BAY ISLANDS INTEGRATED RURAL DEVELOPMENT PROJECT

FINAL REPORT ON
WATER AND SANITATION ACTIVITIES
July 1986

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I SUMMARY

The purpose of the water and sanitation components of the project was to improve the quality of life of over 5,000 low-income Bay Islanders through the provision of sufficient clean water to improve personal hygiene and through the installation of adequate human waste disposal systems. The specific objectives were to install potable water systems, using renewable energy, in 15 rural communities, and to install pour-flush toilets and instruct 750 households in the use of appropriate latrine technology.

Water supply objectives were achieved; water systems were installed in 17 communities (see Table 1 on the next page). To support the maintenance and operations of these systems, community members were trained in operation and maintenance procedures. A three-person local staff received in depth training on repair and maintenance, although VITA has agreed to provide further training, as required. A warehouse was constructed to house spare parts and will serve as the base for islandwide maintenance operations.

The basic framework for an islandwide maintenance program was prepared, although its long-term economic viability is doubtful until larger municipal water systems can be brought into the maintenance program. Office procedures and forms, based on those developed under the SANAA/Prasar project, have been used in the maintenance program. Follow-on training to improve office procedures is needed and will be provided by VITA in the next two months.

Most importantly, an institutional structure was developed that will take the lead on future water development activities. A water subcommittee of the APRODIB Board has been selected, and appropriate Board resolutions passed regarding their commitment to improving and expanding water systems on a private sector basis. APRODIB Executive Director Emilio Sylvestri has shown his capabilities to direct water systems development and, therefore, the necessary institutional ingredients to ensure the long-term viability of water systems development are in place.

Sanitation objectives were not completely achieved; 79 pour-flush toilets were installed under the program and an additional 171 (for a total of 250) will be installed in the near future. While the project did not reach the target of 750 latrines, local capability now exists to ensure that this target will be reached if the necessary materials (toilets, cement, rebar, etc.) can be obtained from SANAA/PRASAR. The APRODIB Board has indicated their interest and commitment to working toward the eventual attainment of this goal.

Careful consideration, however, needs to be given to mechanisms to promote and expand health and sanitation education activities undertaken under the program by both VITA and PADF. APRODIB does not at present have the necessary administrative and financial resources to undertake such an activity effectively. However, consideration should be given to developing collaborative programs in this area with SANAA/PRASAR and the Centros de Salud Rural, which operate medical clinics on the island.

Future Activities

Based on the results obtained in the project and discussions with APRODIB by VITA staff, the following follow-on activities are envisioned in which VITA anticipates providing assistance:

- o Development of larger, municipal water systems in Coxen Hole, Oak Ridge, and French Harbor through the provision of a long-term technical advisor;
- o Follow-up training of APRODIB water systems staff by short-term VITA specialists on a periodic basis;
- o Analysis of well-drilling data and earth and water samples from the current water systems to obtain insights into the hydrogeology and groundwater resources on the island; and
- o Determining the feasibility of collecting rainwater runoff in water reservoirs to supply potable water to municipalities.

II. PROJECT ACTIVITIES

While the internal evaluation prepared by VITA in August 1985, other substantive project documents, and the May 1986 end-of-project evaluation provided significant detail on early project activities, this section attempts to frame activities undertaken in the last year of the project within the context of the entire project. With this in mind, a chronological listing of VITA's specific activities during the project is contained in the Appendix.

Well Siting and Drilling

Lack of available hydrogeological data hindered siting of wells early in the program. While some good information was obtained from a Sir William Halcrow report on groundwater resources (undertaken as part of the feasibility study conducted prior to airport construction) initially conversations with old-time residents and inspection of local geologic features and topography offered the best insights regarding well placement. These insights were later largely confirmed in early 1984 in a study undertaken by VITA Hydrogeologist Bob Tafelski, who participated in the selection of well sites in all communities.

Local well driller Henry Brown was initially contracted to drill all wells under the program. However, a number of problems cropped up during his drilling of the first 13 wells:

- o Several wells were "curved" as a result of settling of the well rig during operation.
- o A flat fee was charged for each foot of drilling resulting in nearly all 13 wells being drilled about 200 feet deep, a depth coincidentally equal to the total length of drop pipe owned by the driller.

