenance scheme also appears to have been borrowed from a World Bank model, which includes the furnishing of a set of tools to the village mechanic. The model was intended for very poor societies where it was unlikely that anyone in the village would have a set of tools.

In Belize, virtually every village has at least a few vehicles and the vehicle owners do most of their own mechanical work. It is therefore likely that more than ample tools are readily available to peform village level maintenance on handpumps. Providing village mechanics with a set of tools probably is unnecessary and should not be used as an objectively verifiable indicator of progress in the water supply program.

If handpumps are not repaire by the local community, it is much more likely to be due to lack of interest or lack of understanding than to a lack of tools. It may be helpful to distribute pamphlets explaining how handpumps work and how they can be repaired. Many villages probably could repair even those parts of the handpump which must be raised out of the well although having them do so runs the risk that they may drop parts of the equipment back into the well and be unable to retrieve them.

4. Iron in Wells

There is a widespread belief in Belize that much or all of the iron in well water is caused by rusting of iron well casings. This is unlikely to be so for any well from which a substantial amount of water is pumped on a regular basis. Like the red water experienced in a house tap where there are galvanized steel pipes, enough corrosion can occur in a well to cause the water to be red if the water stands for a long period of time. If the well is pumped frequently, however, the water will not be red because the corrosion proceeds too slowly to color the rapidly changing water.

Whether the iron is being caused by corrosion of the casing or is naturally occurring in the ground water can be easily tested by measuring the iron content periodically as the well is pumped.

If the iron is coming from corrosion of the casing, then the concentration will rapidly drop as the water is pumped out of the well. If the concentration remains steady, then the iron is naturally occurring in the groundwater.

5. Removal of Iron and Hydrogen Sulfide

The concentrations of iron and hydrogen sulfide can be greatly reduced in water by simple means. Iron is removed by aerating the water to oxidize the iron to the ferric state and then by pouring it over a bed of rocks to let the iron precipitate out. Iron already precipitated on the rocks acts as a catlyst in the reaction. In the city of Chiang Mai in northern Thailand, many of the houses have small elevated steel water tanks on their roofs to remove iron. The city water is sprayed into the tanks over a bed of rocks then trickles down to a holding tank which supplies the house.

Hydrogen sulfide is a gas and will also be removed from water by aeration, i.e., by spraying the water into the air.

It may be difficult to reduce the levels of iron and hydrogen sulfide sufficiently to remove all taste and odor but the water quality can at least be improved, especially in RWSs where the water could be sprayed into a tower.

G. Project Issues

1. Staffing of National Coordinator Position in RWSSP

The position of National Coordinator of RWSSP is the chief administrative position for this program. This position has been vacant since January 1989, with the departure of the National Coordinator on long-term, project-funded studies in the U.S. This vacancy has created a marked deficiency in leadership in program activity. Although an experienced expatriot engineer has been hired as overall Program Manager, this will not contribute to sound institution-building without the replacement of the National Coordinator with a qualified person.

2. Management Information Systems

The planning, implementation and evaluation of program activities in RWSSP is weakened by the lack of current and easily accessible information concerning all aspects of program activity. Management information systems need to be developed, and computerized, (for progress reports, inventory control, costing and cash flow, hydrogeological information and water quality) in

order to facilitate more efficient and effective management of rural water supply and sanitation activities.

3. Second Water Quality Analyst

At present, there is one Water Quality Analyst responsible for all rural water supply testing. This individual is also responsible for testing other products as requested by MOH/EHS. With the policy of testing all approved rural water supplies twice a year, the availability of a single qualified Water Quality Analyst poses potential problems of sustainability of this activity. A backup Water Quality Analyst should be trained by the MOH/EHS in order to strengthen the capacity and stability of this National Water Quality Control Laboratory. The second person could come from existing EHS laboratory staff or could be a second Water Quality Analyst position. The project will support the short-term training of this person.

4. Role of District Health Educators

One of the functions of DHEs has been teaching hygiene education in primary schools with children from project villages in their districts. At the same time, the MOE has developed a primary school curriculum in hygiene education and has begun training teachers in its use. With this official integration of hygine education into the primary school curriculum, DHEs should serve as resource persons to teachers in specified areas rather than as initiators of classroom teaching.

5. Collaboration Between District Health Educators and District Health Teams and Core Committees

The MOH has established a structure of District Health Teams and Core Committees at the district level (discussed further under III. A. 2.) which is designed to coordinate the responses of government and NGOs to community concerns. As a forum for problem-identification and problem-solving for health and community development-related problems, it depends upon active participation of all appropriate program sectors. Active RWSSP DC and DHE participation in this structure will contribute to strengthening support to VHCs and facilitate a broader focus on health-related problems of concern to communities.

6. Training for RWSSP Chief Health Educator

With the GOB plans to strengthen PHC, HE and CD, it is necessary to strengthen their professional staff in these areas. The RWSSP Chief Health Educator is currently the most highly trained health educator in Belize, with Bachelors-level training in health education. Institutional capacity in health education in Belize

will be strengthened by further training of this person. Scholarship support will be provided for a one year Masters in Public Health program during the second year of the project extension. Another MOH health educator is going to England for Masters-level training in HE in September 1989.

The RWSSP will plan in advance for the vacancy created by the CHE's departure in September 1990.

7. Effectiveness of District Health Educators

During the past three and one-half years of project activity, there has been considerable turnover of DHEs. This turnover has weakened health education/community participation efforts due to 1) lack of continuity of effort in villages, and 2) the constant need to train new people rather than building upon the skills of longer term staff. RWSSP management needs to examine the reasons for this high turnover and take appropriate steps to reduce it in the next two years if they hope to improve the contributions of this component to program output.

8. Assessment of MOH Primary Health Care, Health Education/Community Development Strategies

Under the MOH, the MNR (through the RWSSP) and through a variety of NGOs, considerable efforts are being made to implement a sustainable PHC strategy, based on active CHW and VHC participation at the community level and strong and consistent support from government. However, there are questions concerning the specific long-term objectives of this strategy, the necessary approaches to make it work, and what it will require in the way of resources at each level.

The MOH needs to: define clearly the long-term objectives of this strategy; assess the strengths and weaknesses of health education/community development approaches being used to achieve these objectives; and identify the approaches and resources necessary and possible to devote to the achievement of its PHC objectives.

9. Well Drilling Capacity

The existing well drilling capacity in Belize is discussed in considerable detail in Section III. E. 2. of this project paper amendment. As noted there, the well drilling capacity in Belize appears to be adequate to provide the wells needed in this project, especially considering the improved maintenance that has been and will be provided and the possibility that additional drilling equipment will become available.

If, however, severe mechanical difficulties are experienced (e.g., loss of one or more rigs due to fire or highway accident), and the new equipment is not forthcoming, a shortage of well drilling capacity could result.

10. Ferro-Cement Water Storage Tank Technology

The use of ferro-cement water storage tank technology is discussed in Section III. E. 5. of this project paper amendment. This technology has been used on a limited scale in Belize, but this technology has not been sufficiently disseminated to be regularly considered when water storage tanks are being planned. This project extension will include a further demonstration of ferro-cement water storage tank technology both at the rainwater catchment scale and at the RWS scale, with an emphasis on documenting and publishing the costs and quantities of labor required in constructing these tanks.

11. Sealing Out Salt Water Aquifers

Some of the wells drilled in Belize have drawn saline water and thus have been unusable. The existing well drilling personnel are not familiar with techniques for casing off parts of wells to exclude water from aquifers with unsatisfactory water quality. This project extension includes technical assistance from a hydrogeologist to broaden local knowledge on how salt water intrusion occurs, and well drilling technical assistance to supervise the well drilling crews in actually sealing off selected aquifers.

IV. PROJECT IMPLEMENTATION

A. Monitoring

USAID project management will be the responsibility of the Mission's Health Project Manager, who will be assisted by the Mission's Controller. Monitoring of project activity will require the following reporting by RWSSP program management:

- Annual workplans covering the three project districts:

  * the initial workplan, representing the first six months of project activity (November 1989 - March 1990) will be received by the USAID Mission no later that October 31, 1989;

  * the second annual workplan to be received by the USAID Mission no later than March 31, 1990;

  * the third annual workplan to be received by the USAID Mission no later than March 31, 1991.

- Monthly reports of RWSSP activity in the three project districts, to include:

  * VHC meetings held: where, when, purpose, attendance, outcome

  * tube wells dug: where, when, successful or dry

  * latrines constructed: number, where
    slab & riser only completed
    super structure completed

  * problems encountered: construction-related /technical
    community participation-related

The instrument for the above reporting will be agreed to by the Mission's Health Project Manager and the RWSSP Program Manager. Monthly reports will be received by the USAID Mission no later than the 10th day of the following month.

-Quarterly reports of RWSSP activity in the three project districts, to include:

* a narrative summary of project activity, including an assessment of progress made toward defined objectives, problems encountered and progress made toward their resolution, financial summary of project expenditures, and an action plan for the following quarter. Quarterly reports will be received by the USAID Mission no later than the end of the second week following the end of the quarter.

B. Evaluation

There will be a single final evaluation of the project, to be conducted at the conclusion of the project in June 1991. This evaluation will focus on the achievement of purposes and outputs as specified by the corresponding objectively verifiable indicators.

Proposed Project Implementation Schedule

	Technical Assistance	Training	Commodity Procurement	Evaluation	Construction, HE/CP
FY 1990					
Oct					Const.,HE/CP
Nov	Hyd (1 mo)				Const.,HE/CP
Dec					Const.,HE/CP
Jan	MIM (1 mo)	WDA (6 wks)			Const.,HE/CP
Feb	Drlg (2 mo)				Const.,HE/CP
Mar					Const.,HE/CP
Apr					Const.,HE/CP
May					Const.,HE/CP
June					Const.,HE/CP
July					Const.,HE/CP
Aug					Const.,HE/CP
Sept					Const.,HE/CP
FY 1991					
Oct					Const.,HE/CP
Nov					Const.,HE/CP
Dec					Const.,HE/CP
Jan					Const.,HE/CP
Feb					Const.,HE/CP
Mar					Const.,HE/CP
Apr					Const.,HE/CP
May					Const.,HE/CP
June					Const.,HE/CP
July					Const.,HE/CP
Aug					Const.,HE/CP
Sept				Eval.	

LEGEND: Hyd = Hydrogeologist
MIM = Maintenance & Inventory Management
Drlg = Drilling
HE/CD = Health Education/Community Development
HE/CP = Health Education/Community Participation

August 11, 1989
File: AContact

ANNEX A

PERSONS CONTACTED

USAID

Mosina Jordan, USAID Representative to Belize
Mellen Tanamly, General Development Officer
Sam Dowding, Health Project Manager (Until July 31, 1989)
Bibi Essama, Health Project Manager (After July 31, 1989)
Sue Brechen, Child Survival Project Manager

GOVERNMENT OF BELIZE

MINISTRY OF NATURAL RESOURCES (MNR)

David Gibson, Permanent Secretary

WATER AND SEWERAGE AUTHORITY (WASA)

Winston Michael, Chief Executive Officer
Denroy McCord, Chief Engineer
Hugh Broaster, Administrator
Pearl Serano, Assistant Health Educator

RURAL WATER SUPPLY AND SANITATION PROGRAM (RWSSP)

Douglas Wilson, Program Manager
Roland Rivers, National Coordinator
Anthony Nicasio, Chief Health Educator
Ivan Tingling, Master Driller
George Andrews, District Coordinator, Cayo District
Herman Joseph, District Coordinator, Stann Creek District
Eugene Middleton, District Coordinator, Belize District
Eldo Gideon, Chief Mechanic
Regina Neal, District Health Educator

MINISTRY OF HEALTH (MOH)

Douglas Fairweather, Permanent Secretary
Fred Smith, Principal Public Health Inspector
Beverly Clare, Water Quality Analyst
Dr. Kurella S. Rao, Director, Primary Health Care Division
Kathy Bottaro, Director, HECOPAB
Belinda Barry, Principal Trainer, PHC Division
Dr. Lopez, Director of Health Services

CARE

Frank Brechin, Country Director
Sylvano Guerrero, Program Manager
Ravey Smith, Project Coordinator
Estelito Loria, Project Manager

UNICEF

Kathy Kasprisin, Director

PROJECT HOPE

Melanie Austin, Nurse Educator
Abigail McKay, Community Development Specialist

August 6, 1989
File: BDocumen

ANNEX B

DOCUMENTS REVIEWED

AID. Increased Productivity Through Better Health - Project Paper, approved 12/21/84.

AID. Increased Productivity Through Better Health - Project Paper Amendment

CHECK THE TITLE AND DATE

AID. Vector Control Project Paper Amendment (Draft)

CHECK THE TITLE AND DATE

Belize Ministry of Health. Primary Health Care Manual. 1987.

John Snow Inc. Report. Final Evaluation - Increased Productivity Through Better Health Project. Jesse Hobbs, Joseph Haratani, and Wilbur Hoff. John Snow, Inc. Boston, MA (?). January, 1989.

Johnson Division, UOP, Inc. Ground Water and Wells. Johnson Division, UOP, Inc., St. Paul, Minn., 1975.

Improved Productivity Through Better Health Project. Promoting Commmunity Development Skills. Vol. 1. Guidelines for Trainers to Conduct Workshops for Community Development Projects. Vol. 2. Training Modules. Pragma Corp. Falls Church, VA. 1989.

Lehr, Jay, et. al., Design and Construction of Water Wells. New York: Van Nostrand Reinhold, 1988.

WASH Field Report No. 147. Care-Belize Water Supply and Sanitation Baseline Survey. Richard Z. Donovan. Arlington, VA. WASH Project, January, 1986.

WASH Field Report No. 193. Report on Technical Assistance to the Village-Level Water and Sanitation Project, Care-Belize. J. Ellis Turner. Arlington, VA. WASH Project, July, 1986.

WASH Field Report No. 206. Mid-Term Evaluation of the CARE Water Supply and Sanitation Project in Belize. J. Ellis Turner and Shirley Buzzard. Arlington, VA. WASH Project, May, 1987.

WASH Working Report. Belize: Redesign and Technical Assistance for the IPTBH Project. Ralph E. Preble and Joseph Haratani. Arlington, VA. WASH Project, August, 1987.

Annex C

LOGICAL FRAMEWORK

NOTE: Unless otherwise noted, the outputs described below apply to the three central districts of Belize Rural, Cayo and Stann Creek. The CARE Operational Program Grant (OPG) in the northern two districts of Corozal and Orange Walk remain in full force and effect.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
GOAL			
To improve the health & productivity of the Belizean population.	Measurable reductions in morbidity & mortality from endemic diseases which are directly attributable to lack of potable water & poor sanitation. Development of economic sectors such as agriculture will not be adversely affected by losses in worker productivity caused by gastro-intestinal diseases. The tourism industry will not be adversely affected by reports of outbreaks of targeted diseases.	Reports from MOH, other affected ministries & PAHO.	The improvement in environmental health will not be offset by other factors such as declining economic conditions social unrest, etc.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
PURPOSES			
1. To improve the effectiveness of GOB to ensure adequate water supply and sanitation conditions in the rural communities of the country by strengthening its institutional capacity.	Organizational chart & job descriptions developed by WASA/RWSSP reflect organizational structure & staffing necessary to the management (planning, implementation & evaluation) of GOB rural water supply & sanitation programs.	Review of organizational chart & job descriptions	Priority given by WASA/RWSSP to development of these tools. National Policies for Construction & Maintenance of Water & Sanitation Systems to be approved by MNR.
	Organizational chart & job descriptions developed by MOH reflect organizational structure & staffing necessary to support community-based efforts to improve environmental sanitation and undertake other health-related activities.	Review of organizational chart & job descriptions	Continuing MOH priority given to community-based primary health care interventions.
	WASA/RWSSP staff structure filled with qualified & trained personnel who demonstrate program management skills.	Review of project implementation plans & project reports; end of project evaluation	
	MOH sends backup Water Quality Analyst for training	Backup Water Quality Analyst returns from training	MOH commitment to improving water quality in rural areas.
2. To increase community participation in the improvement of water supply & sanitation conditions in their communities.	Functioning VHCs in 90% of project villages using hand pumps.	Evaluation of implementation of VHC plans for hand pump maintenance.	Continuing GOB support of community participation in environmental sanitation & health.
	Functioning Boards of Management in 90% of project villages using rudimentary water systems.	Evaluation of implementation of Board of Management plans for RWS maintenance.	

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
3. To expand coverage of potable water supplies & improved sanitation conditions in rural communities in three districts & to improve the national water quality control program.	Potable water supplies & improved latrines developed in approximately 16 additional project villages in three districts.	Field visits by technical staff	GOB priority given to rural water supply & sanitation
	85% handpump working status for all pumps in the three districts, including those previously installed on potable water sources.	Field visits by technical staff	same as above
	All RWSs in working condition in three districts.	Field visits by technical staff Maintenance crew reports	same as above
	All approved rural water sources tested by MOH Water Quality Control Lab at least twice a year.	Water Quality Control Lab reports	same as above
	Investigation & correction of all contaminated rural water sources according to MOH/EHS protocols.	Water Quality Control Lab reports	same as above
PROJECT OUTPUTS			
1.1 Program management practices are institutionalized in RWSSP for the management, (planning, implementation & evaluation) of rural water supply & sanitation services in Belize.	Program plans for rural water supplies & sanitation are prepared by RWSSP on five year, annual & quarterly basis, reflecting objectives & activities at national & district levels, necessary & available resources, & collaboration with other ministries as necessary to the achievement of project objectives.	Quarterly, annual & 5 year plans based on current rural water priorities & available resources.	Priority given by MNR to development of short & long range planning.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	Management information system developed at RWSSP provides:	Quarterly & annual progress reports.	Commitment of WASA/RWSSP to develop these systems.
	a) quarterly & annual progress reports of project activity;	Quarterly & annual progress reports.	
	b) inventory & control of RWSSP material & equipment;	Functional/up-to-date inventory of RWSSP material & equipment.	
	c) costing & cash flow information;	Functional costing & cash flow system	
	d) historical hydrogeological information; &	Historical hydrogeological data	
	e) water quality data by source.	Water quality data by source.	
	Quarterly evaluation of project progress provides basis for readjustments in existing plans.	Quarterly project evaluations. Readjustments, as appropriate, in existing plans.	Commitment of RWSSP to program management.
	National RWSSP Coordinating Committee meetings are held at least quarterly for the purpose of coordination of effort, solving mutual problems & evaluation of program progress.	National Coordinating Committee meeting minutes.	Commitment of WASA/RWSSP to program coordination & management.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
1.2 Program management practices are institutionalized in MOH, providing for a comprehensive approach to primary health care at the community level.	Program plans are prepared by MOH on 5 year, annual & quarterly basis, reflecting a) objectives & activities at national & district levels corresponding to the national primary health care strategy, b) necessary & available resources, & c) collaboration within MOH & with other ministries & organizations as necessary to the achievement of PHC objectives.	Quarterly, annual & 5 year plans based on current primary health care priorities & available resources.	Demonstrated MOH commitment to primary health care.
2.1 Active community involvement in planning, construction & maintenance of water systems & latrines.	All project villages contribute actively to planning & construction of community water supply & public & private latrines.	VHC records Minutes of VHC meetings District health educator reports	GOB commitment to community development is demonstrated by coordinated approach to communities.
	Boards of Management continue to demonstrate community acceptance & support of agreed upon policies for management of RWS.	Field visits by technical staff District health educator reports	same as above
	85% of project communities use & properly maintain handpump water supply system.	Field visits & records of CHW's District health educator reports	same as above
	85% of project communities use & properly maintain household & public (school, health center &/or community center) VIP latrines.	Field visits & records of CHW's District health educator reports	same as above

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
2.2 Community health workers, where trained, collaborate with village health committees as facilitators of community involvement in environmental improvements & other activities benefitting the community.	60% of project communities ensure proper sanitary conditions in their community (household & public).	District health educator/ RHC reports	same as above
	40% of project communities undertake at least one community project benefitting the community/community members.	Minutes of VHC meetings	same as above
3.1 Construction of tubewells & installation of handpumps in rural communities with populations of less than 450 population in three districts	Approximately 60 handpumps installed in 10 project villages	RWSSP reports Field visits by technical staff	
3.2 Construction of rudimentary water systems in rural communities with populations of more than 450.	About six rudimentary water systems installed in the three project districts.	Field visits by technical staff	High level of community participation in RWS planning & construction
3.3 Construction of ventilated improved pit latrines in rural communities benefitting from improved water supplies.	650 VIP latrines built in 18 project villages, (one per family, & one each per primary school & health center if they exist)	Field visits by technical staff	High level of community participation in latrine construction.
3.4 Maintenance of handpumps on rural public wells with potable water in the three project districts.	85% of handpumps functional in the three project districts, including those previously installed on public wells producing potable water Village pump repairmen in all project villages instructed in basics of pump maintenance	RWSSP Quarterly Reports	

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
3.5 Testing of approved rural water supplies by MOH Water Quality Control Lab.	All approved rural water supplies are sampled & analyzed twice a year (once in rainy season, once in dry season), according to MOH protocols.	Water Quality Control Lab monthly reports	
3.6 Corrective action is taken on rural water supplies found to be contaminated.	Corrective action is taken on all approved rural water supplies found to be contaminated, according to MOH protocols.	Water Quality Control Lab monthly reports.	

