Financially Responsible Endeavor to Serve Humanity Water

Introduction to F.R.E.S.H. Water:

The United Nations has recognized the availability of clean, safe water as one of the most pressing issues facing developing nations. 18% of the world's population does not have access to clean drinking water[i]. Every day, 4,400 children under the age of five die due to water-borne illness[ii]. Many of these illnesses are preventable using basic water treatment methods, such as filtration and disinfection. According to the World Health Organization, "Improved water and sanitation will speed the achievement of all eight Millennium Development Goals."[iii]

In this spirit, several Brandeis University undergraduate students have come together to plan, fund, and implement our own plan for bringing water treatment resources to areas that have none.

Solving this problem is not merely an issue of bringing bottled water. Every individual, no matter where he or she lives, needs to have a consistent and renewable source of clean water. We work by targeting a specific area in need of a source of clean water, developing an economically and technically reasonable solution, and implementing that solution in a way that minimizes overhead.

This organization, known as the Financially Responsible Endeavor to Serve Humanity Water (F.R.E.S.H. Water), is working together with other student groups across the New England Region to hold workshops and educational sessions that deepen our understanding of the issues surrounding water resources and treatment.

Although we come from a variety of backgrounds, we are united in our desire to create a better world, where a child's life is not at risk every time he or she picks up a glass of water.

Our current project focuses on delivering a unique system of water purification to a remote village in Peru. We are receiving extensive advice from Dwight Peavey, a Senior Scientist of the New England division of the United States Environmental Protection Agency.

Who we are:

F.R.E.S.H. Water is a student-run philanthropic organization working towards the goal of bringing water purification resources to rural areas of Peru. F.R.E.S.H. operates under the ideal that college students can and should instigate social change. We focused F.R.E.S.H Water's initial efforts towards a common goal; to put our time and education towards a humanitarian effort. Indeed, we quickly discovered that a lack of clean water was a cause worthy of attention.

More importantly, we realized that we could provide a positive, tangible influence in this area. We have the resources and the desire to positively influence the world.

We seek to take sustainability into account, as well as the cultural context in which we are working. We hope to have a working water treatment system built and running in Peru by the end of the summer of 2009. F.R.E.S.H. Water is considered a Not-For-Profit organization and was therefore granted 501(c)(3) status through Brandeis University.

Membership:

F.R.E.S.H. is comprised of students from Brandeis University. We were drawn together by the simple desire to help others. We come from all disciplines, including biology, chemistry, neuroscience, history, literature, fine arts, and economics. Membership is based only on the demonstrated effort to help F.R.E.S.H. bring about positive social change.

Why we are different:

Given the size of F.R.E.S.H. Water, it is possible to receive individual contributions from each member of the group. The benefits of task specialization are recognized throughout the group and are acted upon accordingly. For example, each challenge is approached as a group and divided into individual tasks; the allocation of these tasks is based on the goals and interests of the individual members. We believe that this approach enhances our confidence as a group and builds connections between the members.

How are we "Financially Responsible?"

F.R.E.S.H. Water has been founded on the notion that all donated money is precious. We can do so much with so little; we are very scrupulous with all of our finances. In this regard,

F.R.E.S.H. Water has vowed to be extremely transparent with all finances. With detailed bookkeeping and frequent financial updates, F.R.E.S.H. guarantees not to fruitlessly spend money for anything that does not directly benefit the local inhabitants of the Peruvian village that we choose.

Can a group of college students effectively plan and implement a water treatment system?

This, of course, is the ultimate question. We fully believe that a group of Brandeis students can make an impact on a small community in Peru, but acknowledge that it will require extensive time and energy from each of us. It seems plausible that our group could implement a water purification system abroad, but there are a number of different challenges that our group will face. We know that this project is feasible, and the effort and time we have

already committed reflects this. With that said, this project rests in the hands of the members of F.R.E.S.H. Water—if we want to build a water purification system in Peru, then we can.

Why we chose Peru:

We chose Peru not only for financial and logistical reasons, but also because several of our members have strong ties with the region and feel compelled to help. Peruvian sand is a perfect fit for the sand filtration system that we intend to implement. The country also has an alarming discrepancy in basic human necessities-- primarily access to purified water-- between urban and rural areas. With the money we are projected to raise, we can make a better system of water purification in Peru, as compared to more remote countries. This is primarily due to lower transportation costs. F.R.E.S.H. Water is based on a financially responsible approach to purify water, which is highly achievable in Peru.

What are the major water-borne diseases in Peru?