- o Lack of the necessary equipment to monitor well-drilling caused several wells to produce salty water, an indication that the fresh water lens had been passed and water was being pumped from the salt water below.

- o Continual equipment breakdowns slowed the progress of well-drilling.

As a result of these concerns, the decision was made in Spring 1985 to look into the possibility of soliciting bids from other well drillers in Honduras to undertake the work. This decision coincided with USAID/Honduras' decision to allow pumps other than the Baker windmills to be utilized in the program (see next section). As a result, well sites had to be relocated; VITA Volunteer Ed Kennell assisted APRODIB to resite wells in July 1985.

Bids were solicited in July 1985 for drilling up to an additional 12 wells. Significant assistance in bid preparation and evaluation was provided by the USAID/Honduras Engineering office. Subsequently, a contract was awarded in August 1985 to Tony Hasbon, a well-qualified driller from Tegucigalpa, who sank 11 wells in September/October 1985. VITA Groundwater Specialist Karl Klingelhoffer monitored the drilling of the first five wells drilled by Hasbon, inspected well sites in all communities to confirm their potential, and provided training to APRODIB staff to develop a fresh water spring at Camp Bay; and design plans for construction of a spring box to allow water to flow by gravity into the community.

The Herculean efforts of APRODIB staff, especially Executive Director Emilio Sylvestri, during the well-drilling by Hasbon should not be underestimated. APRODIB, in addition to soliciting and evaluating bids and awarding the contract using standard USAID procurement regulations, arranged for the transport of Hasbon's drill rig to the island and later between well sites, and arranged for well sites to be cleared and new roads to be cut to allow the drill rig to reach the sites. All of these activities were achieved during a short two-month period between July and September 1985, and give eloquent testimony to the capabilities of APRODIB staff.

Despite their efforts, however, wells planned for Bodden Bight and Gravel Bay/Constellation Bight could not be drilled. In the former case, political concerns prevented the Bodden Bight community from reaching a consensus on the well site and needed access to it for the water system. In the later case, it proved impossible to find a safe way to allow the well rig to reach Gravel Bay. Thus, the water system in Bodden Bight was not completed although APRODIB is hopeful that previous concerns will be resolved and the water system completed. The existing Gravel Bay/Constellation Bight system will be expanded through other means by APRODIB.

Lastly, well-drilling data, "earth core sample," and water specimens from each community were collected by Hasbon during drilling (the water samples will be collected over the next year). While not part of the Bays Islands project, VITA has agreed to provide an initial assessment of groundwater resources in Roatan by analyzing well data

and core samples, and to monitor water quality in each community over the next year using other VITA financial resources. VITA Volunteer Hydrogeologist Bob Tafelski recently received the needed data and core samples; his initial report on hydrogeologic and groundwater resources in Roatan is expected to be completed in September. This exercise represents an important first step at determining groundwater resources on the island.

Choice of Water Pumping Technology

Due to VITA's previous experience on Roatan with installation of windmill systems, the OPG called for the installation of 15 additional water systems using Baker windmills previously purchased by SANAA/PRASAR. As windmills were the only water-pumping technology available under the project, initially only those villages having potentially favorable wind regimes were considered. Anemometers were set up at seven sites and basic data obtained for each community, including: population, number of houses, population density, income levels, water needs, and community interest. These data, together with wind speed data, were analyzed by VITA/Arlington staff to complete water system designs for each community.

It was quickly realized that this approach had several drawbacks:

- Communities without favorable winds could not participate, even if they were anxious and organized to do so;
- Estimated water demand for a community could not always be satisfied by a single windmill; and
- It was difficult to optimize the match between the specific design characteristics and water output of the Baker windmills (for the specific total dynamic heads encountered in a community) with well characteristics.