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
PROJECT INPUTS			
Government of Belize			
1. Adequate funds for RWSSP operations, including fuel costs for project.			
2. Adequate personnel staffing for MNR/RWSSP; & for MOH Water Quality Control Lab & PHC & HECOPAB to facilitate project implementation			
USAID			
	FX LC TOTAL		
1. Technical Assistance		Consultations occur as scheduled	Availability of funds.
2. Training		Trained MNR & MOH staff.	
3. Commodities		USAID, MNR & MOH reports.	
4. Construction		Two district maintenance facilities & the main MNR storage depot rehabilitated.	
SUBTOTAL			
5. Contingencies & Inflation			
TOTAL			

August 11, 1989
File: DNitco

ANNEX D

RECOMMENDED COURSE OF ACTION
FOR DEALING WITH THE NITCO WELL DRILLING RIG

History of the Rig

November, 1988. The rig was shipped and the one year warrantee started at that time.

December, 1988. The rig arrived in Belize.

A casing hammer was ordered subsequent to the initial order for the rig. The visit of the technician who was supposed to come and set the rig up was postponed so that he could also set up the casing hammer.

February, 1989. The hammer and the technician arrived. The hammer could have been purchased as a complete package from the hammer manufacturer but instead, Nitco assembled the various component themselves. It was found that a needed hydraulic cylinder was not sent with the hammer, so the technician left until it could be obtained.

April 3, 1989. The technician returned to set the rig up. He was ordered to get the rig running by April 26 and did so. During setup, the two hydraulic shafts which lift and lower the mast bent when the mast was being lowered with the casing hammer on it. It was noted that the rig would tremble as the mast was lowered, apparetly because the load was right at the limit of the shafts' capacity. The technician replaced the hydraulic shafts with two of the same size. After the departure of the technician, the hydraulic cylinders were replaced with larger units supplied by Nitco by the RWSSP mechanics. The new units raise and lower the mast smoothly.

Under the supervision of Nitco's technician, the RWSSP staff began to drill a practice well. Five of the eight bearings on the mechanism that raises and lowers the rotary head broke immediately. These were replaced with bearings of the same size and a 200' hole was drilled.

It was noted that the bearings on the lifting mechanism are about 1" in diameter and 5/8" wide. On other rigs of this type, these bearings have been observed to be about 3" in diameter and perhaps 1-1/2" wide in this application, i.e., much sturdier. In addition, these bearings are ball bearings, which place all of the load on a single point. Customarily, roller bearings are used to spread the load over a wider area.

4/6

The bearings are reported to be rated at 600 pounds at 1,000 RPM, thus four of them would have a combined capacity of 2,400 pounds. By contrast, the drill rig is capable of creating a pull-down force of around 20,000 pounds. This comparison tends to imply that the bearings have only about one-eighth of the required capacity. (The actual capacity of the bearings may be somewhat higher than stated above at the low RPM at which they are used.)

It has also been noted that the hydraulic cylinder which lifts the casing hammer is rated at only 2,500 PSI while the hydaulic system is rated at 3,000 PSI. The hydraulic cylinder seems to be underpowered, and raises the hammer much more slowly than expected.

Shortly after the technician left, the RWSSP staff attempted to drill a well. They had gotten only 40; when the air compressor froze. The compressor was removed and shipped to Germany, where it had been manufactured. The manufacturer reported that the machine had severely overheated, probably due to a loss of oil circulation. Inspection of the unit after it froze up revealed that the oil level was low by only one or two gallons out of the 35 to 40 U.S. gallons that the machine holds.

One other possible cause of the compressor seizing is misalignment of the shaft from the engine which drives it. The compressor shaft, however, is connected to the engine through an intermediate shaft that has two universal joints. These joints should provide enough play to prevent misalignment.

There is some speculation that the hydraulic lines on the rig are too small. This might have restricted the flow of oil but it seems unlikely that the flow would have been restricted enough to allow the compressor to overheat to this extent.

The replacement compressor arrived in Miami by air late in July and should arrive in Belize early in August.

Current Situation

Mr. Soubhi Naddaf, the President of Nitco, has given assurances that as soon as the parts are available, he will send a technician to put the rig in running order. The two major items required are installation of the replacement compressor and replacement of the bearings on the lifting mechanism. In addition, the hydraulic cylinder that lifts the casing hammer needs to be replaced to make the rig truly functional, but it is not clear that Nitco considers this to be a defect.

Another issue is the three weeks of startup and training that was included in the contract under which the rig was purchased. The

position of RWSSP is that all visits by the technicians to date have been "repairs", not startup and training, and thus that the three weeks is still owed. Nitco may not agree with this, and the wording of the contract was sufficiently loose that it may be difficult to tell with certainty which party is correct.

A final problem is that the GOB staff is very demoralized by the whole affair and may have difficulty mobilizing the resolve that will be necessary to get the rig into operation and keep it running.

Independent Contractor

USAID has prepared a Statement of Work and is trying to find an independent consultant who is experienced both in well drilling and in designing well drilling equipment to inspect the Nitco rig and prepare a list of deficiencies, if any. Although it may be difficult to find an individual with the requested qualifications, it is understood that at least one satisfactory resume has been received. A copy of the Statement of Work is included with this annex.

Presumably, the list of deficiencies which results from this consultancy will be given to Nitco and they will be asked to correct the deficiencies. There is a risk, however, that at some point Nitco will decide that this situation is a bottomless pit and that no amount of repair or improvement of the rig will satisfy the GOB. In essence, they may walk away from it. Nitco's costs might be lessened if the list of deficiencies could be made available in time for them to be acted upon while their technician is on-site installing the compressor. On the other hand, if the list of deficiencies is extensive, the chance that Nitco will decide to make no further repairs will increase. It is also likely that some time will be required before the independent consultant can come.

Recommendations

It is recommended that:

1. Douglas Wilson be asked to coordinate the next few steps in this process since he is an engineer with some experience with well drilling equipment and since the well drilling crews report to him. While it is true that USAID may have more leverage with Nitco than RWSSP, the Health Project Manager at USAID is new and does not have an engineering background. Obviously, Mr. Wilson should discuss the matter with USAID and use their assistance to whatever extent feasible.

2. Mr. Wilson contact Mr. Naddaf as soon as the compressor arrives and try to arrange for Nitco's technician to come and get the rig in operation.

3. At least the following safeties be installed on the compressor system to prevent the compressor from overheating again.

   a. High oil temperature gage and switch.

   b. Low oil level gage and switch.

   c. High metal temperature switch on the compressor body.

   d. Oil flow indicator and switch.

   All switches should light an alarm light, sound an alarm horn, and shut the engine that drives the compressor down. It was reported that some of these safeties existed at the time the compressor seized. It can only be surmised that they did not function correctly and thus did not shut down the engine before the compressor overheated.

4. The Nitco technician supervise the use of the rig for actual well drilling after he gets it back in operation for at least one week. It may be necessary to count this as startup and training time in order to get Nitco to agree to leave the technician in Belize for the week.

5. It be emphasized to Nitco, that fixing the currently known defects does not absolve them from fixing any other defects which appear.

Subsequent Action

When the list of deficiencies is available from the independent consultant, it should be presented to Nitco and they should be asked to remedy them and to provide the startup and training. Whether Nitco will be willing to correct the additional deficiencies and how much the additional training is needed will depend upon how well the rig is running and the extent of deficiencies that the independent consultant finds.

STATEMENT OF WORK
FOR
INDEPENDENT ASSESSMENT
OF
NITCO DRILLING RIG

OBJECTIVE:

The objective of the Increased Productivity through Better Health project, through which the Rotary Drill was purchased, is to improve the health and productivity of the Belizean people. The purpose of this consultancy is to determine the viability of the NITCO supplied rotary drill rig. The drill is required to expedite the water well drilling program in Belize, and is expected to be able to complete a minimum of 50 wells annually, in the various soil formations in Belize. Equipped with a casing hammer, the drill will be the only one in Belize capable of drilling through unconsolidated formations.

SCOPE OF WORK:

An experienced and certified water well driller, thoroughly familiar with the engineering and performance of a wide variety of rotary drill rigs is required to:

a. review the Specifications provided to competing suppliers of rotary drills
b. assess the fabrication of the NITCO supplied rig, specifically examining the quality of workmanship, the quality of components - including but not limited to the compressor, truck, PTO, rotary drive head, hydraulic lift shafts, bearings, pulley systems, casing hammer. Special attention should be paid to load bearing components to assess whether they are appropriately selected.

c. review the engineering design aspects of the rig, specifically how it is put together for operator and operational efficiency,whether major components (compressor, mud pump, etc.,) are adequately placed for complementary performance of the rig as a whole, and whether hoses are appropriately sized for proper flow of hydraulic and compressor oil, etc.

c. assess the rig's potential for trouble-free performance in various soil formations, including its pull-down capacity, hoist limits, rate of drilling, etc.

d. review capability of assigned drill crew to handle the NITCO rig and determine adequacy of training provided to date, indicating areas of weakness in handling the machine.

REPORT:

A detailed report listing observations, findings and recommendations on all aspects of the NITCO drill is required.

LEVEL OF EFFORT:

It is anticipated that the scope of work will require 5 work-days in the field including preparation of a draft report.

QUALIFICATIONS:

The consultant should be a certified water well driller in the United States, with more than 12 years field experience using a variety of rotary drills. The consultant should also possess qualifications in mechanical engineering, ideally complemented by experience in the rotary drill manufacturing industry. Previous experience assessing the capabilities of rotary drills, or developing specifications for such drills would be advantageous.

August 11, 1989
File: ESalt

ANNEX E. TYPICAL PATTERN OF SALT WATER INTRUSION

The typical pattern of salt water intrusion is shown in the following sketch. The Ghyben-Herzberg principle states that under equilibrium conditions in a homogeneous aquifer alongside the ocean, fresh water will float as a lens on top of the salt water. Because of the differences in density of fresh water and sea water, there will be approximately 40 feet of fresh water below mean sea level (MSL) for every foot of fresh water above MSL.

If the groundwater table is drawn down by pumping a well, the interface between the fresh water lens and the underlying salt water rises to maintain the 40:1 ratio.

The first common mistake in attempting to tap a coastal aquifer is to drill too deep. There often is a general belief that deep water is good water, but in this case drilling deep taps the underlying salt water rather than the surface lens of fresh water.

A second common mistake is to pump at a high rate, and thus cause a large drawdown. As the water table is drawn down, the interface of the fresh water lens and the salt water rises to maintain the 40:1 ratio. In effect, an inverted cone of depression is formed under the well. The interface soon reaches the screen of the well and the well produces salt water.

It should be noted that the salt water comes up from below, not horizontally from the ocean. Thus it is possible that wells between the one that is drawing salt water and the ocean may still be drawing fresh water, especially if they are only pumped at a low rate and thus do not create a large drawdown.

It should also be noted that it may take a period of several weeks or months for the upward cone of salt water to develop. Thus a new well may produce fresh water for a considerable period before it begins to produce salt water.

The correct solution is to use a large diameter well and/or pump the well at a low rate. This can be done in several ways. The approach that is used at San Pedro on Ambergris Caye is to use a large number of small wells (well points) so that each well is only pumped at a very low rate. The drawdown is thus small and salt water does not reach the wells.

Another approach is to use horizontal well screens which in effect create a well with a very large diameter. Such installations are often called "infiltration galleries". A hole is excavated down to or slightly below sea level using a backhoe, a drag line, manual labor, or even a diesel driven bulldozer which usually can work in water up to about 4' deep. Normally flat coastal areas are only perhaps 10' above sea level and the groundwater table is only perhaps 3' above MSL. Thus the total depth of the excavation and the depth that is below the water level are not great.

A manhole-like structure of almost any sort is placed in the middle of the excavation and provides an open pool of water from which the pumps can take suction. Because of the shallow depth of infiltration galleries, common centrifugal pumps mounted on the surface can be used. Submersible pumps are unnecessary although they may be desirable to simplify problems of losing suction. It is also possible to have multiple pump suctions in such a large diameter well, although the requirement of keeping the pumping rate low to minimize drawdown usually means that operating multiple pumps should be avoided.

The effective diameter of the well can be extended by placing small gravel out from the manhole. This greatly increases the permeability of the area around the manhole and reduces the amount of drawdown. This concept can be extended further by laying horizontal well screens which are piped directly to the manhole. A sketch of such an infiltration gallery also follows

To avoid the possibility of drawing the water table down below MSL, the bottom of the manhole, the horizontal well screen and/or the foot valve on the pump suction can be located at slightly above mean sea level. Thus it is physically impossible to create an excessive drawdown.

Coastal sands are often very fine and may tend to boil upward into the manhole or to pass through the screens on well points or on infilatration galleries. It may therefore be necessary to gravel pack the area below and around the manhole and the area around the well screens. Gravel packing is made easier if geotextile is available. This material is a plastic cloth resembling felt. The pores in the geotextile are large enough to allow water to pass but fine enough to keep soil particles from passing. If geotextile is not available, a graded sand filter can be used. With well points, the gravel pack must be placed down the hole around the well point and thus geotextile cannot be used.

Several important factors should be considered if infiltration galleries or fields of shallow well points are used. First because the well is shallow, the water passes through only a limited amount of soil. It is important to locate the infiltration gallery as far as practical from sources of pollution.

Petroleum products are especially troublesome because they float on the groundwater surface and impart an objectionable taste to the water even in minute concentrations. It is unwise to use a gasoline or diesel driven pump at or near the infiltration gallery or well field because some fuel will inevitably be spilled. If a generator is used to power an electric driven pump, the generator should be located far away from the well and electric lines should be run to the motor.

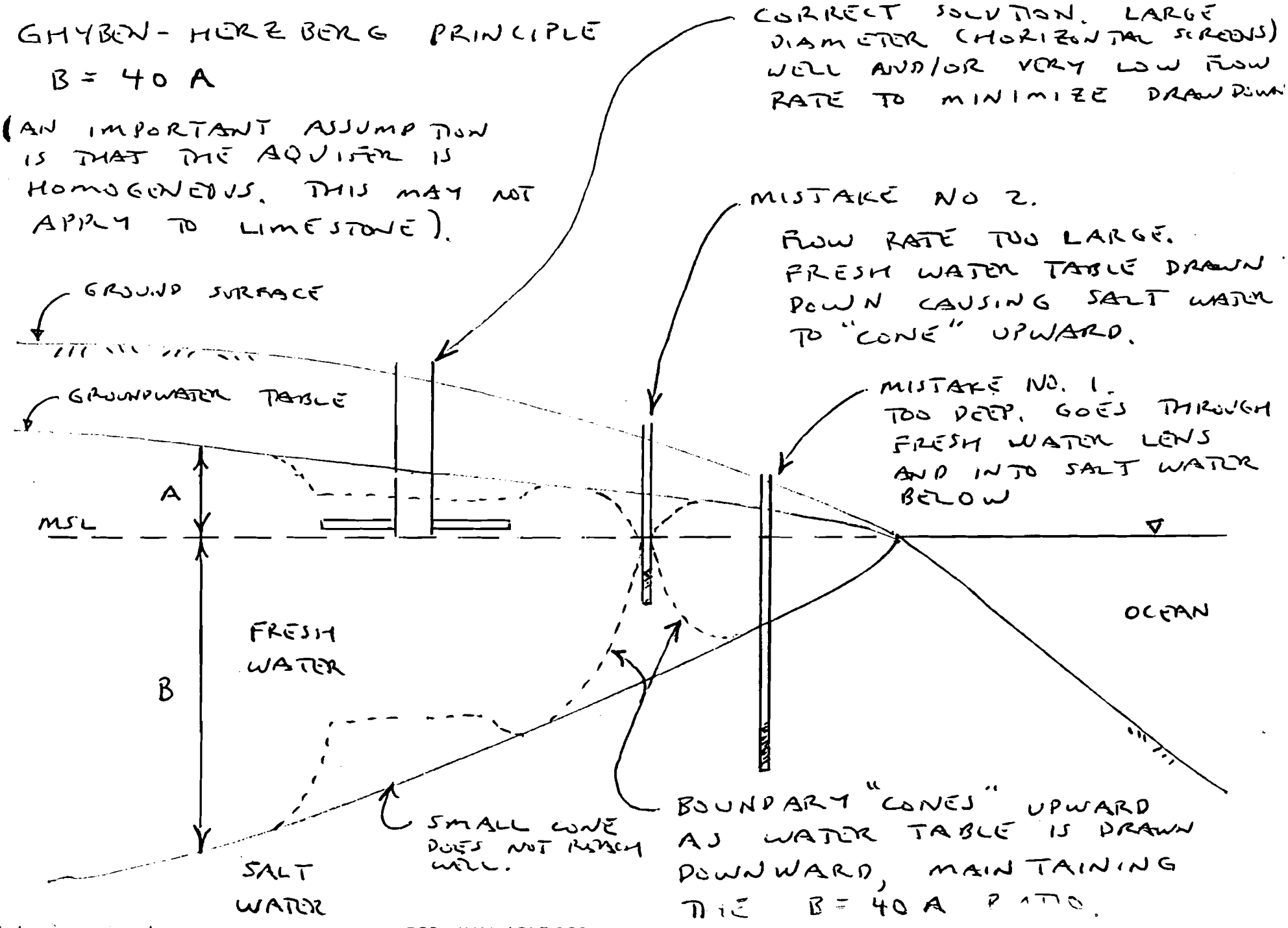
Second, shallow and large diameter wells are subject to pollution. The top of the gallery should be protected and the area around the gallery should be fenced to keep animals out and should be sloped away from the manhole to divert surface runoff away.

