A Proposal to Implement a Circuit Rider Program in Honduras



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1 Project Description

The long-term vision of this project is to provide on-site technical assistance to Honduran communities who currently possess wastewater treatment infrastructure. Globally much is known about how to maintain and improve sanitation services. This project aims to mobilize this technical knowledge in order to rehabilitate and optimize existing systems. This goal will be accomplished through the establishment of a “Circuit Rider” program in which a group of trained technical advisors visit an assigned set of participating communities on a monthly and as needed basis.

The sponsoring organization for this initiative is the International Rural Water Association (IRWA)[1]. The wastewater Circuit Rider program will be modeled on IRWA’s Circuit Rider program for water systems that is established in both the United States and in Honduras.

2 Background and Rationale

2.1 The Need

The United Nations has named 2008 the “International Year of Sanitation” in order to generate awareness about the global sanitation crisis. Globally 2.6 billion people lack access to improved sanitation (UNDP, 2006). However indelicate a subject, the safe disposal of human waste is a fundamental and inescapable issue faced by all cities. Many public health and environmental problems stem from the inadequate management of municipal waste. While countless communities lack basic sanitation infrastructure, more tragically, many communities have invested in infrastructure that no longer functions properly. In some cases, infrastructure intended to treat wastewater actually causes even greater contamination.

The lack of properly maintained sanitation infrastructure within developing communities may facilely be attributed entirely to political and financial failings. While this may be the case to a certain extent, there are also many situations in which a community possesses the desire but does not have the technical training or experience to identify and fix issues within their systems. A consistently available technical advisor would strengthen the local capacity, provide ideas for simple methods to improve the systems, and serve as a reminder and advocate for the maintenance of the sanitation systems.

[1] Author’s Note: While IRWA has expressed interest in creating a Circuit Rider program in Honduras there has been no formal commitment. The theoretical use of IRWA as the sponsoring organization is solely for the purpose of a class paper by the author at the Massachusetts Institute of Technology (MIT). The ideas and views expressed in this proposal are those of the author and do not represent the stances of IRWA.

2.2 Sanitation in Honduras

In 2004, it was estimated that approximately 68% of Hondurans had access to some form of sanitation services. Approximately 25% of coverage is through domestic connections (such as flush toilets) and the remaining 43% is via latrines. Within urban areas, it is estimated that 88% have coverage. However sewage transport should not be confused with treatment. It is estimated that only about 10% of collected wastewater is actually treated (SERNA, 2005).

According to Honduras' environmental protection agency, SERNA, the country operates 41 wastewater treatment systems including 18 Imhoff tanks, 18 waste stabilization ponds, and 5 other technologies (SERNA, 2005). This last category includes the capital of Tegucigalpa, which has an activated sludge treatment plant. However, in Honduras different sources report statistics that do not necessarily agree. A 2000 survey of wastewater treatment facilities in Honduras by SANAA, the national water and sewerage utility, includes 51 locations. It is more than likely the most comprehensive survey of such infrastructure in Honduras. A complete table of locations and types of treatment systems in Honduras may be found in Appendix A: Honduras Wastewater Treatment Systems.

2.3 History of Circuit Rider Program

IRWA is a U.S.-based non-profit organization started in 1989 by members of the National Rural Water Association (NRWA), a U.S government funded technical assistance program. IRWA was conceived with the mission to "help improve the quality of water and health for people in developing countries." The staff of IRWA is composed completely of volunteers. Six members sit on a board of directors that meets several times a year. Depending on the year and active projects three of these volunteers spend anywhere from 3 to 18 weeks a year doing fieldwork abroad and scoping out new projects. Presently, IRWA's presence is greatest in Honduras where they have worked with over 400 community water systems that serve over 300,000 people. Many of the programs introduced by IRWA are modeled after its parent organization, NRWA.

NRWA was started in 1976 and is government funded to help support approximately 21,000 rural water systems in the United States by providing assistance in areas such as finance, administration management, and technical support to over 90,000 technicians. For example, staff members of NRWA may help communities with their billing systems and grant writing to find funds. While NRWA provides many services ranging from economic assistance to training programs, perhaps their most innovative and successful project is the Circuit Rider Program (NRWA, 2008).