These concerns, particularly the desire to enable enthusiastic communities to participate, coupled with the positive experience with solar pumps (attractive because of their low O&M costs) in Pollytilly Bight and Sandy Bay prompted VITA to request permission from USAID/Honduras in December 1983 to utilize alternatives to the Baker windmills. Citing insufficient project funding and lack of experience with Baker windmills (at that point), USAID/Honduras stated its position in Implementation 85 by forbidding the use of project funds for solar pumps. However, recognizing that a particular community's water demand might not be satisfied by a single Baker windmill, USAID/Honduras agreed that 15 windmill systems, instead of 15 communities as originally specified, would constitute achievement of project objectives. This change in looking at "windmill systems" rather than "community water systems" later caused the comments in the EOP evaluation that the team members encountered conflicting numbers in project correspondence about the total number of systems to be installed under the project.

At USAID/Honduras' insistence, therefore, the Baker windmills began to be installed. Following Alan Wyatt's initial installations in February with Jim Lackey, in May/June 1984, VITA Volunteers Ed and Marilyn Kennell assisted local APRODIB staff to erect windmills in Milton Bight, Brick Bay, Juticalpa, and Los Fuertes. Later that summer, as a result of on-the-job training they had received, windmills were installed by Jim Lackey and Mike Rodriguez in Spanish Town (2) and a second machine at Los Fuertes.

From the first, significant problems were encountered with the windmills--a design fault in the tailspring assembly did not allow the windmill to furl easily out of the wind at high wind speeds. The over simplistic brake assembly tended to break easily. Rusting of windmill parts that were exposed to the elements before receipt by the project weakened key parts (e.g., gears in the motor) causing massive purchases of additional spare parts. While some of these concerns, e.g., re-design of the tailspring assembly, were addressed by VITA windmill expert Alan Wyatt in August/September 1984, it appeared that on purely technical grounds the Baker windmills were unsuitable for the strong swirling nature of Roatan wind regimes.

Continuing adamance by USAID/Honduras that the Baker windmills be used caused VITA to begin to document carefully the failure rates and spare parts costs for each Baker windmill. Data were collected enabling VITA home office staff to prepare a detailed economic analysis of pumping options in October 1984. Finally, USAID/Honduras agreed in June 1985 that the Baker windmills were unreliable and agreed to allow other pumping technologies to be used, without increasing the project budget to enable pumps to be purchased, provided that a technical and economic analysis of pumping options for each community was conducted. USAID/Honduras reserved the right to approve of the choice of technology for each community before project funds could be used.

In July 1985 VITA Volunteer Ed Kennell, together with APRODIB staff members Lackey and Rodriguez, visited each community to ascertain the technical feasibility of five pumping technologies (Dempster windmills, solar pumps, diesel pump sets, electric submersibles powered by the grid, and gravity flow systems) and collected the data needed for economic comparisons. These data were analyzed by Kennell and VITA home office staff in July and August 1985 with the following criteria in mind:

- Long-term system reliability and low systems maintenance costs were paramount;
- Standardization of pumping technology (i.e., only one brand of electric submersible, solar pump, etc.) should be utilized to minimize costs of stocking spare parts and facilitate training; and
- Well sites no longer had to be located where the wind resource was best, and that economic trade-offs between anticipated well drilling costs and cost of pumping technology should be carefully assessed.

After analysis of the data, well sites were selected, recommended pump types determined, and approximate pump size indicated for each community in VITA's internal evaluation submitted in August 1985. Exact pump size and detailed economic calculations were later prepared in November-December 1985 after well data had been obtained. Subsequently, USAID/Honduras approval was obtained in February 1986 to utilize an appropriate variety of pumping technologies: wind pumps, solar pumps, electric submersibles tied to the grid, diesel pump sets, gravity flow systems, and hand pumps.

Concurrently with this analysis of pumping options, a budgetary analysis was conducted by VITA and PADF to determine how much money was available to finance purchases of pumping technology. VITA's primary concern was to keep its commitments to all 15 communities that had been promised water systems. To conserve project funds, no VITA staff or consultant support was charged to the project after July 1985. These costs were paid from other sources. Secondly, PADF was able, through savings on well-drilling costs, to allocate $30,000 for the purchase of pumps. And lastly, VITA solicited $20,000 from other sources to enable all required pumps to be purchased and installed.