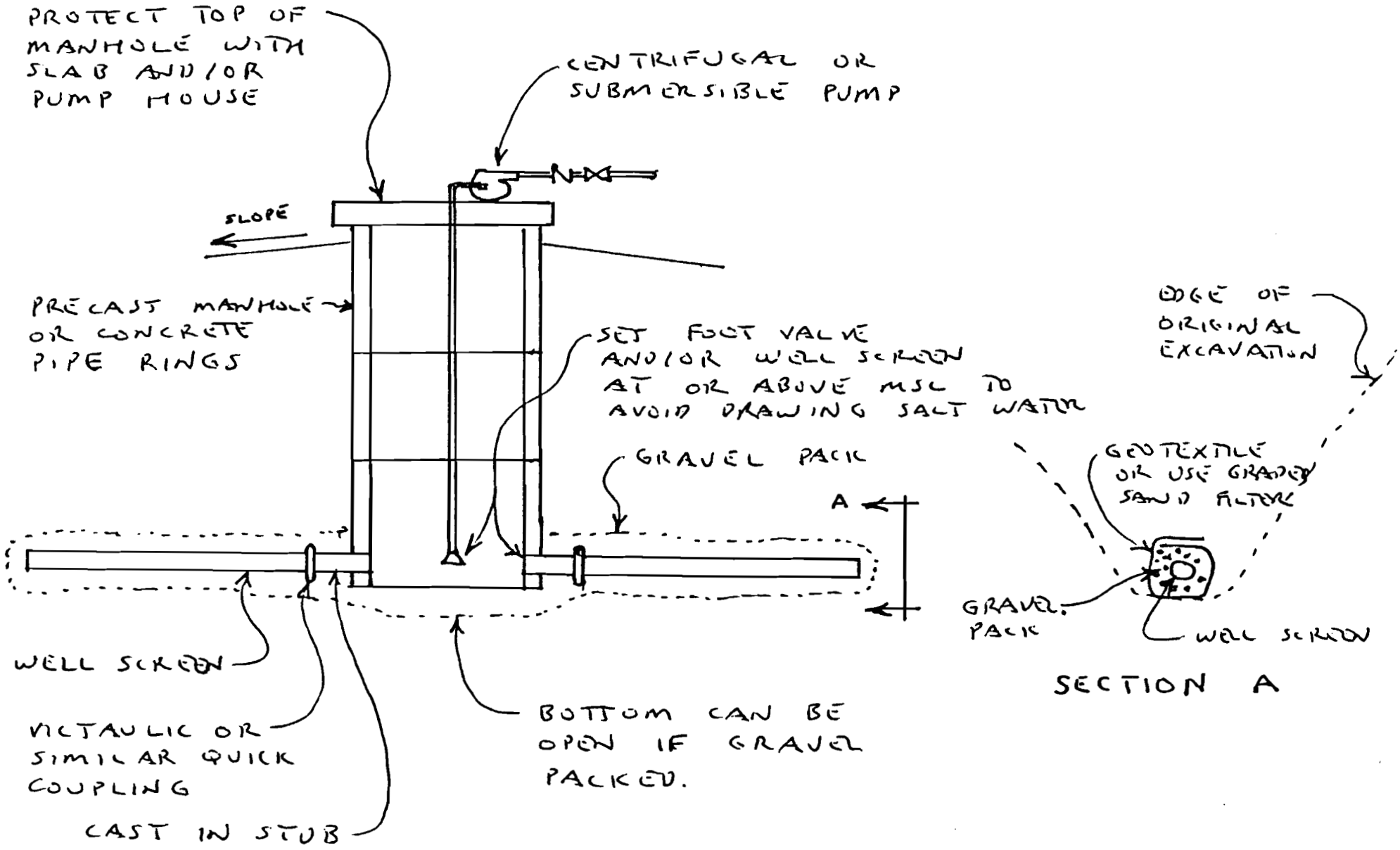
One final caveat: The Ghyben-Herzberg principle assumes a homogeneous aquifer. This assumption may not be valid in limestone formations such as are found in Belize because the limestone may contain passages that act as pipes leading directly from the ocean to a well.

GHYBEN - HERZBERG PRINCIPLE

B = 40 A

(AN IMPORTANT ASSUMPTION IS THAT THE AQUIFER IS HOMOGENEOUS. THIS MAY NOT APPLY TO LIMESTONE).





B.H. DICKSON

AUG 1999

INFILTRATION GALLERY

August 11, 1989
File: Fvillist

ANNEX F

LIST OF ALL VILLAGES IN BELIZE

This annex contains ten pages of lists of all of the "villages" in Belize, tabulated by district. The pages are numbered 2 through 12 except that there is no page 6.

The lists identify the villages by number and by name and give the number of "houses" and number of inhabitants, and the date that the information was last updated. The majority of the dates are in 1988 so the list is relatively recent.

The lists were prepared by the National Malaria Control Program NMCP) for use in their mosquito spraying operations. For that reason, "villages" are listed even if there is no population. Some of these villages may be agricultural buildings which are not occupied by people or are only seasonally occupied.

The number of houses and inhabitants are totaled for each district and for the country as a whole.

These lists may be useful in attempting to estimate the total needs for rural water supplies, especially for wells. The villages which already have water supplies, many of which are identified in Annex G, can be marked on these lists. The rural water supply "needs" will then be the remaining villages without supplies, although a decision may be made that wells will not be provided for "villages" below a certain size, say six houses. These very small villages could use rainwater catchment systems.

ANNEX F (Cont.)

Village Census 04/07/89

trict: 1 COROZAL

Village e Name	Houses	Inhabitants	Update
Santa Elena	24	39	05/07/88
San Jomal	1	0	05/07/88
Chan Chen	98	387	06/10/88
Rancho San Juan	18	45	05/07/88
Consejo Rd	25	66	11/07/88
Gulf Caribbean	5	.1	05/07/88
Remate	15	45	06/07/88
Alta Mira	232	912	06/07/88
Corozal Town	0	0	/ /
Paraiso	154	622	11/07/88
Santa Rita Rd	175	773	12/07/88
Portshall	14	44	04/07/88
San Antonio	64	27	15/07/88
San Andres	104	477	18/07/88
San Andres Rd	83	300	19/07/88
Ranchito	220	857	20/07/88
Carolina	45	208	25/07/88
Xaibe	238	1014	26/07/88
Xcanlum	7	35	29/07/88
Patchakan	211	866	04/10/88
Yo Chen	23	77	17/03/88
Cristo Rey	137	510	07/01/88
San Pedro	99	322	12/10/88
Calcutta	170	703	01/08/88
San Joaquin	257	1036	03/08/88
Aventura	9	19	08/08/88
Concepcion	187	764	31/01/88
Louisville	135	454	10/08/88
Lajes	6	14	12/08/88
San Narciso	498	1643	21/09/88
San Roman	124	449	12/08/88
Santa Clara	130	589	09/08/88
San Victor	96	505	16/08/88
Buena Vista	92	345	11/08/88
Libertad	372	1314	18/08/88
Chan Chan Plant	0	0	01/08/88
Plant Estrella	0	0	01/10/88
Estrella	29	76	25/08/88
Santa Cruz	10	24	25/08/88
Caledonia	248	1124	20/09/88
Cerros	0	0	01/08/88
Copper Bank	73	270	19/09/88
San Fernando	0	0	01/01/87
Chunox	145	590	09/09/88
Progresso	237	890	12/09/88
Sarteneja	305	1162	31/08/88
Little Belize	197	1092	07/09/88

Totals	Houses	Inhabitants	Count
	5312	20690	47

Village Census 04/07/89

District: 2 ORANGE WALK

Village Code	Name	Houses	Inhabitants	Update
1	Douglas	131	521	29/10/88
2	San Pablo	161	753	20/10/88
3	San Jose	335	1647	20/10/88
4	Mamayal	14	16	12/04/88
5	San Luis	47	149	02/11/88
6	San Roman	85	364	04/11/88
7	San Lorenzo	11	14	04/11/88
8	Indian Hill	6	12	12/04/88
9	Trial Farm	438	1732	12/12/88
0	Orange Walk	0	0	01/01/86
1	San Francisco	293	1364	07/12/88
2	San Estevan	247	1076	17/10/88
3	San Estevan Rd	0	0	17/10/88
4	Dublin Bank	0	0	/ /
5	Petiville	14	43	04/11/88
6	Campachite	3	9	07/11/88
7	San Antonio 1	103	363	03/11/88
8	Santa Cruz	36	170	07/11/88
9	Yo Creek	251	1038	08/11/88
0	Cuellos Distillery	3	2	28/10/87
1	Ojo fe Agua	0	0	01/01/86
2	Louisiana Farm	431	1557	30/11/88
3	San Jose Palmar	122	540	07/12/88
4	Bound to Shine	0	0	01/01/86
5	Briceno Distillery	3	0	01/01/86
6	Tower Hill	50	181	05/12/88
7	Hill View	0	0	01/01/86
8	Chan Pine Ridge	67	307	06/12/88
9	Carmelita	51	242	11/11/88
0	Safari Camp	0	0	27/04/87
1	Tiger Creek	2	8	16/05/88
2	Kates Lagoon	6	7	16/05/88
3	London Camp	10	6	16/05/88
4	Rancho Creek	82	309	01/12/88
5	Richmond Hill	0	0	02/12/88
6	Guinea Grass Rd	15	51	02/12/88
7	Guinea Grass	349	1713	22/11/88
8	Guat. Hill Agricult.	9	10	09/05/88
9	MoPal Shal	0	0	01/01/86
0	Shipyard	338	1935	14/11/88
1	Fire Burn	33	95	09/12/88
2	Backlanding	12	20	09/05/88
3	Indian Church	100	144	26/11/88
4	Hill Bank	0	0	01/01/86
5	Miguelas Potaro	0	0	01/01/86
6	San Lazaro	176	784	12/11/88
7	Trinidad	154	491	04/11/88
8	Esperanza	0	0	01/01/86
9	August Pine Ridge	255	1166	16/11/88
0	Caver	8	15	29/11/88
1	San Felipe	213	866	25/11/88
2	Tribruce	5	25	23/11/88

Village Census 04/07/89

Blue Creek	45	136	27/05/88
La Rosita	24	80	24/11/88
Backfield	0	0	01/01/86
Tres Leguas	23	102	24/11/88
Eden Valley	24	148	24/11/88
Pine Ridge Camp	20	39	23/11/88
Honey Camp	30	41	21/04/88
Nuevo San. Juan	48	196	20/03/88

-Totals	Houses	Inhabitants	Count
	4883	20487	60

Village Census 04/07/89

District: 3 BELIZE

Village Code	Name	Houses	Inhabitants	Update
01	Maskall	145	577	18/05/88
02	Bomba	14	58	19/05/88
03	St Ann's	26	65	19/05/88
04	Corozalito	17	57	19/05/88
05	Santana	54	143	24/05/88
06	Lucky Strike	46	208	25/05/88
07	Rockestone Pond	31	136	20/05/88
08	Boston	19	37	26/05/88
09	Crooked Tree	123	863	26/05/88
10	Washing Tree	10	59	27/05/88
11	Biscayne	43	203	27/05/88
12	Grace Bank	19	112	27/05/88
13	Davis Bank	6	62	27/05/88
14	Budd Bank	1	11	27/05/88
15	Salt Creek	19	163	30/05/88
16	Sand Hill	109	710	30/05/88
17	Trinidad Farm	5	11	30/05/87
18	Ridge Lagoon	3	8	30/05/87
19	Mile 10-12	23	98	30/05/87
20	Stains Bank	31	87	31/05/87
21	Ladyville	294	1293	31/05/87
22	May Pen	19	104	31/05/87
23	Flowers Bank	26	163	31/05/87
24	Mussel Creek	15	96	31/05/87
25	Isabela	26	203	31/05/87
26	Liomnal	33	261	01/06/87
27	Bermudian Landing	51	361	01/06/87
28	Double Head Cabbage	55	403	01/06/87
29	Willows Bank	28	213	01/06/87
30	St Paul's Bank	22	179	01/06/87
31	Big Falls	16	109	01/06/87
32	Young's Bank	14	131	02/06/87
33	Rancho Dolores	38	317	02/06/87
34	Burrell Boom	135	598	02/06/87
35	Belize	960	45000	02/06/87
36	Hattieville	183	659	03/06/87
37	Freetown Sibun	14	36	03/06/89
38	Fegurson Bank	1	4	03/06/87
39	Butcher Burns	3	10	06/06/87
40	Rockville	7	65	06/06/87
41	Gracie Rock	21	100	06/06/87
42	Mile 28	6	19	06/06/87
43	Glenwood	4	15	07/06/87
44	Mile 31	25	175	07/06/87
45	Northern Lagoon	15	25	07/06/87
46	Gales Point	47	300	07/06/87
47	San Pedro	226	1926	13/06/87
48	Caye Cauker	117	829	17/06/87

Sub-Totals	Houses	Inhabitants	Count
	3145	57262	48

Village Census 04/07/89

trict: 4 CAYO

Village Name	Houses	Inhabitants	Update
Married Woman	2	4	01/02/88
Castile	2	4	01/02/88
Panama	2	11	01/02/88
Rock Donda	1	2	01/02/88
More Tomorrow	17	38	01/02/88
Saturday Creek	7	28	01/02/88
Never Delay	3	7	01/02/88
Youngs Bank	3	5	02/02/88
Banana Bank	3	16	02/02/88
Little Orange Walk	8	18	02/02/88
Mile 36	29	107	02/02/88
Cotton Tree	3	17	03/02/88
Mile 44	3	17	03/02/88
Beaver Dam	18	61	03/02/88
Roaring Creek	309	1181	11/02/88
Belmopan	575	1181	15/02/88
Belmopan Cooper.	121	522	19/09/88
San Martin	66	303	28/09/88
Roaring River	153	530	29/09/88
Caves Branch	22	37	02/02/88
Sibun	30	132	04/02/88
Chanona	15	45	03/02/88
Over The Top	90	299	04/02/88
Camelote 1	203	891	10/09/88
Teakettle	123	504	17/10/88
Young Girl	26	139	18/10/88
Ontario	118	458	19/10/88
Blackman Eddy	73	311	26/10/88
Unitedville	88	358	31/10/88
Barton Ramie	2	6	31/10/88
Nords Farm	6	12	31/10/88
Georgeville	78	397	01/11/88
Gentles Bank	1	5	01/11/88
Spanish Lookout	143	566	14/03/88
Central Farm	29	103	31/08/88
Listowel	5	63	31/08/88
Norland	4	16	01/09/88
San Miguel 1	2	7	01/09/88
Esperanza	165	726	04/11/88
Saw Mill	8	42	03/03/88
Red Creek	74	321	07/03/88
Bradleys Bank	2	3	07/03/88
Trapiche	33	156	07/03/88
Santa Elena	421	2125	07/03/88
San Ignacio	962	4596	07/03/88
Carmelita	6	35	30/03/88
Santa Familia	117	447	10/11/88
Branch Mouth	38	236	14/11/88
Frutos	14	54	05/04/88
San Jose	23	87	06/04/88
Remanzo	5	14	11/04/88
Dry Falls	3	23	11/04/88

53	Camalote #2	37	173	08/04/88
54	Pedragal	4	18	08/04/88
55	Bullet Tree Falls	135	614	07/04/88
56	Puebla	17	70	11/04/88
57	Paslow Falls	15	60	20/11/88
58	Plantain Sucker	8	32	11/04/88
59	Providencia	3	23	11/04/88
60	San Antonio 2	11	48	12/04/88
61	Santa Rosa	9	32	12/06/88
62	Tranguilo	4	18	12/04/88
63	Alta Vista 2	1	4	12/04/88
64	Calla Creek	19	44	12/04/88
65	Buena Vista	2	11	12/04/88
66	Kemps	2	11	12/04/88
67	Paraiso	12	41	12/04/88
68	Sanchez Ranch	2	6	12/04/88
69	Palmar	4	2	12/04/88
70	Galvez Ranch	3	9	13/04/88
71	Mile74-75	26	100	13/04/88
72	Mile 75-76	5	18	13/04/88
73	Chial	16	63	13/04/88
74	Negro Man	12	37	13/04/88
75	SAlim	2	18	13/04/88
76	Bidles Ranch	3	17	13/04/88
77	Succotz	226	1245	24/11/88
78	Benque Viejo	671	2751	10/05/88
79	San Francisco	4	8	22/06/88
80	Reforma	2	1	22/04/88
81	Arenal	43	705	21/11/88
82	Pilgrimage Valley	11	55	07/03/88
83	Cristo Rey Rd	43	159	29/03/88
84	Cristo Rey	64	341	07/11/88
85	Duffy Bank	1	2	08/11/88
86	Valdez Ranch	6	7	08/11/88
87	Zelaya	1	2	08/11/88
88	Lotiff Ranch	3	7	08/11/88
89	San Lorenzo	0	0	08/11/88
90	Andreas Farm	2	9	08/11/88
91	San Felipe	1	8	08/11/88
92	GreensRanch	1	4	08/11/88
93	Alegria	2	4	08/11/88
94	Branch Mouth	1	2	08/11/88
95	Dos Hermanos	0	0	08/11/88
96	Magana	1	3	08/11/88
97	Perez Ranch	0	0	08/11/88
98	Argentina	3	10	08/11/88
99	Alta Vista 1	1	3	08/11/88
00	Macaw Bank	12	34	29/03/88
01	Paradise Farm	3	6	29/03/88
02	Cool Shade	20	90	17/03/88
03	Barton Creek	66	277	18/03/88
04	Settlement Pine Ridge	77	317	17/03/88
05	San Antonio 1	207	918	24/03/88
06	Maigate	1	5	25/03/88
07	Valley Beacon	1	2	25/03/88
08	San Miguel 2	4	4	25/03/88

Village Census 04/07/89

Augustine	27	225	25/03/88
Cuevas	1	0	25/03/88
Las Flores	98	474	03/10/88
Frank's Eddy	30	72	03/10/88
Valley of Peace	247	1147	27/01/88

)-Totals	Houses	Inhabitants	Count
	6487	27632	113

Village Census 04/07/89

District: 5 STANN CREEK

Village Code	Name	Houses	Inhabitants	Update
01	Middlesex	0	0	/ /
02	Valley Rd 3	20	81	24/10/88
03	Valley Rd 2	130	400	29/10/88
04	Dos Crolas	1	6	24/01/89
05	Alta Vista	58	202	26/10/88
06	Cow Creek	22	72	27/10/88
07	Pomona	136	629	04/11/88
08	608 Quarry	24	97	04/11/88
09	Agricult. & Forestry	74	189	12/10/88
10	Mnllins River Rd	3	18	02/08/88
11	Mullins River	34	132	03/08/88
12	Hope Creek	24	196	05/08/88
13	Lynam	24	180	05/08/88
14	Melinda Rd	24	125	05/08/88
15	Valley Rd 1	24	136	05/08/88
16	Stann Creek	1100	18072	16/08/88
17	Silk Grass	64	187	02/02/88
18	Commerce Bight	1	3	03/02/88
19	Fresh Water Creek	7	94	11/01/88
20	Hopkins	185	882	23/11/88
21	Sittee River	86	235	11/11/88
22	Kendal	17	58	11/11/88
23	Cabbage Hall	34	129	11/11/88
24	Quan Bank	1	4	11/11/88
25	Hancock Rd.	0	0	/ /
26	Pepper Camp	27	111	25/11/88
27	Waha Leaf	48	184	18/11/88
28	Riversdale	34	217	29/11/88
29	South Stann Creek	37	119	10/11/88
30	Maya Mopan	53	191	23/11/88
31	George Town	70	218	24/11/88
32	Cow Pen	250	1231	23/11/88
33	Savannah	15	61	24/11/88
34	Independence	132	2847	11/07/88
35	Mango Farm	77	285	23/11/88
36	Maya Beach	8	12	13/09/88
37	Seine Bight	132	385	13/09/88
38	Placencia	141	405	21/06/88
39	Red Bank	42	177	30/11/88
40	Trio Bladden	51	153	15/12/88
41	Catacamas	41	192	15/12/88

Sub-Totals	Houses	Inhabitants	Count
	3251	28915	41

Village Census 04/07/89

trict: 6 TOLEDO

Village e Name	Houses	Inhabitants	Update
Bladden	14	11	24/11/88
Golden Stream	85	289	13/01/88
Indian Creek	101	368	18/01/88
Hicatee Creek 2	12	43	12/01/88
Hicatee Creek 1	2	8	/ /
San Miguel	85	348	22/01/88
Columbia	232	892	27/01/88
Cocao Columbia	32	129	26/01/88
Crique Arena	5	2	28/01/88
Crique Trosa	44	139	27/01/88
Big Falls	143	533	02/02/88
Dump	30	86	28/01/88
Greens Creek	41	145	02/02/88
Silver Creek	61	253	19/01/88
Machaca Forest	30	156	03/02/88
Laguna	70	304	04/02/88
Jacinto Ville	40	141	04/09/88
Crystal Creek	13	56	22/01/88
San Felipe	32	135	05/02/88
Rancho (Toledo)	157	540	11/02/88
Little Rock	31	161	15/08/88
Cattle Landing	27	79	09/02/88
Jose Taylor	3	13	15/02/88
Punta Gorda	0	0	/ /
Monkey River	38	152	06/10/88
Punta Negra	17	62	07/10/88
New Haven	3	12	07/10/88
Punta Yacas	5	17	07/10/88
Wild Cane Caye	2	4	07/10/88
Majo River	25	94	08/02/88
Crique Jute	58	248	19/02/88
San Jose	167	780	18/02/88
Crique Legarto	11	31	29/02/88
San Antonio	951	1091	29/02/88
Santa Cruz	103	389	03/03/88
Santa Elena	41	134	03/03/88
Pueblo Viejo	112	474	03/03/88
Blue Creek	58	165	07/03/88
Machaca	38	119	26/01/88
Corazon Creek	25	102	11/03/88
Aguacate	54	211	08/03/88
Santa Teresa	45	182	11/03/88
Go to Hell	3	12	27/11/88
Poite	69	279	07/02/88
Mabilha	24	92	11/03/88
Otoxha	57	244	17/03/88
Dolores	36	173	17/03/88
Sarstoon Cardenas	13	37	20/09/88
San Lucas	34	131	17/09/88
Crique Sarco	73	302	24/03/88
Conejo Creek	29	90	20/02/88
Barranco	100	181	22/03/88

Village Census 04/07/89

53	Jordland	14	37	08/03/88
54	Machicla	23	85	15/03/88
55	Jalacte	47	235	09/06/88
56	San Vicente	12	83	13/01/88

Sub-Totals	Houses	Inhabitants	Count
	3577	11079	56

TOTALS	Houses	Inhabitants	Count
	26655	166065	365

August 11, 1989
File: GWaterVil

ANNEX G

LISTS OF VILLAGES HAVING WATER SUPPLIES

Annex G contains lists of villages in Belize which have had water supply systems constructed or for which water supply systems are planned. The various lists are discussed below.