The Circuit Rider Program pairs communities with a NRWA technician to aid in operation and maintenance of rural water systems. When communities encounter problems with their system they can call their circuit rider and the rider will stay with the community until the problem is fixed. In addition, circuit riders routinely drop by their communities to ensure the systems are functioning correctly.

Due to the success of the Circuit Rider Program in 48 of the 50 U.S. states, IRWA introduced the concept in Honduras in the early 90s. The Circuit Rider Program was introduced under the auspices of the Honduran non-governmental organization AHJASA (Asociación Hondureña de Juntas Administradoras de Sistemas de Agua) and is still managed by the organization. AHJASA's circuit riders work directly with rural water boards called "juntas" on a wide variety of issues ranging from proper chlorination to organizing and collecting water tariffs. AHJASA provides training for the circuit riders and general assemblies for the various communities around Honduras involved in their programs.

In addition to the Circuit Rider program established by IRWA, other organizations have endorsed similar initives within Honduras. In 1990 USAID sponsored the creation of two types of technical assistants to communities. The two types of facilitators were labeled: TOM (technico de operacion y mantenimiento) and TAS (technico en agua y saneamiento). TOM promoters received training in monitoring and provision of technical support to water boards during the operation phase. Those that received TAS training were educated to be facilitators in community organization, hygiene education, and the technical aspects of construction. Unfortunately once funds became scarce these initives disappeared. Additionally, the Secretary of Health in Honduras had a basic sanitation division until 1997. They had similar types of facilitators as SANAA's TOM and TAS. However in 1998 the roles became much more broadly defined to include initives such as vaccination campaigns and basically anything broadly related to the environment. These promoters still exist, however due to lack of resources in a very limited capacity for drinking water systems (Water for People, 2007).

3 Case Study

3.1 Imhoff Tanks

During the 1930's Imhoff tanks represented 50% of all wastewater treatment facilities in the United States (Herrera, 2006). While the majority of Imhoff tanks within the U.S. have since been modified to adapt to changing treatment objectives and regulations, within Honduras, they continue to represent a significant portion of wastewater treatment infrastructure at approximately 40% of all documented facilities (SANAA, 2007).

Figure 1 Las Vegas Imhoff Tanks **Side view (1 chamber)** **Top View**

Karl Imhoff invented and patented the Imhoff tank in Germany in 1906 (Herrera, 2006). An Imhoff tank is a structure designed to provide primary wastewater treatment. It is a sedimentation tank with a steeply sloped conical floor resting above a sludge digester.
As in Figure 1, Imhoff tanks are normally constructed with a minimum of two tanks in parallel. This allows the operators to clean one tank without shutting down the entire system.

The tanks function on the premise that larger particles of the total suspended solids (TSS) enter the sedimentation chamber and fall through a small opening into the sludge storage and digestion chamber. In turn this removal of solids also decreases the oxygen demand of the wastewater. The removed solids are then anaerobically stabilized in the sludge storage chamber through natural biochemical and microbiological reactions until the chamber fills up. It is possible to empty the sludge storage chamber by gravity using valves located at the bottom of the tanks (Figure 2).