Pumps were ordered in mid-February 1986 after a competitive bidding process and shipped to Roatan in March. VITA Volunteers Ed Kennell, Christy Holz, and Tim Ball spent the last three weeks of April with APRODIB staff installing the pumps and providing initial training in operation and maintenance to both communities and APRODIB staff. Due to miscommunication, one of the pumps for Flowers Bay was not sized properly. A replacement pump was shipped to Roatan in early June; APRODIB staff installed this last pump in July to complete installation of pumps in all targeted communities.

Water System Design

Between August 1984 and February 1985, SANAA/PRASAR technicians surveyed each community and designed and completed detailed drawings for water distribution systems in each community. System design was based on existing population, with a population growth rate of 3% over a 20-year period and varying per capita daily water demand figures (10-20 gallons per person per day) based on the current size of the community.

A standard system design was used: water was to be pumped up to a 10,000 gallon water storage tank, then piped by gravity through a water distribution network of PVC pipe to each house. Each household on the system was supplied with a single tap, with water cut-off valves installed on each main line. Households were to install gravel "soak pits" under each tap to avoid buildup of standing water.

Later, when the choice of pumping technology was changed (in seven cases), the system design remained unchanged; i.e., the site for the water storage tank and distribution lines were not changed, only the location of the well and type of pump differed.

Water Board Development

A standard approach was used in all communities. Before the project agreed to assist a community, a village water board (composed of a president, vice-president, secretary, and treasurer) had to be elected by the community, be recognized as a legal entity, set up a local bank account, obtain signatures from each household that it would pay $5 to $10 in lempiras per month in water fees, agree to collect these fees, and appoint a person in the village to be responsible for operation and maintenance. APRODIB water promoters assisted the village to accomplish these tasks, which took from one or two months to nearly a year, depending on the community. Once these tasks were completed and the village agreed to provide or pay for labor to construct a water storage tank and lay distribution pipe, the project initiated the system. Rather than discuss them here, the EOP evaluation report, pages 32-33, and Carolyn McCommon's socioeconomic survey in Pollytilly Bight and Sandy Bay give good insights into the composition of the water boards.

Delays in implementation of some of the water systems, however, caused problems in what should have been an orderly, step-by-step process. Initial enthusiasm in 1984 among the village water boards slowly waned as water system installations were delayed. Some members of the boards either lost interest or took jobs elsewhere so that they could not participate. People increasingly began to take a "wait-and-see" attitude, a normal reaction given many of the "empty promises" they had heard in the past. Moreover, despite the APRODIB staff's attempts to keep in touch with the communities and inform them about the status of the project, simply stated, the focus during the last 10 months of the project necessarily had to be on well drilling and water system installations.

Recent discussions with APRODIB staff have indicated their desire to work closely with the community water boards to develop their capabilities further and to finalize in-house office procedures and filing systems to track the progress of each water board. VITA has agreed to finance a volunteer for two months (APRODIB will pay a portion of the associated local costs) to provide assistance in this regard. A scope of work for this effort is currently being prepared and will be forwarded to USAID/Honduras when approved by APRODIB.

Maintenance Program

Initially, the concept of maintenance of the water systems was patterned after the experiences in Sandy Bay, Pollytilly Bight, Jonesville, and Gravel Bay. This involved training one community member in operation, maintenance, and system repair who would be paid by the village water board from the monthly water fees collected. As the Bay Islands OPG progressed, however, a number of problems surfaced with this approach:

- As maintenance and repair was not a fulltime occupation in each village, there was not a significant enough incentive for the maintenance person to stay without having other ways to earn money. Consequently, trained maintenance people occasionally left

for other, more lucrative employment, necessitating re-training of personnel.

- Complicated repairs or "trouble-shooting" were beyond the capabilities of most maintenance persons.

- Spare parts were needed periodically, necessitating a source of foreign exchange and the capability to order parts.