1. Water Quality Laboratory List

This list contains 15 pages of handpumps, by district and by "locality" within districts. In many cases, locality corresponds to a village name in Annex F, but in other cases it does not. The total number of handpumps listed is 619. The handpump numbers are also shown. These are painted on the handpumps so that the handpumps can be easily identified. The lists show numerous annotations which give the impression that they are reasonably up to date.

2. Corozal and Orange Walk VLWS First Phase Villages

List 2, which is page 20 of the Mid-Term Evaluation of the Care Water Supply and Sanitation Project in Belize, shows the eight villages in each project which were included in the first phase of the Village Level Water and Sanitation Project. Two of the villages, Santa Clara/San Roman and San Antonio were to have RWSs rather than handpumps. Later it was decided that Douglas would have a rehabilitation of an existing RWS.

3. Corozal and Orange Walk VLWS Second Phase Villages

List 3 presents an additional 16 villages, eight in each district, that CARE wanted to include in the second phase of the VLWS project. Douglas is on the lists for both phases of the project. In the first it was to receive a single handpump. In the second phase, it is to have an existing RWS rehabilitiated.

Funding for the second phase was less than expected when this list was prepared and the program was cut back to those six villages marked with a check in the right margin.

As discussed below, the remaining 10 villages are proposed for UNICEF funding. (See list below).

4. Increased Productivity Through Better Health (IPTBH) Villages

List 4 is taken from the IPTBH Project Paper Amendment dated 12/19/88 and shows the villages that were considered and the 27 that were included in the project in the three central districts of Belize, Cayo and Stann Creek.

5. UNICEF Villages in Toledo District

List 5 is also taken from the IPTBH Project Paper Amendment dated 12/19/88 and shows the villages that had been covered by the UNICEF project in the Toledo District.

6. Proposed UNICEF Villages in Four Northern Districts

List 6 is a UNICEF telex outlining a further rural water supply program. List 3 above was attached to this telex. The proposed program includes: doing the 10 villages in Corozal and Orange Walk which CARE did not get funding for, plus the village of Indian Church; 6 villages in Belize District; and 6 villages in Cayo District.

The proposed UNICEF program is not currently funded but is considered likely to be funded.

7. Proposed UNHCR Project in Toledo District

List 7 shows 25 villages in Toledo District which UNHCR proposes to fund as an extension of a previous project. It is proposed that this project include an additional Canterra drilling rig.

The project is not yet funded but is considered likely to obtain funding.

LIST I

NUMBER OF DRILLED WELLS WITH HANDPUMPS

BELIZE DISTRICT

Date	Locality	Handpumps	Remarks
	Rancho Dolores	L-1	
		-2	
	St,Paul's Bank	L-3	end of village
		-4	by the school
		-5	
		-6	
		-7	Rusty/muddy water
		-8	cannot be found
		-9	Rusty/muddy water
	Willows Bank	B-10	— BROKEN
		-11	
		-12	
		-13	BROKEN
		-14	
		-15	
		-16	BROKEN
		-17	
		-18	
	Doublehead Cabbage	B-19	BROKEN
		-20	BROKEN
		-21	
		-22	
		-23	
		-24	near Flowers Ear
		-25	" Farm
		-26	
		-27	
		-28	
	Isabella Bank	B-29	behind Community Centre/Removed
	Bermudian Landing	L-30	" Baptist Church.
	Scotland Halfmoon	L-31	
		-32	BROKEN
		-33	
		-34	
		-35	
		-36	
		-37	
		-38	
		-39	
	Burrel Boom vill.	B-40	
		-41	
		-42	
		-43	
		-44	

NUMBER OF DRILLED WELLS WITH HANDPUMPS

BELIZE DISTRICT con't

Date	Locality	Handpumps	Remarks
	Sand Hill	B-45	FIRST PUMP
		-46	NEAR CATTOUSE'S RESIDENCE
		-47	SHORT CUT TO WTP
		-48	at ml.16
		-49	
		-50	near Guadeloupe RC School
		-51	" Methodist School
		-52	
		-53	
		-54	
		-55	
		-56	
		-57	
	Biscayne vill.	B-58	
		-59	
	Crooked Tree	B-60	
		-61	
		-62	
		-63	
		-64	NEAR NORMAN'S TILLETT HOUSE
		-65	NEAR DAWSON'S HOUSE
		-66	
		-67	NEAR JOHN GILLETT'S HOUSE
		-68	
		-69	IN STAINE AREA
		-70	
		-71	NEAR PONCE STATION
		-72	
	Boston	B-73	OPP. MALARIA COLLABORATOR'S HOUSE
		-74	
		-75	OPP. NEW HOPE BAPTIST CHURCH
	New Hope	B-76	
		-77	NEAR 25 m/s OR JANE VILLE
		-78	NEAR 25 1/4 m/s BATON ROUGE
	Rockstone Pond #1	B-79	
		~~B-80~~ -80	2nd PUMP IN village
		-81	AT JUNCTION TO RUIN
		-82	
		-83	
		-84	
		-85	
	Rockstone Pond #2	B-86	OPP. MALARIA COLLABORATOR
		-87	
		-88	
		-89	
	Lucky Strike	B-90	NEAR ML 29
		-91	
		-92	
		-93	
		-94	OPP Last Wagon Train 31½ m/s.
		-95	

NUMBER OF WELLS WITH HANDPUMPS

BELIZE DISTRICT con't

	Corozalito	B-97 ✓	near Community Centre
		-98	Last Pump in vill.
		-99 ✓	near thakn House
		-100	opp. Rubi's Inn
		-96 ✓	3rd pump in village (→ end)
	Santana	B-101	
		-102	near Enriquez Residence
		-103	
	2 main Rd comm. centre	-104 ✓	near Mehin's Residence
		-105	
		-106 ✓	opp Graceville Farm 32 1/4 mls.
		-107	NEAR COMMUNITY CENTRE
		-108 ✓	near Victoria Farm
		-109 ✓	near Zion Park school
		-110	
	St, Ann's	B-111	1st Pump / near wooden House
		-112	
		-113 ✓	near Green School House / NMS# 21
		-114	
	#31 #25	-115	near Community Centre / NMS# 15 NEAR NMS/#16
		-116	
		-117	INDIA MARK II ZETINA'S RESIDENCE
		-118	INDIA MARK II Public Pump
		-119	near House NMS#1 / blue house - INDIA MARK II
	Maskall	B-120 ✓	near Cement House / 1st Pump
		-121	
		-122	street behind Centre
		-123	near NMS # 104
	#79	-124	100 yds From Centre
	#155	-125	near PWD workshop
		-126	" Red/yellow House
		-127	
		-128	
		-129	NEAR NMCP #34
		-130	OPP. GOVERNMENT SCHOOL
		-131	
	La Democracia	B-132	2 new wells - ASSUME ADDITIONAL
	Flowers Bank		2 new wells - ASSUME ADDITIONAL
	22 VILLAGES	141	

ASSUME THERE ARE 5 NEW WELLS IN THE VILLAGES LISTED

5 new wells

NUMBER OF DRILLED WELLS WITH HANDPUMPS

AYO DISTRICT

Date	Locality	Handpumps	Remarks
	Georgeville	C- 1	Oswald Webster's Residence
		- 2	Salvation Army Church
		- 3	House NMS #47
		- 4	Community Centre 1 new well
		- 5	House NMS #12
	Unitedville	C- 6	Merlene Smith's Residence
		- 7	Community Centre
		- 8	New Building site 9 new wells
		- 9	Augustus Benjamin's Residence
		- 10	Football Field
		- 11	Lloyd O'briens Residence
		- 12	Gully; Mount Hope
		- 13	Front of; Mount Hope
	Blackman Eddy	C- 14	Football Field
		- 15	Jack Shy's Residence
		- 16	Alien Community
		- 17	Community Centre
		- 18	School/ Post Office
	Ontario	C- 19	Parking lot Shaw's Bus
		- 20	House NMS# 38 3 new wells
		- 21	road to; Cleveland Gillett
	Teakettle	C- 22	Edmund Campion School
		- 23	Community Centre
		- 24	Blue shop; front House NMS #71
		- 25	Corner; Ypong Gal Rd.-> Ontario
		- 57	En route ; Camalotte
	Young Gal Rd.	C- 26	
	Camalotte	C- 27	A. Lamar To West highway #53
		- 28	front of church; House NMS #61
		- 29	
		- 30	
		- 31	
		- 32	near Roaring Creek
	Salvapan (Belmopan Coop)	C- 33	Iglesia Evangelica
		- 34	7th day Advantist church
		- 35	
	Cotton Tree	C- 36	1 st pump en route to Belize
		- 37	Community Centre
		- 38	in Moro Tomorrow Rd.
	Santa Elena/Cristo rey Rd.	C- 39	front of Post office
		- 40	Rodriquez Farm
	Cristo Rey	C- 41	Community Centre

NUMBER OF DRILLED WELLS WITH HANDPUMPS

CAYO DISTRICT con't

Date	Locality	Handpumps	Remarks
	San Antonio	C- 42 - 43	opp. Communkty Centre School Campus — 1 new well
	Geprgeville Rd.	C- 44 - 47	Samuel Tribb's Residence Gully
	Las Flores	C- 45 - 46	Football Field Creek Mouth
	Bullet Tree Falls	C- 48 - 49 - 50 - 51 - 52 - 53	Football Field Community Centre BEHIND COMMUNITY CENTRE IN FRONT OF R C SCHOOL
	Santa Familia	C- 54 - 55 - 56	 DEMPSTER PUMP - NEAR NMS 97
	St. Margaret		2 new wells
CAYO TOTALS	17 VILLAGES	72	—

NUMBER OF DRILLED WELLS WITH HANDPUMPS

COROZAL DISTRICT

Date	Locality	Handpump	Remarks
9.9.87	Chan Chen	CZ- 1	Dempster (4)
		- 2	Gilharry Residence
		- 3	School
		- 4	
		CZ - 4A	Indian Mark II serial # 8775
	Paraiso	CZ- 5	Dempster (4)
		- 6	
		- 7	football Field
		- 8	
	San Antonio	CZ- 9	Dempster (3)
		- 10	Henry Gilharry
		- 11	
	San Andres	CZ- 12	Dempster (3)
		- 13	
		- 14	
	Ranchito	CZ- 15	Dempster (8)
		- 16	
		- 17	
		- 18	
		- 19	
		- 20	
		- 21	
		- 22	
14.9.87	Concepcion	CZ- 23	Dempster (9) end of village
		- 24	
		- 25	
		- 26	
		- 27	
		- 28	
		- 29	
		- 30	
		- 31	
	San Joaquin	CZ- 32 ✓	Dempster (1) Roman Catholic Church
	Calcutta	CZ- 33	Dempster (2)
		- 34	
	Xaibe	CZ- 35	Dempster (10)
		- 36	Daniel Tzul Reidence
		- 37	
		- 38	
		- 39	School
		- 40	highway
		- 41	
		- 42	
		- 43	
		- 44	
	Xan Lum	CZ- 45	Dempster (1)

7.K/

NUMBER OF DRILLED WELLS WITH HANDPUMPS

COROZAL DISTRICT con't

Date	Locality	Handpump	Remarks
14.9.87	Patchakan	CZ- 46	Dempster (13)
		- 47	
		- 48	
		- 49	
		- 50	School
		- 51	
16.9.87		- 52	Roberto Mesa's Residence
		- 53	
		- 54	
		- 55	
		- 56	
		- 57	
		- 58	
	Yo Chen	CZ- 59 ✓	Dempster (1) Pascual Cruz's Residence
	Cristo Rey	CZ- 60	Dempster (9)
		- 61 ✓	school
		- 62	
		- 63	
17.9.87		- 64	
		- 65	by the school serial # 8746
		- 66	
		- 67	
		- 68	
		- 69	
		- 70	Indian Mark II serial # 8735 (3)
		CZ- 70A	M. Alamilla's house serial # 8759
	San Pedro	CZ- 71	Dempster (6)
		- 72 ✓	NHS #9
		- 73 ✓	Govt. Prep School
		- 74	
		- 75A	
		- 75	near the school serial # 8758 (1)
		- 76	
	Louisville	CZ- 77	Dempster (8)
		- 78	Indian Mark II serial # (1)
		- 78A	
		- 79	
		- 80	
		- 81	
		- 82	
		- 83	
		- 84	
	San Narciso	CZ- 85	Dempster (1) opp. School
		- 86	Indian Mark II serial # 8744 (1)
	San Roman	CZ- 87	Dempster (6)
		- 88	
		- 89	
		- 90	
		- 91	
		- 92	

NUMBER OF DRILLED WITH HANDPUMPS

COROZAL DISTRICT con't

Date	Locality	Handpump	Remarks
28.9.87	Santa Clara	CZ- 93	Dempster (4) Francisco Cenic's Residence #15
		- 94	Reap Garden
		- 95	
		- 96	Community Centre NHS# 53
	San Victor	CZ- 97	Indian Mark II serial # 55123 (11)
		- 98	B-55125
		- 99	8815
		- 100	8795
		- 101	near Park 8220
		- 102	Dempster (2)
		- 103	Behind Novelo's serial # 8815
		- 104	8742
		- 105	Dempster
		- 106	Indian Mark II serial # 8721
		- 107	8776
		- 108	8731
		- 109	Dempster
30.9.87	Caledonia	CZ- 110	Dempster (2) Caledona RC School
		- 111	Football field
	Buena Vista	CZ- 112	Indian Mark II serial # B-55126
		- 113	B-55144
		- 114	55161
		- 115	B-55162
		- 116	School building NHS# 91 B-55191
		- 117	near school. 55147
		- 118	B-55165
	Chunox(5)	CZ- 119	Dempster (1) near school
			T4A, 7UA, 75A, 7JA
COROZAL-TOTAL	22 VILLAGES	123	

NUMBER OF DRILLED WELLS WITH HANDPUMPS

ORANGE WALK DISTRICT

Date	Locality	Handpump	Remarks
10.8.87	San Felipe	OW- 1	Dempster (6)
		- 2	near NHS # 84
		- 3	
		- 4	
		- 5	near NHS # 140
		- 6	beside Templo Evangelico
	August Pine Ridge	OW- 7	Dempster (2)
		- 8	near Catholic church
	Trinidad	OW- 9	Dempster (12)
		- 10	
		- 11	
		- 12	
		- 13	
		- 14	
		- 15	School Compound
		- 16	Road to school Compound
		- 17	opp Elvia Gomez's Residence
		- 18	Main Feeder Road
		- 19	
		- 20	
	San Lazaro	OW- 21	Dempster (5) School Compound
		- 22	near Cordovas Residence
		- 23	near the school
		- 24	
		- 25	
24.8.87	Santa Cruz	OW- 26	School compound serial # 8299 (3)
		- 26A	Dempster (1)
		- 27A	Football field
		- 27	Opp. Vera's Residence serial # 3726
		- 28	Dempster
		- 28A	Indian Mark Ii serial # 8774
	San Antonio	OW- 29	Dempster (2)
	Rio Hondo	OW- 30	Dempster
22.9.87	Santa Martha	OW- 31	Dempster (8)
		--32	
		- 33	Indian Mark II serial # 8764
		- 34	Dempster
		- 35	
		- 36	
		- 37	
		- 38	Indian Mark II serial # 8730
		- 39	3806
		- 40	Dempster
		- 41	
		- 42	Indian Mark II serial # 8783
24.9.87	Tiger Creek	OW- 43	Dempster (1)
	Carmelita	OW- 44	Dempster (4)
		- 45	
		- 46	
		- 47	

NUMBER OF DRILLED WELLS WITH HANDPUMPS

ORANGE WALK DISTRICT con't

Date	Locality	Handpump	Remarks
24.8.87	Guinea Grass RD	OW- 48	Dempster (2)
		- 49	
	Guinea Grass vill.	OW- 50	Dempster (1)
	Chan Pine Ridge vill.	OW- 51	Dempster (6)
		- 52	Indian Mark II (1) opp. school
		0 52a	near school
		- 54	opp. Park
		- 54A	near Park
		- 55	near Gonzalo Torres
		- 56	ent. vill.
	Chan Pine Ridge Rd.	OW- 57	Dempster (2)
		- 58	
	Belize Rd.	OW- 59	Consollent (4) near Adventist school
		- 60	
		- 61	
		- 62	Dempster (2)
		- 63	Consollent
		- 64	Dempster
	Louisianna Farm	O - 65	Dempster (2)
		- 66	
	Orange Walk (Town)	OW- 67	Dempster (4)
		- 68	
		- 69	
		- 70	
8.10.87	San Lorenzo	- 71	Dempster (1)
	San Lorenzo Rd.	OW- 72	Dempster (2)
		- 73	
	Trial Farm	OW- 74	Dempster (17)
		- 75	
		- 76	
		- 77	
		- 78	
		- 79	
		- 80	
		- 81	
		- 82	
		- 83	
		- 84	
		- 85	
		- 86	
		- 87	
		- 88	
		- 89	
		- 90	

NUMBER OF DRILLED WELLS WITH HANDPUMPS

ORANGE WALK DISTRICT con't

Date	Locality	Handpump	Remarks
21.10.87	San Luis	OW- 91	Indian Mark II serial # 8752
		- 92	8767
		- 93	Dempster
		- 94	Indian Mark II serial # 8769
		- 95	Dempster
		- 96	Indian Mark II serial # 8743
		- 97	Dempster
		- 98	Indian Mark II serial # 8773
		- 99	Dempster
	San Pablo	OW- 100	Dempster (4)
		- 101	
		- 102	Consollent (1)
		- 103	Indian Mark II serial # B55131
		- 104	B55145
		- 105	Dempster
		- 106	Indian Mark II serial # B55200
		- 107	B55137
		- 108	Dempster
	Nueva San Juan	OW- 109	Indian Mark II serial # A28402
		- 110	Dempster (4)
		- 111	
		- 112	Indian Mark II serial # A28410
		- 113	Dempster
		- 114	Indian Mark II serial # B55166
		- 115	8789
		- 116	Dempster
ORANGE WALK TOTALS	23	- 117	Indian Mark II serial # B56187
		121	+ 26A, 14A, 28A, 7+A