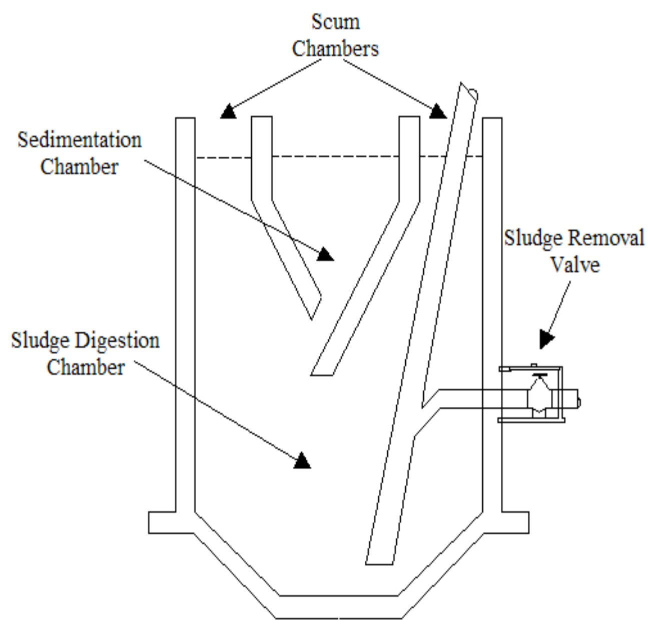

Figure 2 Imhoff Tank Schematic

Expected liquid treatment levels from a properly maintained Imhoff tank are the same as those for sedimentation tanks without a sludge digester. Typically this will provide a TSS removal rate of 20% - 70% and 10% - 40% for BOD_5 (Reynolds, 1996). The actual removal rate for a specific tank will be a function of influent water quality and tank detention time. In the absence of any additional treatment, sedimentation will not yield substantial reductions in other important water quality indicators such as total coliform counts or nutrient loading from phosphorus and nitrogen.

Imhoff tanks remain a viable treatment option in certain developing communities for several reasons. An Imhoff Tank is a low maintenance, low-cost, low-energy option in comparison to activated sludge treatment methods. Primary treatment through sedimentation may reduce the negative environmental and human health effects of untreated sewage to levels such that natural processes such as dilution and biodegradation can accomplish adequate remaining treatment. This of course, depends significantly on the natural assimilation capacity of receiving land and water bodies. Imhoff tanks do not need the large amounts of flat land that waste stabilization ponds or reconstructed wetlands require. In the mountainous terrain of Honduras this advantage is significant. They also provide storage and gravity removal mechanisms for digested sludge that plain sedimentation basins do not. Further, with proper planning Imhoff tanks may later be coupled with applicable forms of secondary and tertiary treatment if these levels are environmental necessary and investment becomes desired and feasible within the community.

