Northern Arizona University

Environmental Design Team

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Project Understanding

1.7 million deaths per year are attributed to the unsafe water within developing countries [1].

The goal of the project is to design and construct a reusable household water treatment system with a budget of $500 [2].

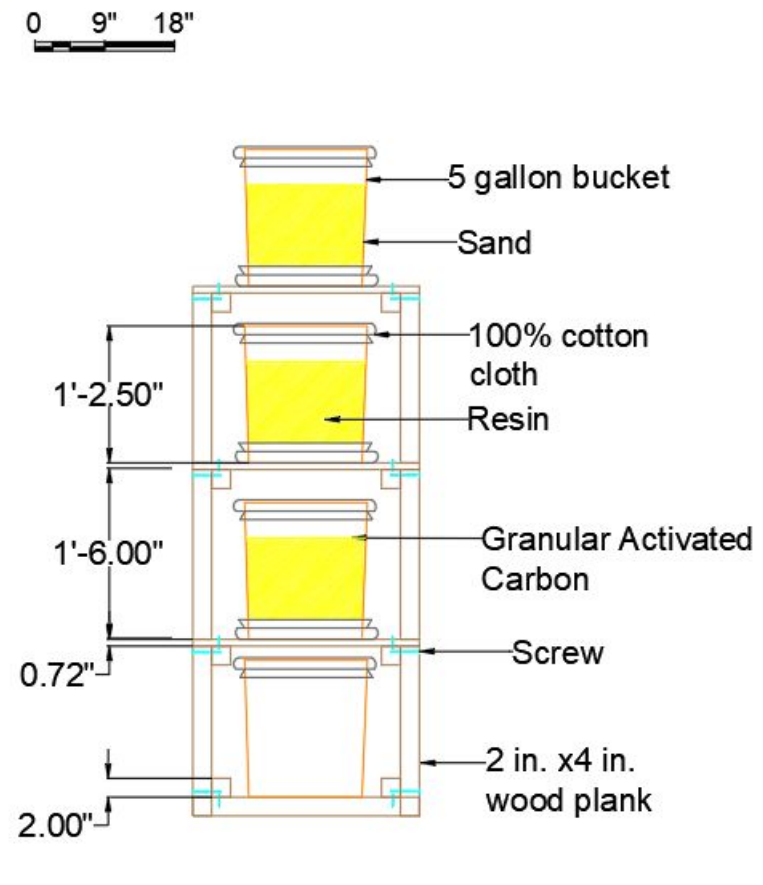

Figure 1: AutoCAD Rendition of Final Design

Step 1: Sedimentation

Sedimentation reduces initial turbidity by allowing suspended clay particles to settle.

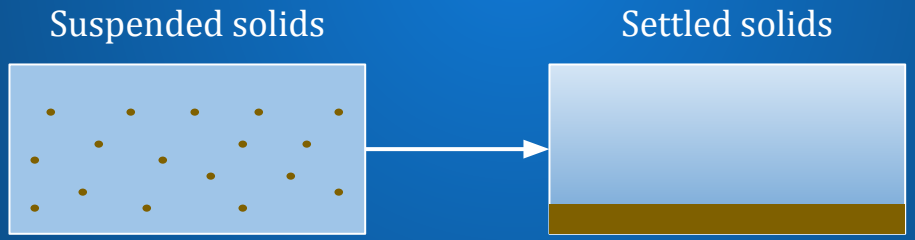

Figure 2: The Sedimentation Process

Step 2: Sand Filtration

Sand filtration further reduces turbidity by decreasing the presence of clay and Miracle Gro.

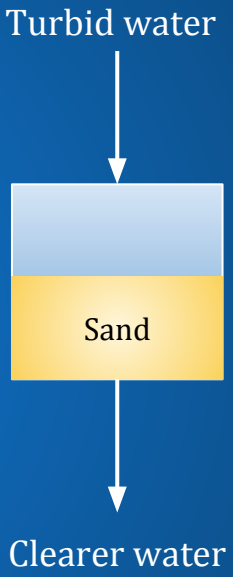

Figure 3: Sand Filtration

Step 3: Ion-Exchange Resin

An ion-exchange resin was implemented to remove Nitrate and Phosphate levels.

To reduce long term cost the resin can be recharged through backwashing.