NUMBER OF DRILLED WELLS WITH HANDPUMPS

12/15

STANN CREEK DISTRICT

Date	Locality	Handpump	Remarks
30.9.87	Joe Meighan Rd.	S-1	Stann Creek Valley Rd.
		-2	Zabaneh's Orchard
		-3	near Emmanuel's House
		-4	Rasberry Farm
	4mls. Saree Wee	S-5	
		-6	Near Community Centre
	7mls. Valley Rd.	S-7	
	7½mls. Valley Rd.	S-8	
		-9	Corner/ Canada Hill Rd.
	Hope Creek	S-10	front of school
		-11	
		-12	" " church
		-13	
		-14	End of village
	9mls. Valley Rd.	S-15	
	9½mls Valley Rd.	S-16	St, Mary's Villa
	10mls. Valley Rd.	S-17	near Green house
	10½mls. Valley Rd.	S-18	
	11mls. Valley Rd.	S-19	Springfield Farm
	11½mls. Valley Rd.	S-20	near Pike's Residence
	Silk Grass	S-21	near Community Centre
		-22	" school
		-23	" Bahai's church
	Hppkins Rd.	S-24	
		-25	
	Sittee River vill.	S-26	
		-27	near Ms. Reynold's
		-28	" Community Centre
		-29	behind Freetown Rd.
		-30	" back Street
	Kendal	S-31	front of Store
	Maya Centre	S-32	1 new well
	South Stann Creek	S-33	near school
	Independence	S-34	front of Tieda Martha
		-35	near football field
		-36 ✓	" Christ's Sanctuary
	Cowpen	S-37	" football field
		-38 ✓	" NHC's

NUMBER OF DRILLED WELLS WITH HANDPUMPS

ANN CREEK DISTRICT con't

Date	Locality	Handpump	Remarks
30.9.87	Santa Rosa	S-39	front of school
		-40	behind school
	San Roman	S-41	near school 2 new wells
	Geargetown	S-42	" Community tent
		-59 ✓	" Garcia's Store 4 new wells
		-60 ✓	" school
		-61	" Ramirez Residence
		-62	over the bridge
	Maya Mopan	S-43	front of school 3 new wells
		-44 ✓	near John Colliar's house
	Melinda Rd.	S-45	
		-46	
	Mullins River	S-47	
		-48	
	14mls. Valley Rd.	S-49	
	20mls Valley Rd.	S-50	near WHC# 49
	Hummingbird Cafe	S-51	
		-52	
	Quarry	S-53	
	6mls. Valley Rd.	S-54	near Austin's Farm
	Lynam Rd.	S-55	
		-56	near Nembhard's Residence
		-57	" Zabaneh's Ranch
		-58	
			+ 13 new wells
STAIN CREEK TOTAL	31 ?	72	=

NUMBER OF DRILLED WELLS WITH HANDPUMPS

TOLEDO DISTRICT

Date	Locality	Handpumps	Remarks
	Pueblo Viejo	T- 1	
	San Antonio	T- 2	
		- 3	
		- 4	
		- 5	
		- 6	
		- 7	
		- 8	
		- 9	
		- 10	
		- 11	
	Mafredi	T- 12	
		- 13	
	Santa Theresa	T- 14	
		- 15	
	Aquacate ~	T- 16	
		- 17	
		- 18	
	Crique Troso	T- 19	near shop
	San Pedro Col.	T- 20	
	7	- 21	
		- 22	
		- 23	
		- 24	
		- 25	
		- 26	
		- 27	
		- 28	
		- 29	
		- 30	
	San Miguel	T- 31	
		- 32	
		- 33	
	Silver Creek	T- 34	
	4	- 35	
		- 36	
		- 37	
		- 38	
	Indian Creek	T- 39	
		- 40	
		- 41	
		- 94	
		- 95	

NUMBER OF DRILLED Wells WITH HANDPUMPS

TOLEDO DISTRICT con't

Date	Locality	Handpumps	Remarks
	Big Falls	T- 42	
		- 43	
		- 44	
		- 45	
		- 46	
		- 47	
		- 48	near theirs unit 62
		- 49	
		--50	
		- 51	
		- 52	
	San Marcos	T- 53	
	Forestry	T- 54	
	Laguana	T- 55	
		- 56	
		- 57	
		- 58	
	11 miles	T- 59	
		- 60	
	San Felipe	T- 61	
		- 62	
	Santa Anna	T- 63 ✓	
		- 64 ✓	
	Jacintoville	T- 65 ✓	
		- 66 ✓	
		- 67 ✓	
		- 68 ✓	
	Elridgeville	T- 69	
		- 70	
		- 71	
		- 72	
		- 73	
	Forest Home	T- 74	
		- 75	
		- 76	
		- 77	
		- 78	
		- 79	
		- 80	
		- 81	
		- 82	
		- 83	
		- 84	
		- 85	
	Cattle Landing	T- 86	
		- 87	
	Carib Reserve	T- 88	SEE UNIT AN CHECK FOR 94 & 95

TOLEDO TOTALS 22 90

TOTAL COUNTRY 617

LIST 2

SOURCE: MID TERM EVALUATION OF VLWS PROJECT (TURNER & BUREAU)

Table 3

VLWS HANDPUMP INSTALLATION
(Life of Project Summary)

	VILLAGES IN	TARGET	ACTUAL INSTALLED	BALANCE	PERCENT COMPLETED	ESTIMATED BENEFICIARIES
	COROZAL					
1.	Buena Vista	7	7	0	100%	330
2.	San Victor	10	10	0	100	350
3.	Chunox[1]	10	0	10	0	450
4.	San Pedro	7	0	7	0	312
5.	Louisville	10	0	10	0	450
6.	Santa Clara/San Roman*	0	0	0	0	910
7.	Cristo Rey/Yo Chen	11	0	11	0	600
8.	Chan Chen	8	0	8	0	368
	Subtotal	63	17	46	27%	3,770
	ORANGE WALK					
1.	San Antonio*	0	0	0	0	344
2.	Nuevo San Juan	6	6	0	100%	160
3.	San Luis	5	5	0	100	145
4.	Santa Marta[2]	7	0	7	0	271
5.	Santa Cruz[3]	4	0	4	0	147
6.	Chan Pine Ridge[4]	7	0	7	0	350
7.	Trinidad	7	0	7	0	600
8.	Douglas[5]	1	0	1	0	500
	Subtotal	37	11	26	30%	2,517
	TOTAL	100	28	72	28%	6,287

Notes:

* A Rudimentary Water System will be installed rather than handpumps in these two villages.

(1) Although 10 handpumps are planned for Chunox, problems are expected to be encountered due to the salinity of the soil.

(2) Although 7 handpumps are planned for Santa Marta, problems will be encountered due to low-lying areas.

(3) Although 4 handpumps are planned for Santa Cruz, the community is requesting a type of catchment system.

(4) Although 7 handpumps are planned for Chan Pine Ridge, problems are expected to be encountered due to salinity of the soil.

(5) Only 1 handpump is planned for Douglas since the community already has a good water tank. One problem anticipated will be to find a source of good water.

As of February 29, 1987.

LIST 3

Shortfall!

CARE INTERNATIONAL ✓ Villages presently involved or to receive assistance from VLWS. (Village level Water Sanital

DATA FROM PROPOSED FY89 - FY91 PROJECT SITES

	Name of Place	District	Population: 1980 (1987)	# of Families	PROJECT GOALS: H/Bd	Sanitation	Water	Remarks	
	Douglas	O.W.	453 (509)	126	X		X	Rehabilitation/Rxtension: of existing RWS	✓
	San Roman	"	352 (360)	73	X	X	X	Rehabilitate existing system(reservoir)	*
	San Lazaro	"	567 (700)	150	X	X	X	Rehabilitation/Extension: of existing RWS	✓
	San Felipe	"	585 (1000)	200	X	X	X	Rehabilitation/Rxtension: of existing RWS	*
5	August Pine Ridge	"	885 (1021)	243	X	X	X	Construct new RWS	*
6	San Estevan	"	978 (1075)	231	X	X	X	Rehabilitation/Extension: of existing RWS	✓ started
7	San Jose/ San Pablo	"	1164/638 (1300/780)	283/154	X	X	X	Construct new RWS JUST H/ED + SANITATION COMP.	*
8	Guinea Grass	"	1291		X	X	X	Rehabilitation/Extension: of existing RWS	*

4: 5 com.* ORANGE WALK DISTRICT

1	Copper Bank	Czl.	350 (280)	67	X	X	X	Rehabilitation of existing system(reservoir)	✓ started
2	Progresso	"	781 (911)	224	X	X	X	Construct new RWS	*
3	Xaibe	"	760 (868)	221	X	X	X	Construct new RWS /Tie in to Corozal mains:	*
4	Caledonia	"	942 (849)	225	X	X	X	Construct new RWS	*
5	Patchakan	"	700 (844)	192	X	X	X	Install handpumps	✓
6	Concepcion	"	608 (734)	186	X	X	X	Install handpumps	✓
7	Libertad	"	1518 (1283)	367	X	X	X	Rehabilitation/Extension: of existing RWS	*
8	San Narciso	"	1436		X	X	X	Construct new RWS	*

5 com.* 5 347* COROZAL DISTRICT

Key
for ✓ cure cover
* ~~to be~~ suggest UNICEF covera

(as of November 25, 1987)

DIST		LOCALITY	NO. OF HSEHOLDS	POP.	HOME LEVEL H/S SURVEY COMPLETED	C.D.VILL. PROFILE COMPLETED	VILL. HLTH. COMMITTEE FORMED	V.H.C FUNCTIONING	LATRINE PLAN OF ACTION COMPLETED	VILLAGE AGREEMENT SIGNED	LATRINES TARGETS	LATRINES COMPLETED*a	HANDPUMPS TARGETS	HANDPUMPS COMPLETED*a	
O	1.	Georgeville	72	432	X		6/87	X	X	9/87	21			RWS	
	2.	San Antonio	110	660	X	X	7/87	X	X	10/87	86			RWS	
	3.	Unitedville	64	398	X	X	11/86	X	X	4/87	39	9	11		4
	4.	Las Flores	57	336	X		12/86	X	X	1/87	62	50	6		
	5.	St. Margaret	55	251 *ed	X		12/86	X							
	6.	Blackman Eddy	64	320 *ed			7/87								
	7.	Ontario	93	558 *ed											
	8.	Tea Kettle	140	637 *ed											
	9.	Cristo Rey	70	427											
	10.	Valley of Peace	131	867	X	Too large for project									
	11.	Succotz	301	1477		No water supply problem. Not selected.									
	12.	Fishing Creek	296	1582		No water supply problem. Not selected.									
IZE	1.	Maskall	86	487	X		10/86							RNS	
AL	2.	Bermudian Landing	31	167	X	X	1/87	X	X	1/87	35	4	5		*b
	3.	La Democracia	30	177	X	X	1/87	X	X	1/87	32	16	5		1
	4.	Flowers Bank	24	109	X	X	6/87	X	X		20		3		
	5.	Lucky Strike	44	212	X										
	6.	Rockstone Pond	28	114	X										
	7.	Corozalito	18	97	X										
	8.	Santana	42	177	X										
	9.	Crooked Tree	91	497	X										
	10.	St. Ann	15	62	X										
	11.	Boston	87	132											
	12.	Scotland Half-Moon	15	90	X										
	13.	Biscayne	30	135		Not selected. Brackish water source; dispersed village.									
	14.	Williams Bank	22	72		Not selected. Difficult access.									
NI	1.	Silk Grass	74	444	X	X	2/87	X	X	3/87	67	24		RNS	
EK	2.	Georgetown	38	243	X	X	10/86		X	2/87	45	12	5		3
	3.	Maya Mopan	36	165	X	X	7/87	X	X	6/87	35	33	4		
	4.	San Roman	30	147	X	X	10/86	X	X	8/87	33	2	4		
	5.	Maya Center	15	98	X	X	8/87	X	X	11/87					
	6.	Hopkins	114	760	X		2/87	X							
	7.	Red Bank	33	178	X	X	8/87								
	8.	Santa Rosa	20	107	X	X	7/87								
	9.	Sittee Village	49	249	X										
	10.	Independence	311	1966		Too large for project.									
	11.	Cow Pen	92	313 *ed	X	No water supply problem. Not selected.									
TAL-		Selected Villages	1649	8731	27	12	13	13	12	11	490	150	43		8

*As of Nov. 3, 1987 *b=3 dry holes *c=To be determined *ed=Estimate

2. UNICEF LIST 5

A similar water supply and sanitation program is underway in the Toledo District with the support of UNICEF. Work is underway in 14 villages as per the following table:

Village	Pop.	Houses	Rehab. Wells	New Wells	Total No. Wells
Aguacate	228	46	0	3	3
Big Falls	323	57	7	5	12
Indian Creek	480	80	3	4	7
Laguna	205	50	2	3	5
Moho River					
San Miguel	227	43	3	2	5
Santa Theresa	164	31	0	3	3
Santa Elena	200	32	3	1	4
Forest Home	206	38	8	0	8
Pueblo Viejo	406	80	3	5	8
San Antonio	1017	220	4	12	16
San Jose	663	116	3	9	12
San Pedro Col.	905	145	3	12	15
Santa Cruz	448	95	2	6	8
Silver Creek	175	27	3	2	5
Other Villages	---	--	36	0	36
Total	5601	1060	80	67	147

LIST 6

TO: RAFAEL DIAZ, FAX # 502-5-531-5097 , MEXICO D.F. , MEXICO

FROM: K. KASPRISIN , BELIZE CITY, BELIZE
UNICEF

FOLLOWING ARE GEOGRAPHICAL AREAS LISTED IN ORDER OF PREFERENCE WITH # OF BENEFICIARIES AND OTHER COMMENTS. UNICEF - BZE CAN BE REACHED THROUGH PAHO FAX # 02-45536 OR PAHO TELEX 30917 OR TEL. #78795 OR #31085

1. THROUGH CARE INTERNATIONAL - TO PROVIDE SUPPLEMENTARY FUNDING TO CURRENT WATER AND SANITATION COMMUNITY INTEGRATED DEVELOPMENT PROGRAM IN 11 ADDITIONAL COMMUNITIES IN THE DISTRICTS OF ORANGE WALK AND COROZAL: (SEE ANNEX 1) MINISTRY SUGGESTS ADDING INDIAN CHURCH, POP. 1000, TO ORANGE WALK DISTRICT.

2. BELIZE DISTRICT RURAL THROUGH MINISTRY IN CONJUNCTION WITH OTHER UNICEF PROGRAM INCENTIVES

	BZ DISTRICT	
CROOKED TREE	750	RWS/SANT
SANDHILL	2006	RWS/SANT
BERMUDAN LANDING	300	RWS/SANT
WILLOWS BANK	200	HANDPUMP/SANT
DOUBLE HEAD CABBAGE	250	HANDPUMP/SANT
RANCHO DOLORES	180	HANDPUMP/SANT
TOTAL : 6 COM.	3686	

3. CAYO DISTRICT THROUGH MSF HOLLAND TARGETING REFUGEE POPULATION CAN CONSIDER WATER TANKS OR RWS THROUGH MINISTRY COMPLEMENTING US AID DECREASING INVOLVEMENT IN CAYO DISTRICT AND IMPLEMENTATION OF HEALTH ED. AND LATRINE - SANITATION COMPONENT THROUGH MSF (MEDICOS SIN FRONTERAS) HOLLAND - AS FOLLOWS:

CAYO DISTRICT- MINISTRY WITH MSF HOLLAND - COMPLEMENT TO US AID DIMINISHING PROGRAM.

COMMUNITY	# BENEFICIARIAS	COMMENTS
ARENAL	500	RWS BELIZEANS REFUGEES
BULLET TREE FALLS	850	" " "
ROARING RIVER	150	HANDPUMP

SEVEN MILES	450	RWS REFUGEES
SALINA AND LOS TAMBOS	200	HANDPUMPS REFUGEES
MANATIAL AND SANTA MARTA	500	" "
TOTAL: 8 COMM.	2650	

SUMMARY BY DISTRICT AND MY PREFERENCE:

1. ORANGE WALK: 6792 BENEFICIARIES

   COROZAL: 5347 "

2. BELIZE RURAL: 3686 BENEFICIARIES

3. CAYO: 2650 BENEFICIARIES

SE BE SURE TO INCLUDE COST OF HEALTH ED. COMPONENTS.

K YOU VERY MUCH - REGARDS - KATHY

LIST 7

xii. VILLAGES, BENEFICIARIES, CHARACTERISTICS, AND EQUIPMENT TO BE PROVIDED IN THE TOLEDO DISTRICT.

	VILLAGE	Pop.	#HH	EW	VIP	WSR	VIPR
1.	Corazon creek	102	14	-	-	2W+HP	14
2.	Jalacte	320	77	-	-	8W+HP	77
3.	San Marcos	216	28	2	-	1W+HP	28
4.	Crique Jute	196	49	1	-	4W+HP	49
5.	Golden stream	270	30	-	-	4W+HP	30
6.	Blue Creek	211	53	-	-	6W+HP	53
7.	Mother Earth	160	25	-	-	3W+HP	25
8.	Crique Troso	75	13	1	-	1W+HP	13
9.	Mafredi	180	27	2	-	1W+HP	27
10.	Silver Creek	205	35	5/5	-	-	35
11.	San Jose	702	116	5/12	92/116	7W+HP	24
12.	Sunday Wood	108	23	-	-	WCS	23
13.	Machakilas	99	27	-	-	WCS	27
14.	Otoxha	240	44	-	-	WCS+3W+HP	44
15.	San Benito Poite	350	60	-	-	WCS	60
16.	Dolores	153	30	-	-	WCS	30
17.	Elridgeville	250	43	3	-	RWS	43
18.	San Antonio	2500	400	15/16	-	RWS	400
19.	San Pedro Colombia	903	150	15/15	-	-	150
20.	Barranco	241	94	-	-	RWS	94
21.	Pueblo Viejo	450	80	5/8	3/3	3W+HP	80
22.	Santa Elena	200	34	2/4	-	2W+HP	34
23.	Santa Cruz	448	80	8/8	-	1W+HP	80
24.	Santa Teresa	164	33	2/3	-	1W+HP	33
25.	Laguna	205	50	5/5	0/50	-	50
		8948	1523			47W+HP 5WCS 3RWS	1523

Pop.....Population
#HH.....Number of households
EW.....Existing wells, installed/targeted
VIP.....VIP latrines, installed/targeted
WSR.....Water system required
VIPR.....VIP latrines required

August 11, 1989
File: HHydoge

ANNEX H

STATEMENT OF WORK AND REQUIRED QUALIFICATIONS FOR HYDROGEOLOGIST

BACKGROUND

The Rural Water Supply and Sanitation Program (RWSSP) of the Ministry of Natural Resources (MNR) of the Government of Belize (GOB) is involved in an extensive program of drilling wells for rural water supplies. For small villages, wells are fitted with handpumps and need provide only a low flow rate to meet the needs of the villagers. The wells for handpumps are therefore small and usually relatively shallow. For the larger villages, rudimentary water systems (RWSs) are constructed, consisting of a well, a pump, a generator or engine drive if power is not available, an elevated storage tank, and a piping system. RWSs require a greater flow rate from the well and thus the wells are usually larger and deeper.

While the success rate in drilling wells for use with handpumps has been over 80 percent, the RWSSP has experienced a success rate of only about 50 percent overall in drilling RWS wells, and a much lower success rate in some districts.

The technical assistance of an experienced hydrogeologist is desired for a period of approximately four weeks in an attempt to improve the success rate in drilling RWS wells. As secondary assignments, the hydrogeologist will also be required to give seminars on hydrogeology for the well drilling teams, to investigate water quality problems which have been encountered, especially salt water intrusion, and to review the status of hydrogeological information in the country.