3.2 Imhoff Tanks in Honduras

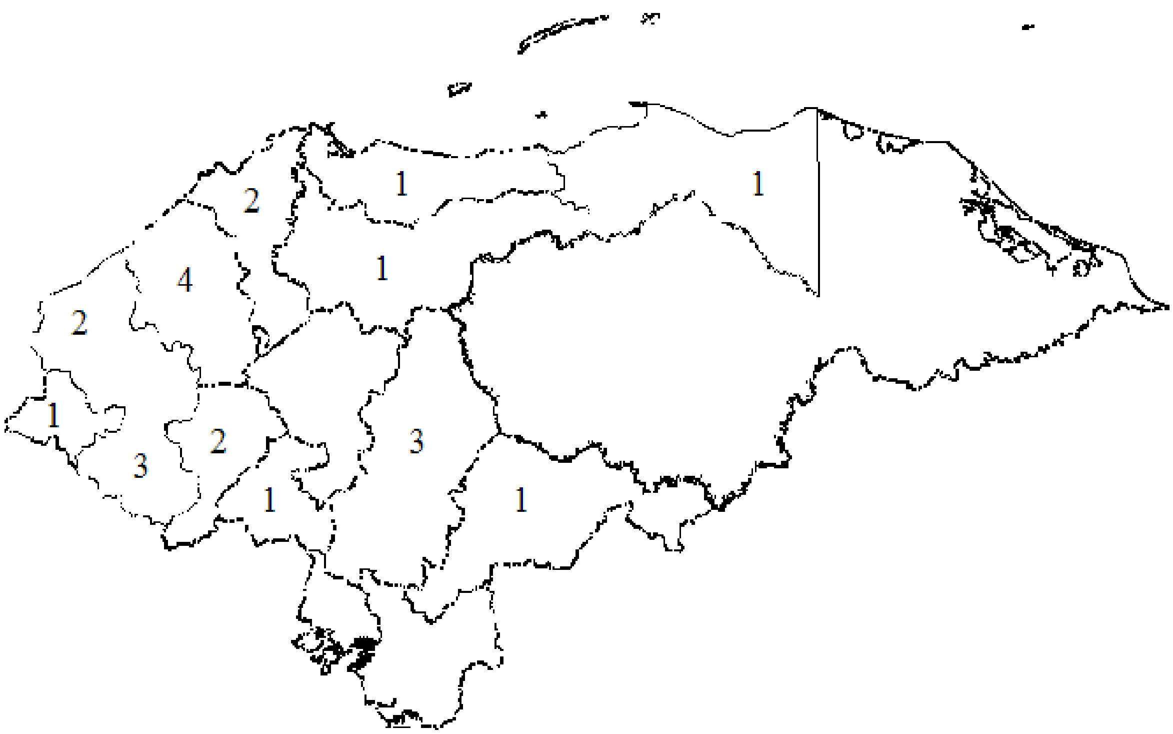

Figure 3 Distribution of Imhoff tanks in Honduras

Figure 3 maps the known locations of Imhoff tanks in Honduras. In the last ten years Imhoff tanks in Honduras have been neglected, as engineers with SANAA have preferred to promote and construct waste stabilization ponds in suitable areas (H. Chavez, personal communications, January 2008). Waste stabilization ponds do have their advantages, however it is recognized that Imhoff tanks still have an important role to play in areas that lack large areas of flat land for ponds. Additionally, they are large existing concrete structures that represent significant prior infrastructure investment. If feasible it would be economic to rehabilitate and/or modify them to aid in any future treatment schemes. Evaluation of Imhoff tanks and aiding communities to rehabilitate or select other methods of treatment will be a major activity for the Circuit Rider Program.

During January of 2008 a team of MIT students visited the Imhoff tanks in the departments of La Páz and Santa Barbara. The communities visited include Marcala, La Páz, and Las Vegas, Barrio El Llano del Conejo, Barrio Galeras, and Gualala Santa Barbara. Maintenance was minimal at all of the tanks and the structural integrity of two of the five systems was severely dilapidated and perhaps not worth fixing. However, for Las Vegas and Barrio Galeras in Santa Barbara and for Marcala in La Páz full rehabilitation of those existing Imhoff tanks should at least be considered. The Imhoff tanks visited were constructed in the late 1980s and early 1990s with funds from major international development agencies such as the World Bank and Plan International. Figure 4 shows an Imhoff tank in Barrio El Llano del Conejo, Santa Barbara, that was improperly constructed. In this situation a circuit rider would need to help the community explore new options for treatment.

Figure 4 Incomplete Sedimentation Chamber in Barrio El Llano del Conejo

Figure 5 is the Imhoff tank in Marcala, La Páz. The Marcala Imhoff tank is a massive below grade structure. The system is packed full of solids, which have even overflowed into boxes that house the sludge valves. During February 2008 the Phoenix professional chapter of the U.S. based non-profit organization, Engineers without Borders started working on evaluating remediation options for the Marcala Imhoff tank.

Figure 5 Marcala Imhoff Tank

Imhoff tanks represent approximately 40% of the wastewater treatment infrastructure in Honduras and are in a state of disrepair. The sites visited during January 2008 indicate that before all else drying beds or other methods of appropriate sludge disposal should be designed. Then the sludge should actually be removed at each site on a regular schedule. If flows and loads warrant system expansion, that option should only be explored after a period of proper maintenance and minor modifications in order to get the existing Imhoff tanks into an optimum working condition. From the author's experience working closely with the municipality of Las Vegas, the local mayor and engineers were initially not only unaware of how an Imhoff tank functions and how to maintain it, but were also unaware that many of the solutions are not expensive. A circuit ride would be able to work with local municipalities to explore different technical options and rehabilitate wastewater treatment systems such as Imhoff tanks.