Recognizing these concerns, the project moved slowly toward the development of an island-wide maintenance facility that would augment the capabilities of each participating village water board. An economic analysis of options for the facility was prepared jointly by VITA staff and APRODIB Executive Director Emilio Sylvestri. The results of this analysis were presented as three options in the internal evaluation submitted to PADF in August 1985. The "medium service option" was viewed by APRODIB as most viable; it included the following elements:

- Simple operation and maintenance work would be performed by a trained member of the village;

- APRODIB would operate a warehouse where spare parts would be stocked and sold at a small profit (to cover administrative costs) to participating villages.

- APRODIB staff would be well-trained and able to perform more complicated repair services, in addition to month-to-month checkups of the systems, for a three-year period.

Even with this approach, it was recognized by both APRODIB and VITA that the long-term economic viability of this plan was dependent on bringing in some of the larger municipalities (e.g., Coxen Hole, Oak Ridge, and French Harbor) into the maintenance program. With this in mind, APRODIB solicited the support of Coxen Hole and French Harbor to join the maintenance program providing that funds for improvement of these systems are obtained through APRODIB's current proposal to USAID/Honduras.

Moreover, because of Jim Lackey's resignation in March 1986 and the focus on water systems installation during the last year of the project, some additional training of APRODIB staff and community maintenance persons is needed. For the communities, a simple one or two day training for at least two community members would be sufficient to familiarize them with their system, periodic maintenance required, and trouble shooting and repairs. Each community would need a small tool box with a few simple tools and spare parts required for routine maintenance. As VITA is aware of what is most likely to need attention for all systems, training could be kept simple and focused on the problems most likely to occur.

Training for APRODIB staff will be provided along similar lines but in greater depth and duration, emphasizing trouble-shooting techniques. A mechanism will also be developed for APRODIB to solicit advice rapidly from VITA experts as the need arises. The focus of

this training will be to ensure that APRODIB staff are expert on all three types of systems--wind, solar, and diesel. APRODIB staff would then be able to assist the communities when problems arise that they cannot handle.

VITA and APRODIB are now discussing the specific scope of work and timing for this training, which will include assisting APRODIB to prepare standard maintenance schedules and check lists for communities to follow. When the scope of work is completed, VITA and APRODIB will send a copy to USAID/Honduras.

Sanitation Activities

Under Implementation Letter 71 (August 1983) SANAA/PRASAR agreed to provide 1,000 water seal toilets and ancilliary supplies needed to construct latrines. Each "latrine set" was composed of a toilet bowl, two sacks of cement, two roofing sheets, one standard 40 foot length of steel bar, and several feet of tie wire. APRODIB agreed to sell these "sets" for $10 Lempiras (a separate bank account was established to account for funds) and provide instruction in their installation and proper use and repair.

VITA Volunteer Chuck Ritter surveyed soil conditions and sanitation options in November 1983. VITA Volunteer Nancy McTigue worked closely with the Peace Corps health educator on techniques to construct latrines using the pour-flush toilets supplied by SANAA/PRASAR in March 1984. An integrated approach to water, sanitation, and health education was prepared, and a plan was mapped out for health education activities for the Peace Corps Volunteer through March 1985. Later in 1984, a videotype presentation was prepared under Dick Fera's direction that APRODIB water and sanitation promoter Jose Hernandez used in his activities using portable equipment the PCV solicited (running off car batteries), enabling it to be easily taken from village to village.

Unfortunately, the first toilets were not received from SANAA/PRASAR until late 1984 but were sold and installed by mid-1985. An additional 200 toilets (but no ancilliary supplies) were received in February 1986, of which 29 have now been installed.

While the project did not reach its objective of distributing 750 latrines and instructing households in their proper use, local capability now exists at APRODIB to ensure that this target can be reached if the necessary supplies can be obtained from SANAA/PRASAR. The APRODIB Board has indicated its interest and commitment to working toward the eventual attainment of this goal. VITA, as appropriate and financial resources permit, will provide further training of APRODIB staff as requested. This will be particularly important in the area of environmental safeguards, as in La Punta, where water tables are very high and latrine installations could pollute groundwater supplies.