STATEMENT OF WORK

The hydrogeologist shall work with and through the Master Well Driller and the National Coordinator.

Collection of Background Information

Prior to going to Belize, the hydrogeologist will be authorized to spend up to two days gathering background information. This information will include general hydrological and geological information on Belize, and satellite photographs, if these are deemed to be relevant. Aerial photographs of the entire country taken in 1964 and 1974 are available at a scale of 1:50,000.

Topographic maps are available at the same scale. The hydrogeologist shall determine if larger scale satellite photographs or maps are available and if so, make a determination of whether the increased scale justifies the cost of such photographs.

Consideration of Special Surveys

The hydrogeologist shall contact the RWSSP Program Manager, Douglas Wilson, and discuss the usefulness and practicality of special surveys such as resitivity surveys, seismic surveys, etc., in selecting well sites. Many of the areas of interest are characterized by Karst (limestone) formations. Water wells for RWSs are rarely less than 100' or more than 300' deep, typical depths being around 200'. If special surveys are deemed to be important, a list shall be prepared showing the equipment needed, whether it is available in Belize, and the approximate cost if it must be transported to Belize shall be prepared and submitted to USAID for approval. The cover letter shall discuss the amount of time that such special surveys will require and the extent to which they are likely to increase the probability of successfully finding water.

Orientation

Approximately the first week of the assignment will be spent in orientation. The hydrogeologist will: meet the various involved persons; will discuss well drilling problems with the well drilling crews; will review the available well logs, maps, photographs, and other data; will hold discussions with the Petroleum Unit of the MNR; will request additional data that is identified as being available; and will make an aerial reconnaissance of the RWS sites by helicopter or small aircraft if this is deemed to be helpful and if it can be arranged.

Field Inspections

During approximately the second week of the assignment, the hydrogeologist will visit about six RWS sites and will recommend sites for wells. For planning purposes, the RWS sites can be considered to be readily accessible and about one hour apart. Depending upon the information developed prior to the field inspection and the complexity of the sites, the hydrogeologist may be able to select sites for several RWSs in a single day. In this case, the field inspections may take no more than two or three days.

Seminars

The hydrogeologist shall prepare and give some short seminars to the well drilling crews on the practical aspects of hydrogeology, particularly on how hydrogeology affects water well drilling and

how hydrogeological information can be used effectively in water well drillling operations.

Water Quality

Some wells along the coast have produced water with objectionable concentrations of hydrogen sulfide. Other wells have drawn saline water, even at locations considerable distances inland from the coast. The hydrogeologist shall gather information on the wells which have had these problems, shall study the information to see what patterns exist, and shall write a brief letter report giving findings on the causes of these water quality problems and recommendations on how the problems may be avoided in the future.

Hydrogeological Data Review

The hydrogeologist shall review the hydrogeological data that have been found during the assignment and shall write a brief letter report discussing the information that is available, additional information that is desirable, and practical actions which might be taken to improve the quality of hydrogeological data that are available in Belize. The system used for collecting and filing well logs shall be discussed, and a comprehensive list of references shall be attached.

QUALIFICATIONS

The overriding qualification for the hydrogeologist shall be recent and extensive experience in selecting sites for water wells. Experience in Karst formations is desirable but not mandatory.

LEVEL OF EFFORT

It is anticipated that the services of the hydrogeologist will be required for a total of about four weeks, including the preparatory days in the U.S. Six day work weeks are authorized. This period may be extended somewhat if it is agreed that special surveys are desirable. The period of assignment may be reduced somewhat if the required work can be done in less time.

August 11, 1989
File: JMntInv

ANNEX J

STATEMENT OF WORK AND REQUIRED QUALIFICATIONS FOR MAINTENANCE AND INVENTORY MANAGEMENT TECHNICAL ADVISOR

BACKGROUND

The Rural Water Supply and Sanitation Program (RWSSP) of the Ministry of Natural Resources (MNR) of the Government of Belize (GOB) is involved in an extensive program of drilling wells for rural water supplies. The well drilling equipment that is available to the RWSSP is mostly old, from several different companies, and in some cases no longer manufactured. One of the major constraints in the rate of production of successful wells is the relatively large amount of time that the equipment is out of service for maintenance and repairs. Part of the down time probably is attributable to the manner in which mechanical repair work is organized, viz. virtually all repairs, even minor ones, are made by mechanics from the central shop. It is believed, however, that a larger constraint is the lack of ready availability of spare parts.

The services of a technical advisor with expertise in the management of maintenance and inventory systems is desired to assist the GOB in improving the timeliness, efficiency and effectiveness of its well drilling maintenance efforts.

STATEMENT OF WORK

The Maintenance and inventory management technical adviosr shall work with and through the RWSSP Program Manager, the National Coordinator, and the Administrator.

Review Existing Systems and Personnel

The maintenance and inventory management technical advisor shall review the methods currently used for: preventive maintenance scheduling; responding to unscheduled repair; stocking of frequently and predictably needed parts; ordering of parts needed for unscheduled repairs; numbers of available personnel; and qualifications of existing personnel. The historical records of maintenance and repairs actually performed shall also be reviewed. The maintenance management system in use by the Water and Sanitation Authority (WASA) shall be reviewed. Since WASA and RWSSP work closely together, the feasibility of using parts or all of the WASA system shall be considered.

Needs Survey

The technical advisor shall estimate the needs for: types of parts needed in inventory; annual budgets required for maintenance and repair, especially for purchase of parts; number of maintenance workers required; and qualifications of maintenance personnel, both in the central shop and within the well drilling crews. To the extent feasible, the estimated needs and the historical levels actually provided shall be compared to numerical data experienced elsewhere, i.e., in similar well-drilling operations elsewhere, among well drillers in the U.S. or to standard labor hour allowances provided by equipment manufacturers. The estimated needs, with supporting explanations, shall be presented in a brief letter report, shall be thoroughly discussed with RWSSP and USAID, and shall be adjusted as mutually agreed.

System Design

The technical advisor shall design systems for maintenance management and for inventory management and present a report describing them for review by RWSSP and USAID. The report shall include recommendations on at least:

Preventive maintenance systems.

Maintenance management systems, including the extent to which lower echelon maintenance should be performed by the drilling crews rather than the central shop.

Methods of controlling inventory of predictably needed parts and the sizes of the required inventories.

Systems for procuring parts for unscheduled repair. These systems must take account of the procurement requirements of USAID, the GOB, and WASA.

Additional training for maintenance and inventory control personnel, and the sources from which this additional training might be obtained, especially whether the required training is available in-country or must be provided or obtained from abroad.

Staffing of the maintenance and inventory efforts.

The supporting discussions of the proposed systems shall clearly explain how the proposed systems vary from current practices.

Implementation

To the extent feasible within the time allowed for the assignment, the advisor shall assist RWSSP in implementing the maintenance and inventory management systems. At the conclusion of the assignment, the advisor shall write a brief letter report discussing the advisability of further technical assistance for implementing and/or evaluating the maintenance and inventory management systems.

QUALIFICATIONS

The maintenance and inventory management technical advisor shall have hands-on experience in designing, implementing and operating maintenance and inventory systems for operations involving numerous pieces of mechanical equipment, such as an automobile or heavy equipment repair shop.

Experience with well drilling equipment or U.S. government or USAID procurement practices is desirable but not mandatory.

LEVEL OF EFFORT

The technical advisor will be required for a period of four weeks to produce a report on maintenance and inventory systems and to review it with RWSSP and USAID. If possible, some implementation might be started during this period. A second assignment at a later date, or an extension of the assignment, may be required to assist with implementation or evaluation of the systems.

August 11, 1989
File: KFerroCe

ANNEX K

FERRO-CEMENT WATER STORAGE TANK [illegible]LOGY DEMONSTR

The Ferro-Cement Technology Opprotuni

Inexpensive water storage tanks co [illegible]ratically i: [illegible]e the
economic attractiveness and thus the [illegible]il t[illegible] of [illegible]ater
supply technologies in Belize: ra: [illegible]to me[illegible]t sy [illegible]and
rudimentary water supplies (RWSs).

Rainwater catchment systems are wide[illegible]lice. Ra[illegible]ater
catchment systems may be the only [illegible]technol[illegible]dam
obtaining a water supply in some cas[illegible]where t[illegible]e is
no potable groundwater or the grou[illegible]emely di[illegible]built
to reach, for small groups of users [illegible]or two [illegible]uses,
or houses which are only occupie[illegible]and fo[illegible]emote
areas which cannot be conveniently r[illegible]r[illegible]easy
the mountains or the cayes). Since [illegible]of a [illegible]build
catchment system is the storage tank[illegible]ch rec[illegible]
cost of storage tanks increases [illegible]ateress[illegible]
technology and the likelihood of it b[illegible]sustai[illegible]

Water storage tanks are a major cos[illegible]of RWS[illegible]
Anything which reduces the cost of [illegible]incr[illegible]the
number of RWSs that can be built wit[illegible]fund[illegible]the
likelihood that villagers will e[illegible]sys[illegible]and
provide more storage as the needs of [illegible]ow.

Ferro-cement tank technology appears [illegible]opp[illegible]y to
reduce the cost of storage to somewh[illegible][illegible][illegible]co[illegible]
of conventional storage in galv[illegible][illegible]r[illegible]
conventionally built concrete tanks. [illegible]cos[illegible]
data provided in Annex L, small gal[illegible][illegible]t[illegible]
the range of $0.60 to $0.72 U.S. p[illegible][illegible]SA[illegible]
funded ground-level conventional [illegible][illegible]th[illegible]
Georgeville RWS cost $0.76 U.S. per [illegible][illegible]ast[illegible]
reported prices for ferro-cement tank[illegible]ran[illegible]0.[illegible]
to $0.31 U.S. per U.S. gallon.

The Proposed Program

Ferro-cement water storage tanks [illegible]ave [illegible]bee[illegible]built [illegible]era[illegible]
places in Belize, but the technology [illegible]as not ye[illegible]. been [illegible]ciae[illegible]
to the point that it is regularly c[illegible]nsidered [illegible]hen wa[illegible][illegible]stem
are being planned. This project [illegible]ill therefore[illegible]i[illegible]duc[illegible]e th
construction of several tanks in varicus sizes and will emph[illegible]asis

documentation of construction methods and costs, and the dissemination of this information.

The project will include the construction of about three rainwater catchment tanks of about 1,000 gallon capacity and one tank on the scale of a RWS tank, say in the range of 5,000 - 10,000 gallon capacity. To the extent feasible, these tanks should be included in existing programs. In particular, the large storage tank should be included in one of the RWS systems that RWSSP is constructing so that both the RWSSP and the public become familiar with the technology.

A major component of the project should be the careful documentation of the materials costs and the labor hours required to construct each tank. The documentation should include photographs showing each stage of the construction. The dissemination of information should include publication of a small booklet showing the construction methods and estimating the costs, and emphasizing that this technology is suitable for Belize. Large signs should be posted at the sites and the sites should be chosen so that they are both representative of typical conditions in Belize and are highly visible.

Ferro-cement technology is well proven elsewhere and has already been used to a limited extent in Belize, but the technology has not yet been popularized to the point that it is regularly considered when water systems are being planned. The Peace Corps is reported to have built an 8,000 gallon ferro-cement tank at Crique Sarco and a 3,000 gallon tank at Laguna village in Toledo District. A Peace Corps Volunteer named David White is said to have been doing some ferro-cement tanks out of Punta Gorda.

Mr. Be Meyer of MSF/Holland has a series of slides of 800 and 1500 gallon ferro-cement tanks built by a Belizean contractor. This contractor had built a reusable set of wooden forms for use in building these two tank sizes, and claimed to have built a 16,000 gallon tank.

Intermediate Technology Publications of London, England publishes a book on how to build ferro-cement water tanks and the Peace Corps may have developed written materials of its own.

The documentation and dissemination elements of this project will make knowledge of the ferro-cement technology more widespread in Belize.

Executing Agency

Three potential executing agencies have been identified: RWSSP, a private contractor, and Peace Corps.

RWSSP would be the ideal agency for building the RWS-scale tank since this agency is responsible for overseeing the construction of RWSs throughout the country. Assuming that there were no serious problems during the construction of the tank and that the cost savings were obvious, it is assumed that the RWSSP would use this technology on many or most future systems where the storage tanks can be located on ground level. Construction of elevated ferr-cement tanks is more difficult and is not recommended for demonstration at this time. This would result in significant cost savings over numerous projects.

RWSSP does not build rainwater catchment systems so it is not a good organization to demonstrate ferro-cement technology at the smaller scale.

The rainwater catchment-scale tanks could be built by a private contractor, but it may be difficult to get such a contractor to document the costs and to publicize the work. A private contractor might, however, be asked to team up with the Peace Corps, with the Peace Corps handling most of the publicity part of the work.

Another alternative might be to offer to subsidize a portion of the costs of the costs of having the work done by a private contractor where a villager is willing to pay part of the costs, i.e., some sort cost sharing program might be worked out.

The final candidate to do the work is the Peace Corps. The advantages of using the Peace Corps are that they have already done some of this type of work, that they are prepared to work on a small scale, and that they are likely to be effective at documenting and disseminating information about the project. The disadvantage of the Peace Corps is that the volunteers are in Belize only for relatively short periods of time and that the organization is not Belizean.

The means of implementing the ferro-cement technology demonstration should be resolved between the RWSSP and the USAID project manager.

August 11, 1989
File LCosts

ANNEX L

COST DATA FOR WATER AND SANITATION FACILITIES

This annex contains miscellaneous cost data which may be of use in estimating the costs of proposed facilities. In some cases, there are considerable differences in the estimates of costs. In all cases, considerable judgement should be used in interpreting the data.

Following the data below are seven pages (numbered 6-1 through 6-7) taken from "Preliminary Investigation of Water Source Availability and Development Potential Belize, C.A.", which was prepared by Hydrology Consultants in 1979 for CIDA. These pages give a breakdown of well drilling costs, but assume 2,000 hours per year. If this assumption is changed to only 1,000 drilling hours per year, the unit costs for well drilling are double those shown.

All costs are in U.S. dollars, unless otherwise noted.

All gallons are U.S. gallons, not Imperial gallons.

WELL COMMODITIES

Steel Casing

Note: The well drilling practice in Belize is to pull the steel casing that is driven as a well is drilled with a cable tool rig, leaving only the PVC casing in the completed well. It is estimated that about 90 percent of the steel casing is recovered from handpump wells but that only 30 percent is recovered from the deeper and larger wells that are drilled for RWSs.

Daryl Bartholomew:	6"	$10.00 per foot.
USX Invoice	8-5/8"	$28.69 per foot.

Plastic Casing

Daryl Bartholomew:	4"	$7.00 per foot.
USX Invoice	4"	$3.33 per foot.
" "	5"	$4.35 per foot.

Screens

Daryl Bartholomew:	4"	$15.00 per foot.
USX Invoice	4"	$5.66 per foot.
" "	5"	$9.66 per foot.

Note: The USX invoice was dated March, 1988. The prices shown include 15.4 percent for ocean freight and insurance.

HANDPUMPS

Mantra Intl., Inc. invoice to UNICEF dated 31 May 1989, including freight from Panama, for an order of 30 India Mark II handpumps:

$421.75 per handpump.

For the well for the handpump, assume that 100' of 4" PVC casing @ $3.33 per foot = $333.00 and 10' of 4" PVC screen at $5.66 per foot = $56.60 will be provided for a total commodity cost for the well of $389.66.

The total materials cost for a handpump well installation thus is $811.41. Including some allowance for lost steel casing, drill bits, and tools and spare parts for repair of the handpumps, a total allowance of $1,000 for the commodities in a handpump well installation might be appropriate.

CARE: $2,500 each. 102 installed.

POWERED PUMPS

Submersible Electric Pump

Generator

Diesel Driven Pump

PUMP HOUSES

USAID paid for the commodity costs of the pump house at Georgeville. It appears to be a typical installation.

STORAGE TANKS

Ground Level

Be Meyer of MSF/Holland reported the following costs for ferr.-cement tanks built by a private contractor:

800 gallons for $175 = 0.22 per gallon
1,500 gallons for $375 = $.25 per gallon

Roland Rivers, RWSSP:

Crique Sarco. 8,000 gallons for $2,500 = $0.31 per gallon. This was a Peace Corps project.

Sam Dowding, USAID:

Georgeville. 20,000 gallons for $15,250 = $0.76 per gallon.

Elevated

Silk Grass. 7,000 gallons for $18,500 = $2.64 per gallon.
Santa Clara/San Ramon 20,000 gal. for $60,000 = $3.00 per gal.

Galvanized Steel

MSF/Holland:

500 gallon for $360 = $0.72 per gallon
1,000 gallon for $600 = $0.60 per gallon

PIPE

MSF/Holland: 4" PVC $2.00 per foot.

RUDIMENTARY WATER SYSTEMS (RWSs)

Unless otherwise noted, the costs are for materials only. The community provides all labor.

From Douglas Wilson:

Seine Bight	$100,000
Hopkins	$100,000
Gale's Point	$50,000

These are estimated costs for systems not yet built.

From Sylvano Guerrero:

San Antonio	$50,000
Santa Clara/San Roman	$75,000
Douglas	$35,000 (Rehabilitation of ext. system)

LATRINES

MSF/Holland: $95 for elevated latrines; $67.50 for regular ones. These costs are only for the materials in the base. The villagers provide all labor and the materials for the superstructures.

CARE: $90 for regular (ground level) latrines. 1150 built.

MISCELLANEOUS

Sack of Cement

Concrete Blocks MSF/Holland: $0.35 Each.

ANNEX L. (Cont.)