4 Project Design and Implementation Plan

4.1 Objectives

The wastewater Circuit Rider Program has the following short and long-term objectives:

1) Survey the current status of wastewater treatment infrastructure.
2) Solicit participation of interested local governing entities.
3) Recruit and train Honduran circuit riders.
4) Aid partner communities in the maintenance and repair of existing systems.
5) Provide technical education to partner communities.
6) Establish and coordinate regional supplies between communities (i.e. water testing equipment and sludge pumps.)

4.2 Role and responsibilities of the Circuit Rider

Honduran circuit riders will become full time employees of IRWA. Circuit riders will be trained to facilitate the following roles and responsibilities:

- Assist local governing entity in assessing baseline condition of system.
- Work with local governing entity to rehabilitate system.
- Identify best management practices with local governing entity.
- Assist in defining team leaders and a schedule for best management practices.
- Encourage and facilitate public involvement in decision-making.
- Aid local governing entity in assessing resources, legal authority, and funding needed to maintain system.
- Visit the site monthly and on an as-needed basis.
- Provide new technical information when it is made available.
- Evaluate the need and possible options for further treatment/expansion.

4.3 Steps for Achieving Success

A Circuit Rider Program for wastewater treatment infrastructure in Honduras would initially emphasize community organization and the technical aspects of reconstruction. Following rehabilitation circuit riders need to remain available to provide continued technical support for operators and monitoring. The creation of a system of rehabilitation and maintenance in Honduras may be divided into four aspects:

1) Scoping
2) Rehabilitation
3) Training
4) Monitoring

4.3.1 Scoping

The initial phase of the program should be to survey the locations in the 2000 SANAA inventory. An attempt should also be made to ascertain if the list is comprehensive. Development of a standardized assessment form would enable the program to evaluate and select several sites as candidates for pilot circuit rider locations. This assessment would include engineering aspects such as visual inspections of the structural integrity of the system. An example of a checklist of topics is provided in Table 1. Of course, not all of these topics would apply to every type of system. Eventually a database should be created that includes pictures, history, and dimensions of each system. Contact with the local municipalities and/or water and sanitation boards should also be established during this phase. Interest and willingness for community participation should be gauged.

Table 1 Scoping Checklist

Background

- Type of Technology
- Construction Date
- General Contractor
- Design Engineer
- Design Drawings
- Funding Organization
- Initial Project Costs
- Local Entity in Charge of Maintenance
- Number of Operators and Contact Information
- Maintenance History
  • Sludge Removal (Frequency and Quantity)
  • Scum Removal (Frequency and Quantity)
  • Reversal of Flow (Frequency)
  • Pipe/Valve Replacement (Frequency and Quantity)
- Connections
  • # of Households
  • # of People
  • # and Type of Industries
- Use of Stabilized Sludge
- Resident's Water & Sanitation Fees
- Water Use Metered

Technical

- # of Tanks/Ponds
- Tanks/Ponds in Series or Parallel
- Elevation of Land Occupied by System
- Dimensions
  • Surface Area of System and Components
  • Depth of System Components
  • Slope of System Components
- Influent Flowrates

- Influent & Effluent Loads (at a minimum the parameters below)
    - Total Suspended Solids
    - Biochemical Oxygen Demand/Chemical Oxygen Demand
    - Total Coliforms
- Locations and Use of Flow Gates in Imhoff Tanks
- Distribution of Wastewater Between and Within Tanks
- Presence and Use of Sludge Drying Bed
- Sludge Valves Working Properly
- Structural Condition of Concrete (Any Cracks, Broken Walls, Etc.)

Future

- Available Land for Expansion
- Community Desires and needs
- Current and Potential Partner Organizations
- Local Opportunities to Reuse Sludge

4.3.2 Rehabilitation

Communities selected for participation in a pilot of the Circuit Rider Program must be able to identify and provide an operator for continued maintenance issues such as monitoring flow distribution and removal of scum and sludge when appropriate. It is expected that rehabilitation will involve the removal of existing sludge within the systems and replacement of broken valves and pipes where necessary. Removing existing sludge is not an easy process. In Las Vegas, Santa Barbara the municipality removed 16 years worth of sludge in two days with a team of three men, ropes, and buckets. Unpleasant activities such as sludge removal in the absence of a pumper truck require dedication from the community. It is important that workers remain safe and that the sludge is disposed off in a sanitary manner. Therefore, the acquisition of a sludge pumping truck that could be shared amongst Honduran municipalities is major goal of the program. Additionally, sludge drying beds will probably need to be constructed near many of the sites in order to have a disposal facility available for the sludge removed from the systems. The insides of systems such as Imhoff and septic tanks are rarely exposed therefore it will also be crucial to document the inner dimensions and make any structural adjustments during this phase of the program. Guidance from a trained circuit rider could be very useful during these activities.

