Nerkin Khndzoresk Community Water Improvement Project

Using the generous donations of Six Senses Resorts & Spas with the help of Appropriate Projects, the Nerkin Khndzoresk Community Water Improvement Project was recently completed, implementing BioSand water filters throughout the village. Local town experts have now deemed the yielded water as 'safe for drinking', seeing an immense reduction in bacteria as well as turbidity levels. This goal of the water improvement project was to provide clean drinking water at accessible points within the village while training community members on the filter design for maintenance and future use. The outcome of the project successfully addressed the community's need for improved drinking water through the use of BioSand slow water filters. This water filter was selected due to the availability to gather resources needed as well as effective remove up to 99% of diarrheal infecting bacteria. The filter works to remove pollutants through the use of biologically active layers of oxygen-rich environment found within the sand.

After much discussion on the filter's design and acquisition of resources, the project completed with the assistance of water and engineer experts from the village's closest town. The engineers adapted the standard design of the filter to assist in ease of use for the recipients while keeping the overall concept of the filter. The completed project, constructing BioSand Filters throughout the village (1 in the school, 2 in town), concluded with a final seminar on volunteering of which the children assisted in the construction of the filter, learned maintenance of the filter, and gained awareness of the importance of helping their communities. After learning about the filter design, children were instructed to obtain gravel of various sizes to assist in removal of impurities and percolate the water. The children were able to see the results of their work and were excited to get to drink out of the filter. The vice principle and engineer of the school was amazed at the materialization of the filter, "I didn't understand how something so simple could actually help clean our water. Now it makes sense, it's just like a river."

The success of the project provided the community members, especially the youth, with further hope for their community. One mother stated, "It's great that they can see that they can make a change and be creative. These are the skills that we need to teach our children to continue to improve our village slowly."

A step by step process to building the filter is indicated below:

BioSand Filter Building Process

Step 1: Collection of Materials

The following materials were collected to build the filter:

- 200L Container
- PCP Pipe
- Water Strainer/Disperser
- Large Rocks and Smaller Gravel
- Sand
- Large Pale for Water Collection
- Balloon Catch
- Rivets
- Faucet
- Valve
- Hose Bib
- Spigot

Step 2: Engineering of Filter

To ease use of the filters, the community designers decided to attach a hose to a water valve to allow a constant flow of water to enter the filter. This device prevents human labor from continuously adding water to the filter and to maintain the water level above the sand level. On the top inside the large container, a dispersing device was placed on the inside of the container to disperse the water equally onto the sand, preventing a tornado effect and ensuring the creation of the biofilm layer. Additionally, a balloon catch was implemented to prevent the water level from reaching too high and providing oxygen to flow throughout the filter (activating the bacteria in the biofilm layer). If the water level reaches approximately 1-2 inches above the sand, the valve will close, and the water flow will be cut from entering. Small holes were drilled into a PCP pipe circling the bottom of the filter. This architecture was designed to avoid any one rock inhibiting water flow into the pipe. The flow of water would then move upward through the hose (located at the level of the 1 inch water sitting on the sand) where the water would pass through a large detainer catching all the yielded water into a faucet system, which was engineered so students could pour the desired amount of water using the spigot.

Step 3: Cleaning of Rocks

Rocks were gathered by the students and separated into two groups: larger rocks and smaller gravel. The larger rocks were designed to be at the bottom of the filter, followed by smaller rocks, and finally sand embodying the structure of water coming from a river.

Step 4: Assembly of Materials

The assembly of materials began with a small hole puncture at the bottom portion of the container. A rivet system was placed to tightly fasten around the outlet. The PCP pipe was joined to the rivet on the inner side, approximately 2 inches above the bottom of the container.

Using the same rivet design, the balloon catch was placed at the top of the container from the inside. A large connecting hose was connected to the respective filter's water valve.

The larger rocks were placed in the lower ¼ portion of the container followed by smaller rocks and gravel. Sand was added after the small gravel to prevent sand from entering the yielded drinking water.

Step 5: Connection of Filter

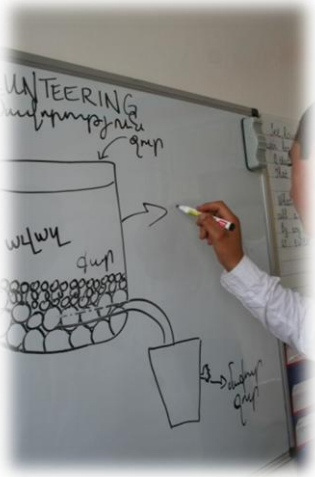
The hose connecting water to a valve was inserted at the top of the container. The valve was opened and water was dispersed throughout the container.

Step 6: Development of Biofilm Layer

Water was passed through the filter at a slow rate yielding over 50L of water per day for an extended period of time. Students and community members were told not to drink the water throughout this initial timespan. After a little over 2 weeks, a dirt cover was formed on top of the sand. Time was allowed for water to pass through the filter to create the biofilm layer.

Step 7: Maintenance Training and Knowledge Transfer

During a 3 day summer workshop on volunteerism, students and teachers gathered to learn about our new filter. In addition to helping gather materials and assemble materials, the students and teachers learned about how the process works. They were taught 4 main steps in how the filter improves the water: (1) Creation of a biofilm layer by 1-2 inch stand still water on top of sand; (2) Absorption of bacteria to sand while the water passes through; (3) Coating of film acquires throughout the sand and becomes more effective over time; (4) As the water must pass through over ½ meter of sand, once it reaches organisms/bacteria will die once yielded into



rocks. In addition, they learned that for best practices, the water sitting on top of the sand must be stirred approximately 1 time per month.

Step 8: Testing and Drinking

From initial view of the water, the turbidity has been greatly decreased. The water was taken to the nearest local water testing in Goris and revealed safe for drinking. The results indicated that the bacteria had been greatly reduced from the yielded water.

Outcomes & Results

1. *Improved Water* – The filtered water resulted in approximately 20% reduction in turbidity of an untreated source located nearly the new built filters. The local Goris area water company retested the yielded water and approved it safe for drinking, seeing less than 5% bacteria. They claim the bacterium previously seen in the tested water indicates a substantial reduction in coliform bacteria dependent on where the original water was received.
2. *Increase of Water Consumption by Youth* – Previous to the completion of the water filter, there was no specified drinking water within the school. The estimated water consumption by children throughout the entire day was less than 1 cup. Teachers now indicate that due to the availability of clean drinking water, each student generally drinks approximately 1-2 cups of water throughout the school day. With the completion of the filter, awareness has been raised that it is recommended to drink 6-8 cups of water per day.
3. *Acquired Knowledge* – The building process of the filters was a communal process with assistance from local engineers, teachers, and students and youth throughout the community. All were informed about the building process of the filter, trained on the maintenance, and assisted in material collection.
4. *Disease Prevention* – The local health post currently has documented that over 50% of the villagers experience some sort of infectious disease throughout the year, generally diarrheal diseases, directly believed to be caused by the drinking water. With the new water filters, one local health practitioner believes we can expect to decrease the rate of these infectious diseases by approximately 20%. The health post in combination with the village major's office, will be analyzing the reduction in disease specifically targeting the populations using the filter.