Hydrology Consultants 1979 CIDA

1.0 DRILLING COSTS

1.1 Assumptions

1. Utilize existing drilling rigs
2. Base cost of rig - $45,000.BZ = $25,862.CDN
3. Base cost of trucks - $15,660.BZ = $9,000.CDN
4. Depreciate over 10 years
5. Operate rig for 2000 hours per year
6. Currency conversion $2.00BZ = $1.15CDN
   $1.74BZ = $1.00CDN
7. Base year of estimate - 1979
8. Inflation factors - estimate Canada 10% per annum
   Belize 15% per annum

1.2 Annual Fixed Costs - Rig

	BELIZEAN	CANADIAN
1. Depreciation - 10% of rig cost	$ 4,500	$ 2,586
2. Repairs - 75% of depreciation	3,375	1,940
3. Investment - 10% of rig cost	4,500	2,586
TOTAL	$12,375	$ 7,112

1.3 Annual Fixed Costs - Vehicles

1. $0.30 per mile for 20,000 miles incl. depreciation, insurance, fuel, repairs.	10,440	6,000

1.4 Fixed Hourly Costs

1. Rig - $12,375 ÷ 2000 hrs.	6.19	3.56
2. Fuel - 0.75 gal/hr x $3.00BZ	2.25	1.29
3. Lubrication - 50% of fuel cost	1.13	0.65
4. Vehicles - $10,440 ÷ 2000 hrs	5.22	3.00
TOTAL EXCLUDING WAGES	$14.79	$8.50

	BELIZEAN	CANADIAN
1.5 Annual Wages	$	$
1. driller	6,600	3,793
2. helpers (2)	7,000	4,023
3. overhead - 25%	3,400	1,954
TOTAL	17,000	9,770
TOTAL PER HOUR	6.81	4.89
4. Annual Subsistence	4,000	2,299
Hourly Subsistence÷(48x48)	1.74	1.00
1.6 Summary		
1. Fixed hourly cost-rig, vehicle	14.79	8.50
2. Hourly wages	6.81	4.89
3. Hourly subsistence	1.74	1.00
TOTAL HOURLY COST	23.34	14.39
1.7 Approximate Cost of Drilling		
1. Assume average drilling rate of 1½ ft/hr		
2. Cost per foot of well	15.56	9.59
1.8 Total Annual Cost per Rig		
1. Fixed cost - rig	12,375	7,112
2. Fuel	4,500	2,586
3. Lubrication	2,250	1,293
4. Wages and overhead	17,000	9,770
5. Subsistence	4,000	2,299
6. Fixed cost - vehicle	10,440	6,000
	50,565	29,060

2.0 COST OF SERVICE RIG	BELIZEAN $	CANADIAN $
2.1 Assumptions		
1. As per 1.1		
2. Cost of rig	26,100	15,000
2.2 Annual Fixed Costs		
1. Depreciation 10% of rig cost	2,610	1,500
2. Repairs - 75% of depreciation	1,958	1,125
3. Investment - 10% of rig cost	2,610	1,500
4. TOTAL	7,178	4,125
2.3 Fixed Hourly Costs		
1. Service rig - 7178 ÷ 2000	3.59	2.06
2. Fuel - 0.75 gal/hr x $3.00BZ	2.25	1.29
3. Lubrication - 50% of fuel cost	1.13	0.65
TOTAL EXCLUDING WAGES	6.97	4.00
2.4 Annual Wages		
1. Pump repair man	5,600	3,218
2. Helper	3,500	2,011
3. Overhead - 25%	2,275	1,307
TOTAL	11,375	6,536
TOTAL PER HOUR	5.69	3.27
4. Annual Subsistence	2,700	1,552
Hourly subsistence ÷ (48x48)	1.17	0.67
2.5 Summary		
1. Fixed hourly cost	6.97	4.00
2. Wages	5.69	3.27
3. Subsistence	1.17	0.67
TOTAL COST PER HOUR	13.83	7.94

	BELIZEAN	CANADIAN
2.6 Total Annual Cost for Rig	$	$
1. Fixed cost - rig	7,178	4,125
2. Fuel	4,500	2,586
3. Lubrication	2,250	1,293
4. Wages	11,375	6,537
5. Subsistence	2,700	1,552
TOTAL	28,003	16,093

3.0 COSTS OF CASING AND SCREENS

1. 6 inch steel pipe - $4.90/ft.CDN ($8.53BZ - $13.00BZ fob BZ)
2. 6 inch plastic pipe - $7.51/ft. CDN
3. 6 inch plastic screen - 10 ft. @ $500.CDN
4. 4 inch plastic pipe $5.00/ft. CDN
5. 4 inch plastic screen 10 ft @ $300CDN

4.0 APPROXIMATE COST OF DRY HOLE

1. Assume 100 ft. deep - casing recovered		
2. Cost	1,556	959

5.0 APPROXIMATE COST OF SUCCESSFUL HOLE

1. Assume 70 feet deep		
2. Drilling cost 70 x $15.56/ft	1,089	671
3. Casing cost 70 x $13/ft	910	523
4. Pipe slotting 10ftx$7/ft	70	40
5. Materials	20	12
TOTAL	2,089	1,246

		BELIZEAN $	CANADIAN $
6.0	ESTIMATED COST OF PUMPS		
6.1	Hand Pumps	696	400
6.2	Submersible pumps up to 50 gpm from 60 ft.	3,480	2,000
6.3	Windmill driven pump up to 5 gpm	2,610	1,500
6.4	Diesel or gasoline driven pump		
	1. Motor	6,000	3,448
	2. Converter	1,000	575
	3. Pump	500	287
	TOTAL	7,500	4,310

Gasoline motors are likely to be 50% cheaper than the estimated price but present a greater hazard to groundwater quality if the fuel is improperly handled.

7.0	OTHER ASSOCIATED COSTS		
1.	Pump base for hand pumps	20	12
2.	Pump housing - Type 1 - submersibles	3,480	2,000
3.	Pump housing - Type 2 - diesel driven	500	287
4.	Well appurtunances	200	115
5.	Connection - well to reservoir	500	287

8.0 COST OF RESERVOIRS

Variable - depending on capacity
could be in range of $2.00 to $5.00/gallon
Reservoirs should be sized to provide for the 20 year maximum day demand and for small emergencies in the following manner:
20 year population x 20 year average day demand (ie. 20 Igpcpd) x 2 = reservoir capacity in Imperial gallons
Each system will require a design to meet local conditions and constraints. A minimum system pressure of 10 psi is suggested.

		BELIZEAN	CANADIAN
		$	$
9.0	COST OF TEST PUMPS (2)		
	1. Pumps (2) - 50 gpm from 60 ft	7,064	4,060
	2. Portable generators (2)	3,480	2,000
	3. Spare parts	3,532	2,030
	TOTAL	14,076	8,090
10.0	COST OF SPARES FOR RIGS		
	1. Bucyrus Erie 22 W's	17,400	10,000
	2. Edeco's	17,400	10,000
	TOTAL	34,800	20,000
11.0	COST OF VEHICLES (3)		
	1. 3/4 ton, four-wheel drive pickups $9,000 each	46,980	27,000
12.0	COST OF PARTS FOR HAND PUMPS		
	1. Assume 25% of capital cost/well	174	100
13.0	ANNUAL COST OF LABORATORY CHEMICALS		
	1. Estimate $1,000CDN/yr	1,740	1,000
14.0	ANNUAL SALARY COSTS - OFFICE		
	1. Program Manager	10,000	5,747
	2. Program Hydrogeologist	8,000	4,600
	3. Drilling Maintenance Superintendent	8,000	4,600
	4. Water Resources Technical	4,000	2,300
	5. Subsistence	3,000	1,724
	6. Overhead - 25%	8,250	4,743
	TOTAL	41,250	23,714

15.0 ESTIMATE OF FREIGHT, TRANSPORT AND INSURANCE COSTS

- estimate $0.33/ton mile including transfers and insurance
- distance to Belize is approximately 3,700 miles
- estimated cost factor - $1,230/ton
- casing to be purchased in U.S.A. at estimated transportation cost of $615/ton

		BELIZEAN	CANADIAN
1.	Service rig est. 3 tons	$ 6,421	$ 3,690
2.	Test pumps, spares, generators est. 1 ton	2,140	1,230
3.	Pick up trucks (3) est. 6 tons	12,841	7,380
4.	Spare parts for rigs est. 4 tons	8,561	4,920
5.	Casings: steel 1000 ft at 14 lbs/ft est. 7 tons	7,482	4,300
	plastic 3000 ft at 2.5 lbs/ft est. 4 tons	4,280	2,460
6.	Hand pumps 50 at 120 lbs est. 3 tons	6,421	3,690
7.	Spares for hand pumps est. ½ ton	1,079	620
8.	System well pumps est. 1 ton	2,140	1,230
	TOTAL	$51,365	$29,520

August 11, 1989
File: MHealthW

ANNEX M. DESCRIPTIONS AND ACRONYMS FOR HEALTH WORKER ROLES

Presented below are descriptions of the roles of various persons and/or groups who participate in health activities and/or community development, and the acronym used for them, if any.

DHT — District Health Team. A large district-level committee consisting of program managers from government ministries and non-government organizations involved in health or community development activities.

DCC — District Core Committee. A sub-group within the DHT made up of the program managers who implement the plans of the larger DHT.

District Implementing Team. The local sub-unit of RWSSP. Consists of the District Coordinator, a Health Educator, a Carpenter/Foreman, and a three man well drilling crew.

DC — District Coordinator. In charge of the RWSSP District Implementation Team.

DT — District Trainer. District-level staff of MOH/PHC Division, responsible for CHW training and DCC orientation to their roles in the training of CHWs.

DHE — District Health Educator. District-level staff of 1) RWSSP, responsible for community health education activities & mobilizing community participation related to RWSSP program; & 2) MOH /HECOPAB, responsible for health education for the district.

CHW — Community Health Worker. A volunteer selected by the community to provide certain PHC services to the community It is intended that there be at least one CHW per village. CHWs are trained by the District Core Committee (DCC) (in actuality, often by NGOs). An important component of the national PHC strategy.

VC — Village Council. A locally elected volunteer body representing the community in most interactions with higher level government and/or other agencies. Tends to be polictical. VHCs were established in an attempt to avoid the polarization that marks the Village Councils.

VHC — Village Health Committee. A locally elected volunteer body representing the community, and facilitating their intervention, in issues concerning health and community development.

CHE — Chief Health Educator. Head of health education component of RWSSP, responsible for planning, implementation and evaluation of health education activities, including training and technical supervision of RWSSP DHEs.

PHI — Public Health Inspector. MOH/EHS staff, responsible for a wide range of environmental health inspections.

PT — Principal Trainer. MOH/PHC Division staff responsible for technical assistance to, and training of, DTs.

ANNEX N

STATEMENT OF WORK
EXTENSION OF WATER AND SANITATION ACTIVITIES
FY 1989-1991

OBJECTIVE: The objective of this activity is to improve the capacity of the Ministry of Natural Resources (MNR) in Belize to plan, implement and sustain a rural water and sanitation program. The purpose of the activity is to define a program of assistance to be financed by USAID for approximately two fiscal years, with the above objective in mind.

SCOPE OF WORK: A three person team of technical consultants, to be supplemented by USAID/Belize, and MNR staff in Belize, required to achieve the above stated purpose of the activity. The consulting team will comprise a sanitary engineer, an economist/financial analyst, and a community [illegible] specialist. One member of the team will be designated team leader, who will be responsible for coordinating the team's work and ensuring that the product is complete.

The product of the team will be a project paper (PP) amendment to be prepared in consultation with USAID/Belize and the Ministry of Natural Resources. The team will meet with and interview personnel in the MNR and other governments departments as necessary to obtain information on the sustainability of current Water and Sanitation Program. The team will be available of all applicable reports, including but not limited to the recent Project Evaluation report and recent short-term consultants' reports. An illustrative Table of Contents is included as an Annex to this Statement of Work.

The members of the team will perform the following specific tasks:

a) Sanitary Engineer

- review project documentation related to the implementation of the water and sanitation programs

- discuss as needed, including taking field trips, w MNR staff to determine the status and requirements the program for its sustainable development;
- define in coordination with MNR, USAID and other appropriate agencies the strategies and program activities in water and sanitation, to be accomplis in the next two years with USAID FUNDING.
- draft and finalize the Technical Analysis and Proje technical description sections of the PP Amendment collaboration with other team members as necessary

b) Economist/Financial Analyst Tom Murray.

- review technical plans, proposed and alternative c with the sanitary engineer and community developme specialist,
- discuss costs with the MNR USAID and Ministry of Finance within the macro-economic context of Belize
- develop a comparative analysis of recurrent costs including an examination of cost containment option and further, an economic analysis including annual analyses,
- determine the financial and economic sustainability the project.

c) Community Development Specialist

- review community development and health education activities conducted to date, and recommendations for the future,
- discuss with pertinent personnel, including taking field trips, in order to determine needs and acceptability of various options for community development/health education support to the project,
- in collaboration with other team members, MNR and USAID, define or elaborate a community strategy whic leads to accomplishment of the project's goals.
- draft description of future activities in this area necessary to complement the technical water and sanitation efforts, an assessment of institutional readiness to implement and maintain the CD/HE progr and a social soundness analysis,
- analyze from available information the impact the program is likely to have on women's participation livelihood.

In addition to specific technical tasks, the team leader wi coordinate the completion of the PP, and to this end will assign additional writing tasks which are not covered by AID and MOH personnel to other team members as appropriate.

A project review panel comprising MOH and USAID personnel will be established to provide guidance and comments to the team in the project development process.

QUALIFICATIONS: Each consultant shall possess an advanced degree in his/her specialty, over five years experience in the field of development, and AID project design or project evaluation experience. Demonstrated excellent writing skills are essential. Preference will be given to consultants who have long-term field experience in underdeveloped countries, and evaluation or work experience with U.S. PVOs.

The Sanitary Engineer must be skilled in organizational analysis of rural water and sanitation programs. To this end, it is expected that this expert will have credible experience with water well-drilling equipment and organizations, and water systems construction programs.

REPORT: The report of this consultancy will be the PP amendment of which a complete draft will be left with USAID/Belize and the MNR at the end of the consultancy.

LEVEL OF EFFORT: The Sanitary Engineer and community development specialists will each be required for 24 workdays, and the economist for 15 days. Six-day work weeks are authorized. Two days at the beginning of this consultancy may be allotted for team planning sessions and for familiarizing consultants with the Water and Sanitation for Health (WASH) Project.

ILLUSTRATIVE BUDGET

1. Consultants Fees

   a) Sanitary Engineer — 24 X
   b) Community Development Specialist — 24 X
   c) Economist/Financial Analyst — 15 X

2. Overhead

3. Travel

4. Per diem a) Belize 74 days x $96.00

5. Miscellaneous Costs (DBA, FICA, Telephone, Ground Transportation Computer rental Local Secretarial Services)

INCREASED PRODUCTIVITY THROUGH BETTER HEALTH
PROJECT NO. 505-0018
PROJECT PAPER AMENDMENT
WATER AND SANITATION ACTIVITIES

I. SUMMARY AND RECOMMENDATIONS

A. Recommendations
B. Project Description and Financial Plan Summary
C. Project Issues Summary
D. Project Development Team

II. PROJECT DESCRIPTION

A. Background

(i) Country Setting - Geographic/Demographic
- Social Profile
- Macro Economic Picture
- Sectoral Economic Problems

B. Project Description

(i) Goal and Purpose
(ii) End of project status
(iii) Project Activities
(iv) Outputs
(v) Inputs (AID and GOB)
(vi) Financial Plan (AID and GOB)

C. Project Relationships

(i) to GOB plans
(ii) to USAID plans
(iii) to other donor plans

III. Project Analyses

A. Institutional Analysis

(i) Institutional Background and Organization
(ii) Management Analysis
(iii) Planning and Monitoring
(iv) Procurement

B. Financial Analysis

(i) Financial Plan
(ii) Recurrent Costs
~~(iii) Cost containment~~

C. Economic Analysis

(i) Project Costs and Benefits
(ii) Quantification of Benefits
(iii) Economic Analysis
(iv) Sensitivity Analyses

D. Social Soundness Analysis

(i) Project Beneficiaries
~~(ii) Use of Voluntary Collaborators~~ (Sector program only)
(iii) Cultural Feasibility of ~~Project~~ Community ~~Level Interventions~~ Involvement
(iv) Role of Women
(v) Benefits of Women to
(vi) Community Organization

E. Technical Analysis

(i) Technical Feasibility of Services
(ii) Analysis of Technologies Selected
(iii) Long-term Sustainability and Impact

F. Environmental Analysis

G. Project Issues

IV. Project Implementation

A. Monitoring

B. Evaluation

C. Procurement Plan

(i) Responsibilities
(ii) Procedures
(iii) Source and Origin
(iv) Local Cost Financing

D. Financing and Disbursement Procedures

E. Implementation Schedule

V. Conditions and Covenants

A. Conditions Precedent

B. Covenants

August 11, 1989
File: QPolicy

ANNEX Q

SUGGESTED MODIFICATIONS OF THE NATIONAL POLICIES FOR THE CONSTRUCTION AND MAINTENANCE OF WATER SUPPLY AND SANITATION SYSTEMS

The July, 1989 draft of the National Policies follows this note. It has been marked up to show suggested modifications.

Where these are short and simple, e.g., typographical changes, the suggested modifications have been marked directly on the text.

Where larger modifications are suggested, they have been typed below inside quotation marks, and are labled as inserts. The locations of the inserts are marked in the text of the National Policies.

Some notes are also included below, but are not in quotation marks and generally reflect issues for thought and discussion rather than additions to be made to the National Policies.

*****

The pages should be numbered for easy identification.

Insert 8:

"The basic tenet of the MNR documentation will be that the Boards of Management are independent and are expected to be self-reliant, that they have full authority to set rates, collect fees, and take action such as disconnecting persons who do not pay, and that they have the responsibility for mobilizing money, labor and whatever other things are required to keep the system in operation."

Note 9:

There seems to be a lack of understanding of the difference between a "built-up" privy and a composting privy. Privies are "built-up" when there is a high ground water table so that the excreta are a minimum of one meter above the groundwater table, or where thre is rock and it is difficult to dig a pit. Composting privies can have the same general form but are intended for holding the wastes for a long period of time to render them suitable for agricultural use. As noted in Section

III. G., the author questions whether the compost will actually be used in Belize.

Note 11:

The concept of giving the village mechanic a set of tools appears to have been borrowed from a World Bank model that pertains to very poor societies. Since virtually every Belizean village has at least a few automobiles, and since these are repaired in most cases by the owners, there is sure to be an adequate supply of tools in the village for repairing handpumps.

Note 11A:

Since District Maintenance Teams are supposed to cover two districts each, they will be receiving orders from two District Coordinators. Some means will have to be worked out to coordinate the two sets of orders.

Note 12:

The author questions whether a computer is needed and whether it will actually speed up the process, especially since it is likely to be located in Belize City, far from the District Coordinators who process and act on the information.

Note 12A:

The District Public Health Inspectors have difficulty getting the desired samples and sending them to the laboratory because of lack of transport. Consideration might be given to asking the National Malaria Control Program to assist with sampling since they are better equipped with transportation and regularly visit the villages anyway.

ANNEX D. (CONT.)

NATIONAL COORDINATING COMMITTEE

ON

WATER SUPPLY AND SANITATION

NATIONAL POLICIES

FOR THE

CONSTRUCTION AND MAINTENANCE

OF

WATER SUPPLY AND SANITATION SYSTEMS

July 1989

I. GENERAL:

A. Guidance

1. These policies cover:

- the establishment and composition of a National Coordinating Committee;
- the drilling of wells;
- installation of handpumps (HP);
- construction of rudimentary water systems (RWS);
- construction of rainwater catchment systems;
- construction of sanitation latrines;
- maintenance systems for all of the above; and
- water quality analysis and treatment.

2. These policies do not govern the construction of hand dug wells. However, projects which are implemented under these policies in villages where hand dug wells exist, shall provide educational programs on the protection, improvement and sanitation of those hand dug water sources.

3. Health Education efforts covering, at a minimum, the community participation and technical modules of the Health Education manual, shall be conducted in every community prior to any construction of water supply and/or sanitation systems, and shall continue throughout the life of the project. After project termination, HECOPAB shall continue to support health education programs in the villages. Each project developed in the water and sanitation area shall provide technical assistance resources to train and develop local capability in this area. The HECOPAB should be central to coordinating and implementing all HE/CD aspects of the W/S projects.

4. Each beneficiary community shall establish a Village Health Committee (VHC) which shall function under the auspices of the National Primary Health Care Committee (NPHCC), and be integrated within the District Health Team (DHT) structure. The projects will assist the villages to establish their VHC where none exists. Where a VHC already exists, the projects will cooperate with and strengthen it. The VHC shall sign a written agreement with the Government of Belize before any construction activities start in the village. The terms of the written agreement will outline the

responsibilities of the two parties (GOB/VHC), and the contributions by the parties. Each agreement shall include community participation in construction and maintenance of all systems (HP, RWS, latrine) installed through the program.

5. A maintenance program shall be developed for all water and sanitation systems constructed under the provisions of this policy. The program will be applied nation-wide.

6. When villages identify their needs for water and sanitation on their own, these needs shall be made known in writing firstly to the Ministry of Natural Resources, through the District Coordinator. Letters identifying needs at the village level may be copied to the funding agencies operating in those areas if the funding agency has already been consulted by the community.

7. Prior to the drilling of any wells, every attempt will be made to base the site selection on available hydrogeological data.

8. Each project supporting drilling shall assist with the development of hydrogeological mapping using data obtained from the drilling logs. Copies of all well logs, from both successful and unsuccessful well shall be sent to RWSSP. RWSSP shall develop a filing system for these well logs.

B. Conditions:

1. Community participation in the planning, construction, and health education phases of these projects is essential to successful installation and usage of physical outputs.
2. When the drilling of wells, or construction of RWS reservoirs on private property cannot be avoided, the MNR will execute a written agreement with the land-owner acquiring the specific piece of land as public property, and providing compensation to the land-owner at rates prescribed under existing law.

3. The national maintenance program elaborated in Section IV of this document, must be followed and supported by all projects implemented under these guidelines.