4.3.3 Training

In conjunction with rehabilitation the circuit riders themselves need to be trained and they also need to be able to conduct educational seminars on the history, maintenance, and technical aspects of wastewater treatment. Several standard presentations should be developed to tailor fit varied audiences such as local elected officials, neighbors surrounding the systems, and system operators. The majority of community members will probably not already know how the inside of the systems function, therefore props such as small three dimensional models and pictures of other systems within Honduras should be produced as presentation aids. Circuit riders will further assist in training local operators to clean the necessary components of the tank and to regularly record simple data such as flow rates and sludge depths.

4.3.4 Monitoring

A standardized approach to data collection that takes into consideration the time and financial limitations of the municipalities should be developed and applied to all of the rehabilitated systems. Successful wastewater treatment requires a detailed knowledge of daily, monthly and annual flow and load cycles. However, equipment to regularly monitor aspects such as COD, fecal coliforms, and TSS many induce a heavy financial burden on one community. A system and plan to share equipment between several locations should be developed. Additionally partnerships with university and professional organizations may provide means for continued monitoring. University students can use the experience to practice and master standard lab methods and write theses, while the local systems may receive more detailed records with the equipment brought by these organizations.

4.4 Major Activities Timeline

The Circuit Rider Program is designed as a five-year commitment from the IRWA. After this time period the entire program will be revaluated before its continuation. An outline of the major activities to occur during each year is outlined below.

<u>Year 1</u>

- Country wide scoping and assessment of wastewater treatment infrastructure.
- Procurement of funds.
- Procurement of laboratory equipment and maintenance tools.
- Establishment of partnerships with network of key collaborators (see Appendix B).
- Selection and training of circuit riders.
- Evaluation and selection of pilot sites.

<u>Years 2 & 3</u>

- Rehabilitation and definition of best management practices at each pilot site.
- Monthly and as-needed visits by circuit rider to communities
- Local educational seminars.
- Regional conference.
- End of year review.

<u>Years 4 & 5</u>

- Increased number of project sites.
- Rehabilitation and definition of best management practices at new sites.
- Monthly and as-needed visits by circuit rider to communities.
- Local educational seminars.
- Regional conference.
- End of year reviews.
- Year 5: end of Program review.

4.5 Expected Outcomes and Indicators

The expected results for the program are listed in Table 2. The expected outcomes are categorized by program objective and the events that will be used to gauge achievement of the objectives are defined under the column labeled "indicators."

Table 2 Program Outcomes and Indicators

Program Objective 1: Survey the current status of wastewater treatment infrastructure.	
Outcomes	**Indicators**
• Assessment of existing systems. • Knowledge of which systems are appropriate for the Circuit Rider Program.	• Site visits to locations listed in Appendix A: Honduras Wastewater Treatment Systems. • Completion of checklist in Table 1. • Creation of database of collected information. • Selection of pilot locations for the Circuit Rider Program.
Program Objective 2: Solicit participation of interested local governing entities.	
Outcomes	**Indicators**
• Demand from communities for circuit rider services.	• Memorandum of understanding between local governing entity and Circuit Rider Program indicating roles and responsibilities.
Program Objective 3: Recruit and train Honduran circuit riders.	
Outcomes	**Indicators**
• Highly skilled technical advisors.	• # of trained circuit riders
Program Objective 4: Aid partner communities in the maintenance and repair of existing systems.	
Outcomes	**Indicators**
• Households gain sustainable and effective access to improved wastewater treatment • Environmental health improvements	• Documentation of baseline flows and loads on wastewater treatment system. • # of households that have gained improved wastewater treatment facilities. • % of children and % of adults whose feces are disposed of safely. • # of systems rehabilitated. • Definition of best management practices. • Achievement of Honduran wastewater effluent regulations.