III. FUTURE ACTIVITIES

VITA fully recognizes the fragile status of water and sanitation activities in Roatan. While water and sanitation systems have been installed and procedures developed for operation and maintenance, further follow-on support will be needed--especially in the following areas:

- o Improvement of office systems and procedures to track the progress and status of each water system;
- o Further training of APRODIB staff in the maintenance, troubleshooting, and repair of wind, diesel, and solar systems;
- o Further training of community maintenance persons, and provision of basic tools and spare parts, in normal operation and maintenance procedures.

While these needs exist, VITA also recognizes that there is now a strong, private association in place, APRODIB, that provides the institutional framework for future development and improvement of water resources on the island. A water sub-committee of the APRODIB Board has been selected and appropriate Board resolutions passed regarding their commitment to improving and expanding water systems on a private sector basis. APRODIB's Emilio Sylvestri has shown his capabilities and commitment after what was, in essence, a "baptism under fire" during the past year. Therefore, the necessary institutional ingredients are in place to ensure the long-term viability of water systems development and improvement.

VITA stands ready to work with APRODIB, as appropriate and as requested, to ensure this happens.

Based on recent conversations with APRODIB Executive Director Emilio Sylvestri, VITA has agreed to assist in the following ways:

- o Provide follow-on training and support over the next two months to refine and improve office procedures to track the progress and status of each water system;
- o Analyze well-drilling data, soil "core samples," and water specimens from each community over the next year to obtain insights into the hydrogeology and groundwater resources on the island;
- o Provide periodic, short-term technical assistance to further train APRODIB and community maintenance person in water system operation, maintenance, and repair, as described previously;
- o Assist, as requested, in the development of municipal water systems in Coxen Hole, Oak Ridge, and French Harbor;
- o Determine the feasibility of collecting rainwater run-off in water reservoirs to supply potable water to municipalities.

EXHIBIT 7

SUMMARY DATA ON VILLAGE WATER SUPPLIES, ROATAN, HONDURAS

TOWN	N HOUSES	* HOUSES CONNECTED	SOURCE OF WATER	TYPE OF PUMP	SIZE OF TANK (GALS.)	CONNECTION CHARGE (L.) (CASH OR LABOR)	MONTHLY FEE (L.)	COST OF SYSTEM (L.)	COST PER HOUSE (L.)
BODDEN BIGHT	62								
BRICK BAY	13	13	well	Baker windmill	5500	250	5	30,139	2318
CAMP BAY	10	7-public tap	spring	(gravity)	1000	n/a	pending	pending	pending**
COROZAL	14	11	well	solar	12,000	-0-	pending**	41,650	3786
DIAMOND ROCK	46	(46)	well	solar	10,000	pending**	pending**	50,600	pending**
FLOWERS BAY	104	54	wells (2)	diesel electric submersible	16,000	100	pending	65,000	1203
GRAVEL BAY	81	36	well	Dempster Windmill	4,500	35	5	36,680	1018
JONESVILLE	38 (1986)	38	well	Solar	16,000	325	10	42,500	1118
JUTICALPA	28	21	well	Baker windmill	16,000	150	10	36,340	1730
LA PUNTA	74	(74)	wells (2)**	electric submersibles	10,000 **	500	10	41,200	pending **
LOS FUERTES	59	(59)	well	Baker Windmill	13,500	pending**	pending**	31,200	pending **
MILTON BIGHT	19	17	well	Baker Windmill	10,000	250	5	31,962	1880
POLYTILLY BIGHT	44	33	well	solar	16,000	5 to 22	6	35,500	1075
SANDY BAY	112	95	wells (3)	solar; elec submersible	16,000	20	10	50,300	529
SPANISH TOWN	39	30	well	electric submersible	16,000	-0-	pending	35,000	1166

* 1984

Source: Berliner, Leni S. and Joseph A. Haratani, "Evaluation of the Bay Islands Integrated Rural Development Project," OPG No. 522-0233 (Washington, D.C.; May 20, 1986). p.24.

** Additions by John H. Downey. (Arlington: June 1986).