Construction of Improved Community Spring for Clean Drinking Water in Rural Peru

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Background

The availability of clean water is a necessity of life. However, millions of people living in developing countries lack essential clean water sources to maintain good health. Today, approximately 884 million people worldwide lack access to improved drinking sources that provide water free of pathogens and contaminants (World Health Organization [WHO] & UNICEF, 2010). Unclean water leads to a multitude of health problems and often results in illnesses and deaths among vulnerable populations such as infants, children, and the elderly (UNICEF, 2010). Access to clean water could prevent the deaths of 1.4 million children annually and significantly reduce disease while improving the overall health of the population (WHO, 2008).

Since 1990, the country of Peru has increased clean water sources by ten percent for the total population (WHO, 2006). However, the availability of these clean water sources is linked to health disparities which exist throughout the country. Significant health disparities exist between the urban and rural populations in Peru, often leading to fewer health-related resources available to rural populations, including potable water (Huynen, Vollebregt, Martens, & Benavides, 2005). The World Health Organization (2006) estimates that 92 percent of urban residents in Peru have access to improved drinking water sources, while only 63 percent of those dwelling in rural areas are able to obtain clean water. Communities located in the Andes Mountains are particularly vulnerable to using unclean water sources for a variety of reasons including lower socioeconomic status, the remoteness of the locations in which they live, and poorly constructed or no water and sanitation infrastructure. The community of Parina located in the rural southeast region of the Andes Mountains, adjacent to Lake Titicaca, currently struggles to access clean water sources. Parina is a small rural community situated approximately 12,500 feet above sea level and located outside the regional capital of Puno. Due to the rural location of Parina, community members lack access to clean water sources and struggle to obtain health-related services that would contribute to an improved health status.

Needs statement

The community of Parina primarily obtains their drinking water from unprotected springs contaminated by human and animal waste and unmaintained wells built by the government. The primary spring is a location in which the community obtains drinking and cooking water and takes their animals to drink (Figures 1 & 2). While water from this spring is initially pure and potable, environmental contamination and lack of maintenance leads to unclean drinking water in the spring. The structure of this spring is not ideal for preventing contamination of ground water and perpetuates water-related diseases. A local Peruvian non-governmental organization, Suma Marka, along with two dedicated community members have been conducting monthly water quality monitoring tests on the spring water since January 2010 and have consistently found bacterial contamination in the water. The spring has been seen to contain higher than normal levels of *Escherichia coli* and fecal coliforms. The presence of these indicator microbes increases the likelihood of gastrointestinal problems and diarrhea in Parina, especially among vulnerable children, pregnant women, and the elderly. Therefore, the construction of an improved community spring with a catchment box is needed to prevent further contamination of the spring and provide clean drinking water to Parina community.

Figure 1: Community spring in Parina where community members get drinking water

Goals and objectives

Goal: To improve the health of the community in Parina, Peru by creating a sustainable potable water source.

Outcome Objectives:

1. By March 31, 2011, one spring in Parina, Peru will be improved by constructing a protected spring box and small cement catchment box.

2. By March 31, 2011, community members in Parina will be trained on the maintenance of the protected spring to ensure clean water distribution in the future.

Figure 2: Parina community spring containing high concentrations of *E.coli* and fecal coliforms

Methodology

The development and implementation of this project will occur in two phases: 1) planning and community engagement; and 2) construction of improved community spring.

Planning and community engagement (February 2011)

The initial phase of this project began in February 2011 to coordinate with community members in Parina and to develop plans for the construction of the improved spring. Suma Marka and the project coordinator began by conducting a focus group with Parina community members to discuss options of spring and well improvements, solicit the concerns and desires of the community members, and initiate community involvement. Following the initial focus group, a community visit to Parina was conducted in which methods for spring improvement were presented to the community, the community determined the most appropriate design and a schedule for construction was developed. Community members assisted in developing the plans for construction, acquiring costs for materials, and have committed to contribute materials to the construction process.

Construction of improved community spring (March 2011)

The construction of the improved spring with a small cement catchment box will be completed in the month of March. Community members decided that the most appropriate method for improvement and distribution was to protect and cover the existing spring and construct a small catchment box that will provide sufficient water to families within Parina. Figure 3 shows a model for improving the existing spring that will be used as the basis for spring improvement in Parina. The actual spring and catchment box will vary slightly from this figure (see below).

Due to the rural location of Parina it is not possible to purchase materials within the community; therefore all construction materials and equipment will be purchased locally in the nearby city of Puno. These materials will then be transported via truck to Parina. Community members have also committed to providing certain materials that they currently have within the community such as manual labor, wood for the spring box frame, and construction tools.

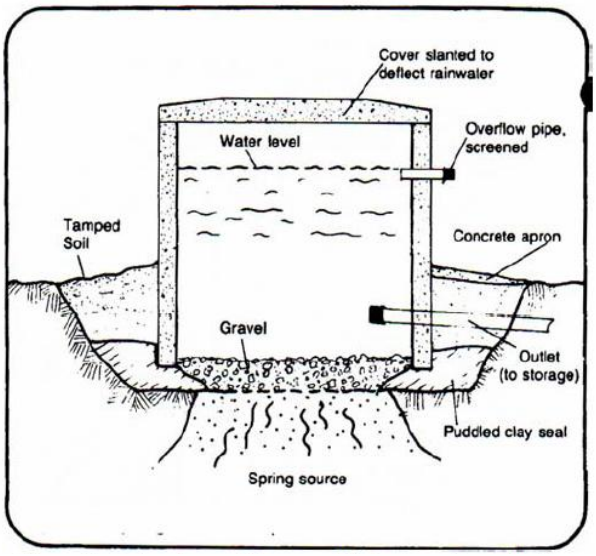

Figure 3: Spring box with permeable bottom that will be the model for the improved spring in Parina. (Courtesy of USAID, 1982, available online at www.lifewater.org)