According to the World Health Organization, only 32% of rural inhabitants in Peru have access to potable water. There is an estimated 11,800 rural water systems in the rural regions of Peru. However, 7,000 of these rural water systems have neither the knowhow nor the ability to disinfect and purify water.[iv]

Water-borne illnesses continue to be a serious problem in Peru. The Center for Disease Control has been tracking a large Cholera epidemic that swept through Peru in the early 1990's. In 1991, there were 322,562 cases of Cholera reported in Peru. While today, this outbreak is nowhere near as dire as it has been in the early 90's, there are still numerous cases each year. This epidemic highlights the lack of safe drinking water available in rural areas, and also underscores the dangers of a lack of a clean water system. Water-borne illnesses can spread extremely rapidly.

According to the United States Center for Disease Control, the water-borne pathogen in Peru that is most concerning is Cryptosporidium. Cryptosporidium causes a diarrheal illness called cryptosporidiosis. Another lingering danger is Cholera. The World Health Organization estimates that the death rate for cases of Cholera that go untreated is greater than 50%.

Other Peruvian water borne bacteria include Hepatitis A, Malaria, Oroya Fever, and Yellow Fever. [v]

What percentage of rural Peru has access to sanitary drinking water?

In rural areas, coverage of drinking water is 65% and the rate of water sanitation is only 32%.[vi]

How will the Peruvian community take ownership?

We must train the community members about how the water system works. Specifically we must explain to them what potential problems could arise and how to fix these problems. Having locals assist in the construction will involve the community and help create local excitement towards the project. In this way, they will have an incentive to keep it working properly. It is important to come across not as an imperialistic group of Americans wanting to expose our beliefs or practices on local Peruvians; therefore, we intend to open a dialogue between our group and their leaders. The community must embrace our water solution in order for it to be successful. This is absolutely imperative. The local inhabitants of rural Peru have been marginalized for a long time (which is why they are impoverished in the first place). We fully intend to create an overall sense of community ownership towards the project. We will have a preliminary trip to Peru to establish a connection with a willing community so that we can examine their specific water needs and ensure that they really want our help. It is essential to stress that we will always consider local customs and practices—we understand the vast cultural differences that have to be accounted for.

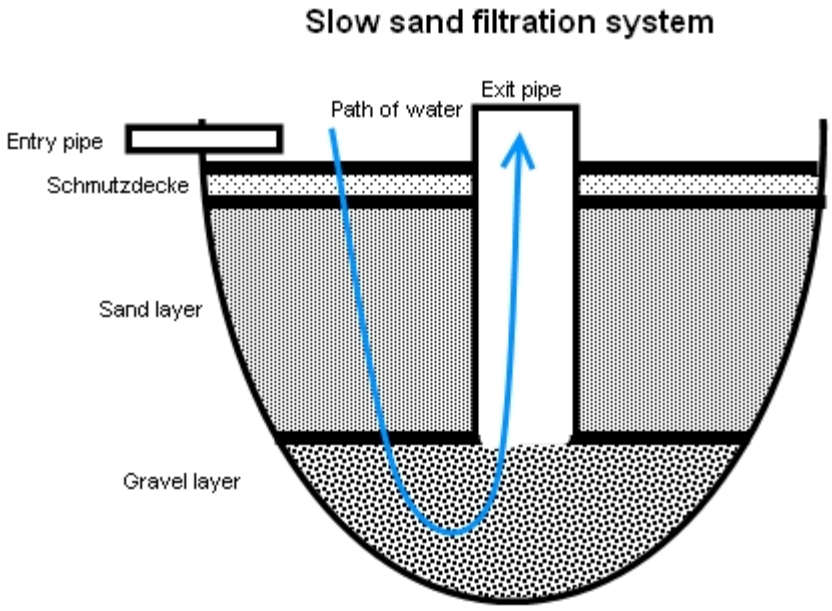
Slow Sand Filtration Technique:

F.R.E.S.H. Water intends to combat water-borne pathogens by providing for the access to clean water in a rural Peruvian village. Our current project focuses on the use of slow sand filtration. This filtration system is incredibly effective for a variety of reasons:

- Slow sand filtration allows for local Peruvian materials to be used in the process of water purification, specifically local sand, clay, and gravel.
- Slow sand filtration is an extremely long term solution. The primary filter is sand, which only needs to be replaced infrequently and from local sand.
- Slow sand filtration is extremely simple. The only moving parts are in a simple hand pump that moves water from a water source into the slow sand filtration system. This results in little opportunity for the system to fail.
- Slow sand filtration has been proven effective. This system has been used for thousands of years, first by the Romans. The Romans were known to utilize open aqueducts to move water, yet had extremely low documented cases of water-borne illnesses, because of the effectiveness of the slow sand filtration system.
- Slow sand filtration is extremely financially responsible. Since there are few moving parts, and the sand is local, there are very little overhead costs to create a slow sand filtration system.
- Slow sand filtration is very easy to use. Local Peruvians will quickly learn how to create slow sand filtration systems in other villages because of the integral simplicity that is involved in a slow sand filtration system.