Program Objective 5: Provide technical education to partner communities.	
Outcomes	**Indicators**
• Increased number of community members with skills to work effectively with wastewater treatment system • Strengthened capacity of public institutions, private entrepreneurs, and other NGOs to carry out and sustain wastewater treatment systems. • Positive changes made in local policy, legal, and regulatory instruments	• # of documented materials disseminated. • Employment of local system operator. • # of positive changes made in policy, legal, and regulatory instruments to facilitate effective wastewater treatment.

Program Objective 6: Establish and coordinate regional supplies between communities	
Outcomes	**Indicators**
• Regional centers equipped for the testing of wastewater quality. • Regional centers equipped with tools for wastewater system maintenance.	• # of communities successfully sharing equipment. • Quantity and quality of testing and maintenance supplies. • # of communities expressing interest for a circuit rider.

5 Budget

The budget in Table 3 was prepared with the assistance of Fred Sotttlemyer. Fred is the director of IRWA's work in Honduras and was part of the team to introduce the water system Circuit Rider Program to AHJASA in 1990. He is currently overseeing construction of a water treatment plant in Marcala, La Páz. IRWA is now based out of Marcala and functions through the NGO Aqua y Desarrollo Comunitario. The yearly overhead costs are based on the assumption that the wastewater Circuit Rider Program would share office space and management with this organization. Laboratory supplies were priced from the Hach company.

Table 3 Wastewater Circuit Rider Program Budget

Item	Unit Cost	Quantity	Cost
		Capital Costs	
Vehicle	$10,000	1	$10,000
Sludge Pump	$1,500	1	$1,500
Portable Incubator	$1,000	1	$1,000
Portable Spectrophotometer	$3,500	1	$3,500
COD Reactor Block	$700	1	$700
Misc. Tools and Laboratory Supplies	$3,000		$3,000
		Total	**$19,700**
		Yearly Costs	
Overhead	$3000		$3,000
Circuit Rider Salary	$7200	2	14,400
Circuit Rider Benefits	30%	2	4,320
U.S. Based Technical Support	$6,000		6,000
Vehicle Upkeep	$3,000		3,000
Monitoring Supplies	$5,000		$5,000
		Total	**$35,720**

6 References

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Appendix A : Honduras Wastewater Treatment Systems