II. COORDINATION AND MANAGEMENT:

A. Committee

1. Policy:

a) A National Coordinating Committee on Water Supply and Sanitation shall be established for the following purposes:

(i) to coordinate financial, technical and human resources in order to ensure adequate and equitable clean water and sanitation coverage to the rural population of Belize;

(ii) to share information on technical, administrative and policy matters arising from implementation of individual projects or originating from donor organizations that are of interest to other members;

(iii) to study implementation issues common to all projects or affecting the national program which arise during project implementation, and to recommend solutions to the GOB and donors;

(iv) to collaborate, to the fullest extent feasible, on baseline data gathering, program monitoring, and evaluation with the intention of developing comparable indicators and data to measure national progress.

b) The committee shall be comprised of representatives from the Government of Belize, Donor Agencies, and private voluntary organizations involved in water and sanitation projects in Belize. Representatives shall be as follows:

(i) Government of Belize:
- Ministry of Natural Resources
- Water and Sewerage Authority
- Medical Officer of Health (Environment)
- Health Education and Community Participation Bureau
- Water Quality Laboratory
- Ministry of Labour and Social Services (Community Development).
- Ministry of Education
- Bureau of Standards

(ii) Donors:
- United States Agency for International Development (USAID)
- United Nations Children's Fund (UNICEF)
- United Nations High Commissioner for Refugees (UNHCR)
- Peace Corps

(iii)Private, and Voluntary Organizations (PVOs)
- Cooperative for American Relief Everywhere (CARE)
- Medicos sin Fronteras/Holland (MSF/Holland)
- Project CONCERN

(iv) Such others as the committee shall see fit to invite to join.

c) Representatives from the Donor and PVO community shall be added to or retired from the Committee according to their project activity in the water and sanitation area in Belize.

d) The Committee shall meet at a frequency, time and place set by consensus.

e) The Chairman of the Committee shall be appointed by the Ministry of Natural Resources, and should be a senior member of the management team from the Government of Belize. The appointment shall be for a one year, renewable period.

f) The Secretary to the Committee shall also be appointed by the Ministry of Natural Resources, and should normally be a member of the Rural Water Supply and Sanitation Program Staff.

g) The Committee shall appoint sub-committees, as required, to deliberate and to develop recommendations for the full Committee. These sub-committees shall meet as frequently as needed to complete their terms of reference.

h) A core committee of the National Coordinating Committee shall be appointed to meet monthly for the purpose of coordinating ongoing project activities.

2. Conditions:

a) It is essential that meetings of the Committee be structured and desired outputs planned. There should be a process of evaluation to ensure that meetings produce desired outputs.

b) Effective participation by all members is essential to the success of this coordination effort. The nominated representatives from each organization should ~~either~~ either be able to commit their organization, or to effectively represent its views while seeking concurrence from senior management.

III. CONSTRUCTION

A. Hand Pump Systems

1. Policy

a) In all cases, the well, casings, pump and materials for the pump pad shall be provided to the communities by the GOB/projects. The communities shall contribute labour for site preparation and drainage under MNR supervision.

b) Existing pumps will be repaired, if necessary, or replaced with an India Mark II, if appropriate.

c) Hand pumps shall be installed at an average rate of one pump to 10 families. Variations to this average are permitted, within reason, depending on the size and spatial distribution of the village population.

d) Existing wells will be rehabilitated where necessary and possible, or new wells will be drilled.

2. Conditions

a) The Village Council and the Village Health Committee must have advance notification of the number of pumps to be placed in the respective villages.

b) The Village Council and the Village Health Committee will be consulted on the locations for the hand pumps within the technical guidelines as follows:

(i) Wells will not be drilled on private property, except where unavoidable. (See General Guidance #5)
(ii) Wells must be at least 100 feet from a latrine.
(iii) Wells must be away from burial grounds and open wells.
(iv) Swamps and low-lying areas will be avoided.
(v) Wells must be accessible to all users, and clear of roads.
(vi) The National Coordinator and District P.H.I. will concur in providing final approval of each site.

c) There ... agreement by ... community ... contri... our in a time ... and efficient ... for insta... on of both ne... pumps and re... ones.

d) Hand pump... rams will n... trained ... which do ... gree to con... e labour ... construct... nd for the h... mp mainte... program.

e) If the co... ty does not ... hand pumps ... of existi... ternatives) ... oes not qu... RWS, ass... e will be pro... d to test ... the qual... the existing ... er systems.

f) The GOB ... rovide addit... hand pump ... villages ... ncreased vi... population ... appropri... and within i... ns, whethe... from don... ources or ... s own budg...

B. Village Rudime... Water Syst... Ss)

1. Policies

a) The mini... pulation fo... ages in whi... will be ... ucted is 450 ... Ss will not ... installe... llages of s... r populatio... the cost ... e RWS will be ... s than that ... installi... s and handp... at the aver... of one f... y ten famil... This will ... villages ... the water ta... is very low ... where th... high improb... ty for sus... completi... e than a si... ood produc... well.

b) RWSs wil... be constructe... any villag... the syst... considered fi... cially or te... unfeasi...

c) The fo... components wi... be installed in ... eligib... village, based ... the need existi...

(i) De... water source ... ll, spring, ... infil... gallery) ... and ne...
(ii) ... system (inclu... pump, engine or ... gener... where perman... power is not ...
(iii) ... ission and dis... ution mains, as ...
(iv) Wa... eservoir, (ele... d or ground, as ... appropr... te)

(v)Standpipe installed 3 feet inside each eligible householder's property line. No standpipe shall be provided to households which have not contributed the agreed labour ~~and monetary labour~~ and monetary contributions to project implementation.

d) Eligible communities shall arrange, through the Village Health Committees, to provide labour on schedule for digging of trenches for the transmission and distribution mains, laying of the pipe, and backfilling of the trenches. Where feasible, communities will also be required to provide labour for the construction of water reservoirs and pump houses. Where individuals or the community are unable to provide voluntary labour, the VHC shall collect or raise funds within the village to contract and pay for the required labour.

e) Extensions to the system beyond the standpipes in each yard, i.e. home hook-ups, shall be at each householder's expense.

f) Technical Assistance will be provided to the communities in making decisions on selection of the water source, storage and distribution systems, and financial planning and management.

g) Seventy percent (70%) of the total families in each eligible community shall agree to participate in the program (comprising health education, community development, and construction activities) before the village is included in the projects' shortlists.

h) If a village decides it does not want to have a RWS on the basis of these policies, economically and technically sound alternatives will be explored, before a decision is made as to the solutions implemented in that village.

2. Conditions

a) GOB agencies will apply and supervise the application of these policies equitably to all beneficiary communities. Deviations from these guidelines will be made only after exhaustive study of all alternatives.

b) A Board of Management (BOM) for each RWS will be established and trained prior to the completion of construction. Members of the BOM will have specific responsibilities which will be spelt out in documentation prepared by the MNR and revised from time to time.

INSERT 8 →

c) The source of water for each RWS must be evaluated on the basis of the most economical way of providing an adequate supply of clean water. Deep or shallow wells, natural springs, infiltration galleries, and surface water will all be investigated where available, and the best solution selected.

C) Rainwater Harvesting Systems:

1. Policies

a) Rainwater harvesting systems will be supported and implemented only where other alternatives (drilled wells, natural springs, RWSs) are not technically or ~~and~~ financially possible.

b) Assistance in these schemes will comprise:

(i) construction of a large reservoir at the school or community centre;
(ii) materials for the construction of one-1000 gallon ferro-cement ground tank per household.
(iii) technical guidance and supervision for tank construction.

c) The community will provide scheduled voluntary labour for the construction of the community reservoir, and individual householders will provide labour for the construction of the household tanks, galvanized roofing material, and guttering for the roofs (to fill the tanks).

d) In developing programs with Donor agencies/PVO's, the MNR shall look at the resources available and how they are scheduled. Program solutions should be developed on the basis of resources available, and rainwater harvesting is to be considered as a primary option when drilling resources are likely to be scarce or unavailable.

2. Conditions

a) Each householder will contribute a determined small sum per family at the beginning of the project to a village revolving fund. The fund is to be used to provide loans to new families in the village, who desire to construct similar tanks.

D) Sanitation Systems

1. Policies

a) The following materials will be provided to the villagers under the sanitation programs:

i) collars;
ii) slabs;
iii) risers;
iv) concrete work for compost and "built-up" latrines, where necessary; and
v) ventilating pipes.

b) Individual householders will supply the materials for the superstructures of their household latrines, and will also be responsible for getting the latrine pits dug, and the superstructures erected. The householders, through the VHCs, will collaborate in the construction of the collars, slabs and risers for the entire village, or section of the village as determined by the VHC.

c) Several alternative latrine-types shall be available to the villagers based on the physical conditions existing in the village. Compost, and "built-up" latrines shall be offered as alternatives to the regular ventilated improved pit (VIP) latrines

NOTE 9 →

primarily promoted in the rural areas. The design of the riser and superstructures shall be discussed with the villagers when the projects are introduced to the village. These shall conform to cultural preference and to the molds which are used currently by the GOB programs.

d) Donor projects shall be designed to provide several set options as solutions to the lack of adequate sanitation. If villagers determine by consensus or majority vote that none of the options is desirable, a decision shall be made by the MNR whether to exclude that village from the current project and to wait for the more desirable solution to be provided through other means.

2 Conditions

a) The uniform sizes and standards for collars, slabs and risers as established in the manual " " (Phillippeaux) shall be followed.

SKIP A LINE

b) Each beneficiary household must contribute a small sum, to be determined by the VHC, to a village sanitation fund. The sum may be paid either at the beginning of the project in a lump sum or at monthly or other frequencies. The fund is to be used to provide loans to new families in the villages who desire to construct VIP latrines.

IV. MAINTENANCE

1. Policy

a) There shall be a single maintenance structure for hand pump systems and RWSs even though, in operation, the structure will deal differently with the two types of system.

b) A three tier system of maintenance, as described below, will be operated:

(i) Village ~~Safe Water Group~~ Health Committee - cleans and monitors handpumps and reports condition or damage to the the next level. For RWSs this group will monitor the condition of the taps and

standpipes, and the pumphouse and tank/reservoir.

(ii) Village Mechanics - The mechanic for the handpumps will tighten notes and bolts, grease the pump where necessary. This work will be restricted to the head of the pump, and will not involve anything more elaborate or technical. These mechanics will be trained by the next level and will be given a set of basic tools with which to carry out their tasks. Two persons will be trained from each community for these tasks. In RWS villages, the village mechanic will organize tank cleaning and plumbing repairs, in addition to performing basic maintenance and minor repairs to the engine, pump and tank. This individual will be trained by qualified personnel from the GOB, or the agency responsible for constructing the system. All breakages or damage that the Village Mechanic is unable or untrained to perform will be reported to the next level.

VOTE 11 →

(iii) District Maintenance Team(DMT) - A minimum of three teams will be assigned to cover the entire country. As resources permit, and according to the demand, the GOB will add more teams to supplement the minimum three teams. Each DMT will have a minimum staff of three, equipped with a truck, tripod, and tools. The DMT will be programmed on regular monitoring rounds, but will also respond to emergency situations. The DMT's program will be developed by the District Coordinator.

VOTE 1A →

c) Communities will finance the procurement of grease for the handpumps from their own resources. The cost of other major repairs will be financed by the GOB.

d) Operating costs for the RWSs will be paid out of funds collected by the villages as user fees. Assistance will be provided to the villages for the establishment of collection and assessment systems, the villagers alone, through their elected Boards

e) The standard contractual agreement which will be signed between the GOB and each community will define the level of maintenance support to be provided by the GOB and the concomitant responsibilities for maintenance by the community.

sible - setting and collecting fees which are adequate to fund the operating

2. Conditions

a) Boards of Management in RWS villages must have the authority to set and collect fees from users of the system in order to pay for operating and maintenance costs, and to take enforcement action against

b) The minimum three maintenance teams must be supported and supplied in the long term, in order to ensure the projected life of these systems is realized.

c) An information system to monitor the performance and condition of all pumps and RWSs must be developed and used for management of the rural water and sanitation program. This information system should be computerized to speed up the processing of reports and thus improve management response to field situations.

NOTE 12 →

d) Village mechanics must keep logs of RWS equipment use and performance, which will form part of the information system for the MNR. District Coordinators will monitor and supervise this documentation process.

e) Requests for maintenance work by the DMTs must go through the District Coordinators who are responsible for scheduling the teams.

V. WATER QUALITY MONITORING

1. Policy

a) The Ministry of Health(MOH) has the responsibility to monitor the quality of potable water supplied nation-wide. Through the Water Quality Laboratory, the MOH is able to test samples of the water from each source. District Public Health Inspectors are primarily responsible for taking the water samples at the sources in the field and for getting the samples in adequate time to the lab. for valid tests to be completed.

NOTE 12A

b) This policy encourages the training of District Coordinators in taking water samples and conducting field tests. Cooperation and coordination of efforts between the MOH and the MNR in this regard will significantly improve the quality of the water supplied to the communities.

c) Reports on the tests completed both at the field and central laboratory levels shall be sent by the MOH to the MNR for remedial action. The appropriate remedies will be suggested with each report.

d) The MNR will be responsible for correcting any deficiencies found in the quality of water supplied through any GOB-constructed water source.

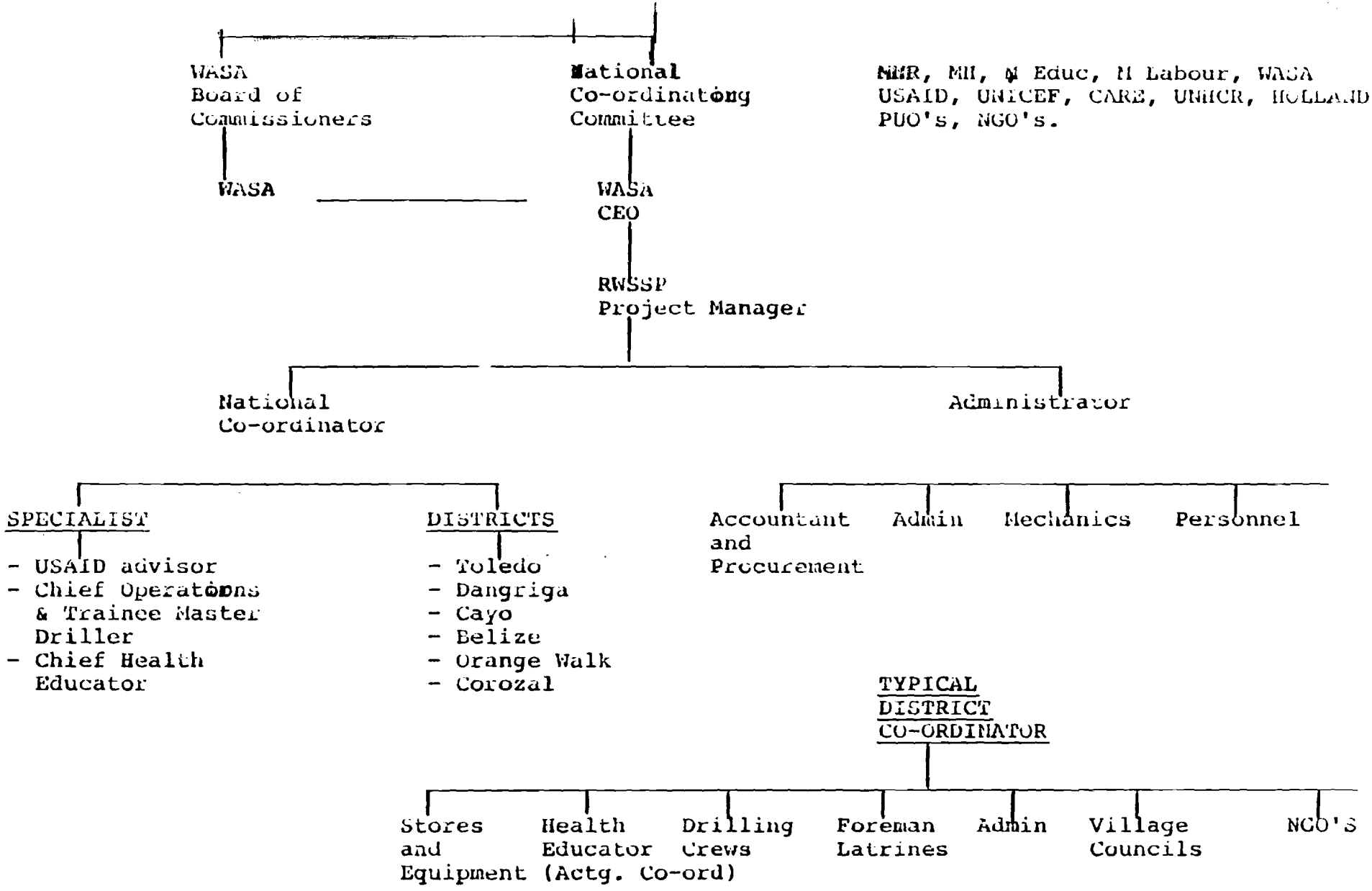
e) Samples of the water found at each new source developed shall be sent to the laboratory for testing prior to the commissioning of the source, (i.e. the pump should not be installed until the quality of the water being produced has been tested.)

2. Conditions

a) Tests must be conducted at least twice annually on each water source in order to maintain the monitoring system.

b) The Water Quality Analyst must produce an annual report on the quality of water available nationally in the rural areas. The report is to particularly highlight any serious defects in water sources which may have led to the closure of any sources, or are potentially of concern to Health officials.

c) The information from the laboratory must be included in the Information system on water sources so that a national data base on ground water resources can be developed.



ANNEX O

August 12, 1989
File: PHealth

Annex P

Statement of Work and Required Qualifications for the Health Education Technical Advisor

Statement of Work: The Health Education Technical Advisor is responsible for providing technical assistance to the GOB (MOH and MNR) in the analysis of the existing PHC strategy and HE/CD activities; and in the elaboration of a PHC and HE/CD workplan which responds to the needs of the population and the resources of the GOB. S/he will provide assistance to MOH & MNR personnel (to be designated by the MOH and MNR) in the execution of the following tasks:

* identification of prevalent disease patterns in Belize; associated knowledge, attitudes and practices of the population; and corresponding environmental and socio-economic factors.

* analysis of all PHC and HE/CD activities being conducted by the GOB and by NGOs with respect to:

- definition of the problem to which the activities respond (including noting by whom & how the problem is defined),
- long and short term objectives,
- the appropriateness of overall strategies and particular methodologies used to achieve objectives,
- the appropriateness and adequacy of available resources,
- obstacles encountered and their resolution, if resolved
- results achieved and/or realistically anticipated,
- duplication of effort with other HE/CD efforts.

This analysis will involve a review of all pertinent documents and observation of activities being undertaken in the field.

* identification of structural and organizational strengths and weaknesses of the MOH in terms of its expanding focus on PHC and HE/CD.

* elaboration of a national workplan for PHC and for HE/CD, to include:

- definition of the problem, the need for PHC and HE/CD in Belize

182

- definition of PHC and HE/CD long and short term program objectives
- identification of potential obstacles to the achievement of objectives, and how they will be addressed
- identification of resources available, and needed, to achieve program objectives, to include:
  -- staffing required at central and district levels (number of staff, qualifications and any additional training needed at each level
  -- other materials (vehicles, materials equipment etc)
- identification of strategies to be used to achieve objectives
- identification of activities corresponding to each strategy
- elaboration of a program budget
- elaboration of a plan of action, including a calendar of activities and designation of responsibility for each activity
- elabortion of a plan for program evaluation including specification of indicators and frequency of evaluation

Qualifications: The HE Technical Advisor must have a degree in community health education, community development or public health. A Masters level degree in these areas is preferred. S/he must have a minimum of five years overseas experience in community health education, including at least two years experience in implementation of community level HE/CD activities and at least three years in the management of such programs.

LEVEL OF EFFORT

The Health Education Technical Advisor will be required for up to four person-months. This assignment may be conducted in two two month periods, allowing for reflection regarding findings before undertaking elaboration of the long-term workplan.