- Slow sand filtration removes over 99% of Cryptosporidium, the pathogen that causes Cryptosporidiosis. It is also proven to remove over 99.9% of Cholera pathogens from water.
- Slow sand filtration uses no chemicals. This means that once the system is in place, local Peruvians have no dependency on outside materials.

The slow sand filtration system is extremely simple to both create and use. Filtration works through a combination of physical, biological, and chemical mechanisms. We intend to utilize three sand pits to create purified water. The initial pit offers primary filtration, which is removing any debris that is larger than individual grains of sand. Particles smaller than grains of sand adhere to sand particles through a combination of Van der Waals forces as well as electrical forces. Pathogens including viruses, bacteria, and parasites are removed through the same combination of physiochemical slow filtration and through biological mechanisms in the schmutzdecke, which is essentially a "grime filter" that offers the biological filtration in a slow sand filter. The composition of the schmutzdecke includes a biofilm mixture of bacteria, fungi, protozoans, and other small aquatic organisms. Since we intend to utilize three sand filtration pits, the initial pit will serve as primary filter, while the second and third serve as subsequent secondary and tertiary treatment filters. The advantage of having three filters allow for more purified water to be created, requires less need to change the sand in the slow sand filters, and allows more time to recharge the schmutzdecke layer. The initial sand filtration pit will need to have sand replaced with relative frequency, while the other two pits will not require new sand often. It is important to stress that these slow sand filters work perfectly with local Peruvian sand. Despite the need to infrequently replace the sand, there is little cost, because the materials are free and local. Once this filter system is constructed, there is absolutely no reliance on materials and chemicals from abroad.



The sand filtration system is essentially a pit dug out of the Peruvian countryside. This pit is lined with clay (if it is widely available) or an impermeable tarp that will not allow water to seep through. It is then filled with sand. In the middle of this sand pit is a PVC pipe, or locally available alternative that reaches from the bottom to the surface of the pit. Underneath the sand and the pipe is a semi-permeable layer of gravel that will only allow water through, keeping sand out (this is all above the clay or tarp that is laid down). Water is pumped into the sand pit and is purified as it travels through the sand. It then will collect below the sand in the layer of gravel. As enough water enters the pit, water is forced up the PVC pipe in the middle because it offers the path of least resistance. This results in clean water in the PVC pipe. It is then piped to another sand pit, to repeat the process. We will build the subsequent pits lower than the original, which will allow gravity to move the water from one pit to another, through extremely simple piping. The process will be repeated three times, at which point the water will be collected in sanitary collecting pools and made available to the villagers.

Is slow sand filtration sustainable and reliable?

Our water apparatus will use sand as the main form of filtration. One of the many advantages of this system is that the sand needs to be replaced very infrequently. Sand is a readily available resource so replacement is quite easy. It is essential to bear in mind that this system has been used before. The Romans had used slow sand filtration extensively during the height of their civilization.[vii] We are using some modern innovations, including a hand pump to move water into the filtration system, tarps to trap water in the pits, and utilizing multiple sand pits. However, the basic concept has been around and utilized for centuries. The Romans had extremely low instances of water borne illnesses, especially when considering that open aqueducts should have been a breeding ground of bacteria. Modern science also argues that this system works well. The concept for this system was brought to us by Dwight Peavey, a Senior Scientist at the New England division of the Environmental Protection Agency.

History of F.R.E.S.H. Water:

F.R.E.S.H. Water was founded on the belief that anybody can instigate positive social change given the thoughtful application of concerted effort. The following is a brief timeline of our progress. Here are several of our landmark achievements:

- F.R.E.S.H. Water pursued recognition as an official Brandeis University Club. After the University approved the constitution as well as a thorough evaluation by University officials, the Brandeis University Student Union approved F.R.E.S.H. Water as a recognized club.
- F.R.E.S.H. Water was officially granted 501(c)(3) status that is given to all official Not-For-Profit clubs and organizations of Brandeis University, officially making us a Not-For-

Profit legal entity. We can now offer tax dedications for any sizable donations made to us.

- F.R.E.S.H. Water became a member of the Millennium Campus Network (MCN), a group of philanthropic organizations from several universities in the New England area, including Harvard and MIT.
- F.R.E.S.H. Water began a partnership with Positive Foundations, another Brandeis University student organization, to create the Water Taskforce. This taskforce works with the Harvard Clean Water Project to find solutions to water contamination problems, such as heavy metal and arsenic contamination.
- F.R.E.S.H. Water began working with Dwight Peavey, a Senior Scientist of the United States Environmental Protection Agency, Region 1, New England.

[i] Water for Life, WHO
[ii] http://www.un.org/works/water/
[iii] Water for Life, WHO
[iv] Water for Life, WHO
[v] https://www.cia.gov/library/publications/the-world-factbook/geos/pe.html
[vi] http://www.bvsde.paho.org/bvsacd/cd51/planes.pdf
[vii] http://www.lenntech.com/history-water-treatment.htm