2000 SANAA Inventory of Wastewater Treatment Plants (SANAA, 2007)

Municipality	*Department*	*Type of System*
Tela	Atlantida	Waste Stabilization Ponds
Tela	Atlantida	Mixed Aeration/Oxidation
La Ceiba	Atlantida	Imhoff Tank
La Ceiba	Atlantida	Mixed Aeration/Oxidation
La Entrada	Copán	Waste Stabilization Ponds
La Entrada	Copán	Imhoff Tank
Corquin	Copán	Imhoff Tank
Santa Rosa	Copán	Waste Stabilization Ponds
Tocoa	Colón	Imhoff Tank
Sonaguera	Colón	Waste Stabilization Ponds
San Pedro Sula (Col. Fesitranh)	Cortés	Trickling Filter
Villa Nueva	Cortés	Waste Stabilization Ponds
Choloma	Cortés	Waste Stabilization Ponds
Puerto Cortés	Cortés	Waste Stabilization Ponds
San Francisco de Yojoa	Cortés	Imhoff Tank
La Lima	Cortés	Imhoff Tank
San Pedro Sula	Cortés	Trickling Filter
Siguatepeque	Comayagua	Waste Stabilization Ponds
Taulabe	Comayagua	Waste Stabilization Ponds
Villa de San Antonio	Comayagua	Waste Stabilization Ponds
El Paraíso	El Paraíso	Waste Stabilization Ponds
Danlí	El Paraíso	Waste Stabilization Ponds
Teupasenti	El Paraíso	Imhoff Tank + Constructed Wetlands
Choluteca	Choluteca	Waste Stabilization Ponds
Guaymaca	Francisco Morazan	Imhoff Tank + Constructed Wetlands
El Zamorano	Francisco Morazan	Imhoff Tank
Tegucigalpa	Francisco Morazan	Activated Sludge
Sabana Grande	Francisco Morazan	Imhoff Tank
Marcala	La Páz	Imhoff Tank
Gracias	Lempira	Imhoff Tank
Lapaera	Lempira	Imhoff Tank
Las Flores	Lempira	Imhoff Tank
Nueva Ocotepeque	Ocotepeque	Imhoff Tank
San Marco de Ocotepeque	Ocotepeque	Waste Stabilization Ponds
Intibuca	Intibuca	Imhoff Tank
La Esperanza e Intibuca	Intibuca	Imhoff Tank
Catacamas	Olancho	Waste Stabilization Ponds
Juticalpa	Olancho	Waste Stabilization Ponds
Salamá	Olancho	Waste Stabilization Ponds
Colinas	Santa Barbara	Septic Tank
Santa Barbara (Barrio El Llano del Conejo)	Santa Barbara	Imhoff Tank
Santa Barbara (Barrio Galeras)	Santa Barbara	Imhoff Tank
Gualala	Santa Barbara	Imhoff Tank
Roatan	Islas de Bahia	Waste Stabilization Ponds
Nacaome	Valle	Waste Stabilization Ponds
San Lorenzo	Valle	Waste Stabilization Ponds
El Nispero	Yoro	Imhoff Tank
Victoria	Yoro	Waste Stabilization Ponds
El Negrito	Yoro	Waste Stabilization Ponds
Morazán	Yoro	Waste Stabilization Ponds
Olanchito	Yoro	Waste Stabilization Ponds

Appendix B: Identification of Key Collaborators

Any efforts to continue investigations and create a wastewater circuit rider program will require a core group of collaborators. The following individuals and institutions have been instrumental in the work to date and it is hoped they will continue to support and contribute to the development of a longer-term action plan and partnership.

<u>Ari Herrera</u>
Ari's thesis work while at the University of Texas-Austin focused on the rehabilitation of Imhoff Tanks in Las Vegas, Santa Barbara. He grew up in El Progresso, Honduras and is currently working as an engineer in Austin Texas. He helped to organize and advise the MIT Masters of Engineering work in Las Vegas during January of 2008.

<u>Diana Beatencourt & Manuel Lopez</u>
Diana and Manual are environmental engineers based out of San Pedro Sula. They are active members of Ras-Hon (Red de Agua y Saneamiento de Honduras) which is a network of professionals within Honduras who help to shape water and sanitation policies. Ras-Hon represents the voice of civil society and provides a forum for open collaboration and awareness for pressing issues. Additionally, Diana is the country coordinator for the organization Water for People. Both are excellent resources for advice on what is locally available and relevant to Honduras.

<u>MIT MEng Program</u>
Each year students in the Environmental Engineering Masters of Engineering program at MIT spend the month of January doing fieldwork in relation to a thesis project. Professor Eric Adams has led groups of students to Honduras on two occasions. These students can provide support to technical issues that arise and perform modest scientific studies on methods to improve treatment.

<u>Engineers without Borders – Phoenix</u>
Through the coordination of a local Peace Corp volunteer and Ari Herrera the Engineers without Borders Professional chapter in Phoenix preformed an initial assessment of the Imhoff tank in Marcala. Based on their experience, their interest and ability to contribute to any sort of initives should be further explored.

<u>Municipality of Las Vegas</u>
The municipality of Las Vegas served as gracious and interested hosts during the January 2008 MIT work. The support of the Mayor and city engineers was crucial and their positive experiences with the collaboration can be used to promote continued initives. The Imhoff tanks in Las Vegas are in good structural condition and hold the potential to be an excellent site to receive assistance from a circuit rider as soon as possible.