In order to ensure proper and sustainable construction, a local professional who has experience in constructing improved springs or wells will be hired to oversee the construction process of the catchment box. Community members in Parina will volunteer their time to be trained in proper construction techniques and carry out all construction activities. To initiate construction the current spring will be excavated until an impermeable soil layer is reached. Gravel and stones will be placed above the soil layer to prevent erosion and further ensure a clean water source. A cement wall with an overflow tube at the top will be placed on the open wall of the spring to close the spring off. A second tube will be placed towards the bottom of the wall, approximately 50 centimeters from the ground, providing a connection to the catchment box. The water will flow from the protected spring into the catchment box where it will then be accessible to the community through a tap. In addition, a cover will be constructed from local materials to ensure no contamination enters the spring from above; this cover will be locked to ensure no unauthorized persons enter the spring. The construction of the cover from local materials is a community desired feature to allow entry into the spring for cleaning and maintenance.

After the initial protection of the spring is completed, the catchment box will be constructed. A wooden frame for the catchment box will be created along with iron reinforcement bars. The frame will be created to construct a 1.5 m x 1.5 m x 2 m catchment box. The cement mixture will be created and poured into the frame. The frame will be covered and allowed to dry for at least seven days; it is possible that the structure will dry for longer to ensure stability. The inside of the catchment box will also be painted with a liquid called Sika®1 to ensure impermeability. A cover for the catchment box will also be constructed with a top allowing for easy access to clean and maintain the catchment box. This cover will also have a lock to ensure no unauthorized persons enter the catchment box and water is not collected from the top of the catchment box. In the structure of the catchment box will be an outlet tube approximately 50 centimeters from the ground with a tap to allow for water collection. This outlet tube and tap will be clearly labeled as the water collection site. An overflow tube will be placed 50 centimeters from the top of the catchment box to ensure that the catchment box does not overflow. All tubes will have a screen on the end to ensure no debris will enter the spring or catchment box and all water leaving the catchment box will be free of particles. Lastly, the spring and catchment box will be disinfected with a chlorine solution before use. Community members will be trained on spring and catchment box maintenance to ensure a clean water source in the future and sustainability of all structures. Monthly water quality monitoring will continue to be conducted on the spring water to determine if the water is being contaminated.

Sustainability

The sustainability of this project is inherent if community members are able to maintain the spring as clean water will improve the health status and quality of life for the entire community. The infrastructure of the spring and catchment box utilizes a mechanically simplistic method to ensure ease of construction and replication. During construction the majority of equipment and materials will be obtained or made locally ensuring access to these materials in the future. Along with the use of local materials, community members will be trained on construction and maintenance techniques for the spring. These methods ensure that community members will be able to maintain the spring and fix problems that arise in the future. In addition, the support and collaboration of Suma Marka will ensure that a local organization is available for future community development needs.

Project Budget

Budget for improved spring and catchment box in Parina, Peru	
Cement (20 bags x $7.50/bag)	$150.00
Iron reinforcement bars (20 bars x $9)	$180.00

Accessories (tubes, nails, wire, tap, etc)	$22.00
Sand and gravel (2 large cubes @ $45 each)	$90.00
Sika®1 (liquid to ensure impermeability) (15L @ $7 for 5L)	$21.00
Transportation of materials to Parina	$32.00
Construction specialist	$100.00
Construction tools	In-kind from community
Community manual labor	In-kind from community
Wood for spring box construction	In-kind from community
Total amount requested	**$595.00**

The total budget for implementation of this project is **$595.00**. Approximately $463.00 will be used for the acquisition of construction materials including cement, iron reinforcement bars, sand, gravel, tubes, wires, etc. The transportation of these construction materials from Puno to Parina is estimated at $32.00 to cover truck rental and gas. A construction specialist will be hired to provide oversight in the construction of the catchment box and provide expertise as needed. It is estimated that this specialist will be on-sight for at least four days during construction of the catchment box and will be available for consultation throughout the rest of the project. This person will be paid according to a local scale estimated at $25 per day for a total of $100.00. The community of Parina has committed to provide manual labor, wood for the spring box frame, and construction tools through in-kind contributions. Therefore the total amount requested from Water Charity is **$595.00**.

Description of organization and personnel

Suma Marka is a non-governmental organization dedicated to studying and improving environmental conditions throughout Peruvian communities and Lake Titicaca. Suma Marka seeks to test environmental indicators through low-cost technologies and to examine social impacts on the environment. The organization is composed of young professionals in the fields of science and sociology who collaborate with communities and regional governments to improve the environment. Suma Marka conducts monthly water monitoring in communities throughout the Puno region to determine physical quality and bacterial contamination of local water sources. The organization collaborates with communities, Peruvian municipalities, and external partners such as Global Water Watch, the Chijnaya Foundation, and Pomona College in the United States. Suma Marka will be the lead organization in this project, providing expertise on environmental management and training methods. They will be essential to the on-going training and sustainability after the completion of this project.

Kristen Gunther is a graduate student in global health at Loma Linda University, School of Public Health. She has experience developing public health curricula and training materials for a community based organization working with Hispanic populations, as well as implementing training sessions for *promotores de salud*. Kristen was involved in research conducted by Loma Linda University on the wastewater treatment system in Juli and Huaquina, Peru in July 2010. She co-wrote an Environmental Impact Assessment for Suma Marka on the treatment system and its effects on the environment in Huaquina. Kristen will be the project coordinator overseeing well construction and community education activities.

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