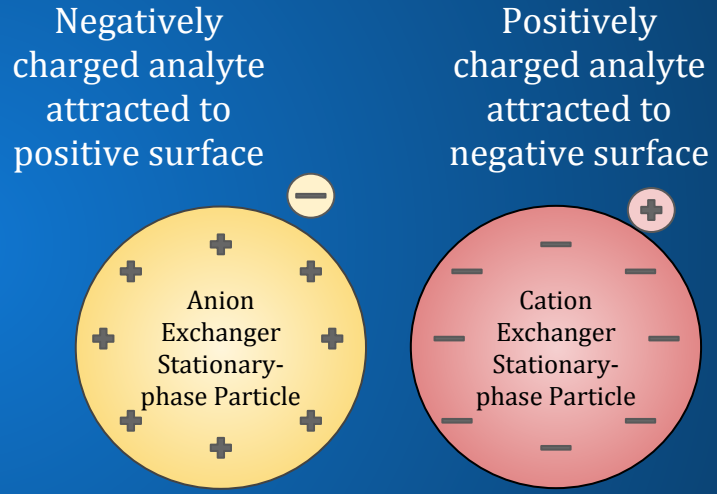

Figure 4: Ion-Exchange Particles [3]

Step 4: Granular Activated Carbon

Granular Activated Carbon aims to remove odor and any additional Turbidity.

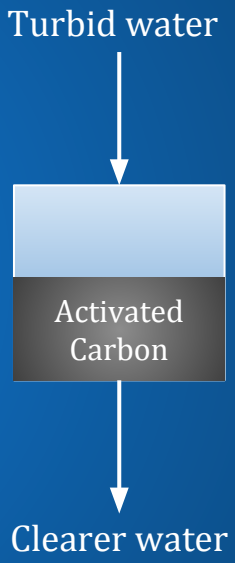

Figure 5: Granular Activated Carbon Filtration

Step 5: Disinfection

Clorox bleach was used to remove bacteria and fecal coliforms.

Multiple tests ran to determine necessary dose for residual chlorine amount.

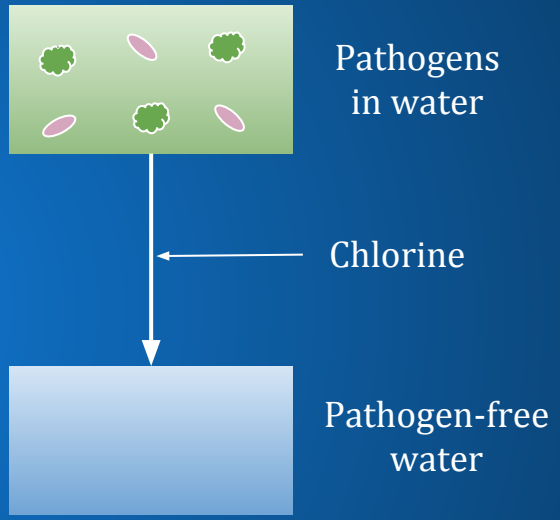

Figure 6: Chlorine Disinfection

Final Design

Figure 7: Water Treatment System

Materials and Cost

Table 1: Total Cost of System

Item	***Unit***	***Cost Per Unit***	***Quantity***	***Total cost***
2 in. by 4 in. Prime Stud	104.625 in. Stud	$3.77	4	$15.08
Plywood	48 in. x 96 in. Sheet	$9.98	1	$9.98
5 Gallon Bucket	1 Bucket	$3.25	5	$16.25
Screws	90 nails	$8.38	1	$8.38
30 Gallon Storage Tote	1 Tote	$9.97	1	$9.97
Screwdriver	1 Screwdriver	$0.87	4	$3.48
Mens Crew T-Shirts	10 T-Shirt Pack	$19.93	1	$19.93
Rubber Bands	64 Bands	$1.27	1	$1.27
Deionization Resin	5 Pounds	$45.00	4	$180.00
Bleach	30 Ounces	$8.14	1	$8.14
Activated Carbon	39 Ounces	$16.99	8	$135.92
Sand	50 Pounds	$28.41	1	$28.41
Total Cost				***$436.81***

References

[1] "WHO | Environment and health in developing countries", Who.int, 2017. [Online]. Available: http://www.who.int/heli/risks/ehindevcoun/en/. [Accessed: 17- Oct- 2017].

[2] American Society of Civil Engineers Environmental Design Competition. (2017). Flagstaff: Northern Arizona University, pp.1-9.

[3] Central Department of Microbiology. “Ion Exchange Chromatography”. (2018). Tribhuvan University. Institute of Science and Technology. [Online]. Available: https://microbiotu.edu.np/. [Accessed: 3-Mar-2018].