Village Water Ozonation Systems

Lizzy Chang and Daniel Ma

April 28th, 2017

14th Annual School of Science, Engineering, and Health Symposium

780 million

people worldwide lack access to clean water

80%

of all illness is a result of contaminated water

Vision

Every community should have access to clean water.

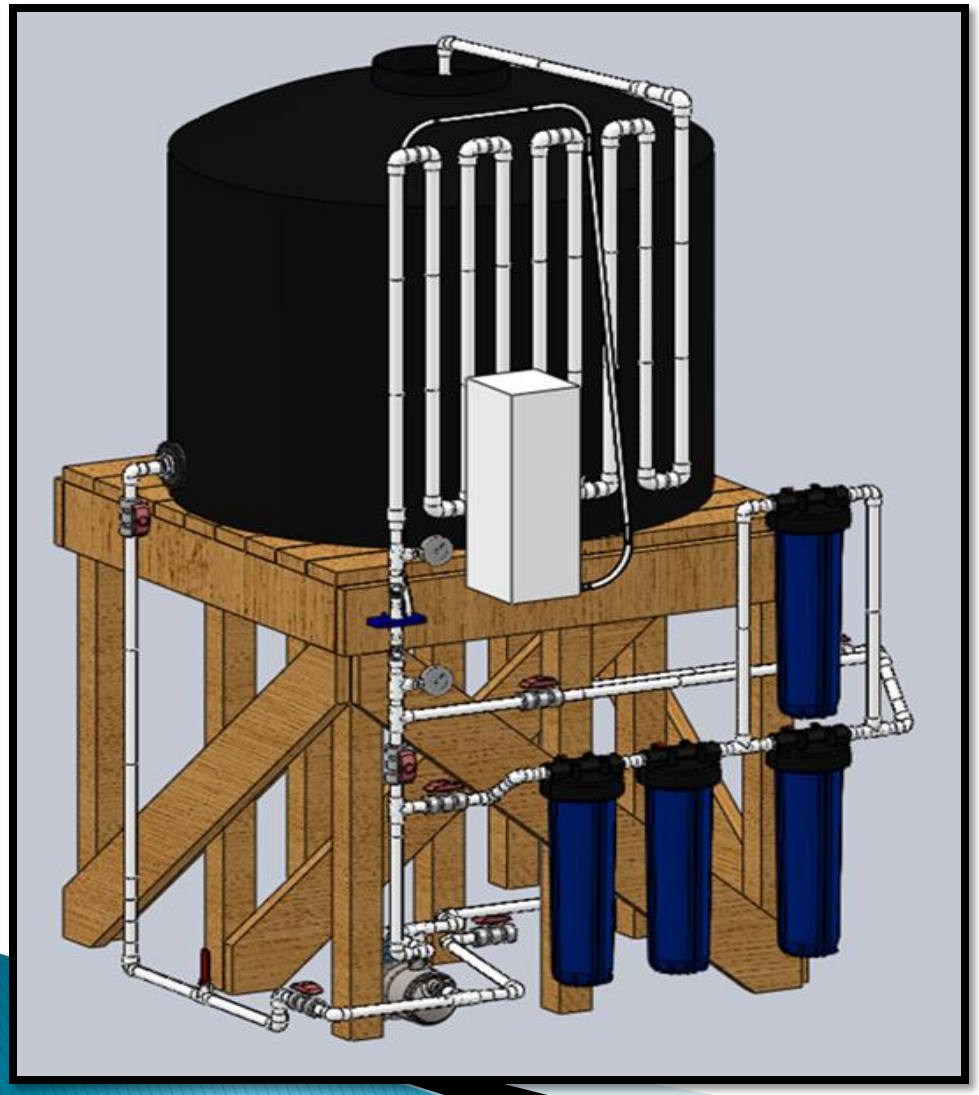
Project Goals

Affordability

Sustainability

Community

Village Water Ozonation System



- Small scale water treatment batch system
- Utilizes filtration and ozone disinfection
- Reliably treats water at an average rate of 3 gallons per minute
- Costs $3500

May 2016: Site Visit

FORWARD EDGE INTERNATIONAL

May 2016: Successful Installation

Current Work and Next Steps

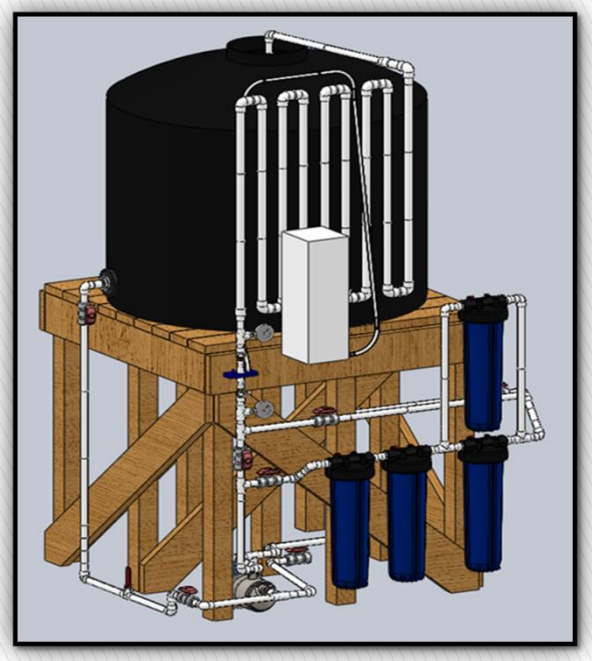
Los Prietos, Honduras

- School of approximately 120 students
- Limited economic resources
- Water Situation
  - 300 CFU/100 mL Coliform
  - 2 CFU/100 mL Fecal Coliform
  - 2 Spigots
- Ideal Water Situation
  - 0 CFU/100 mL Coliform
  - 0 CFU/100 mL Fecal Coliform

System Options

UV Purification

Ozonation



Biosand Filtration

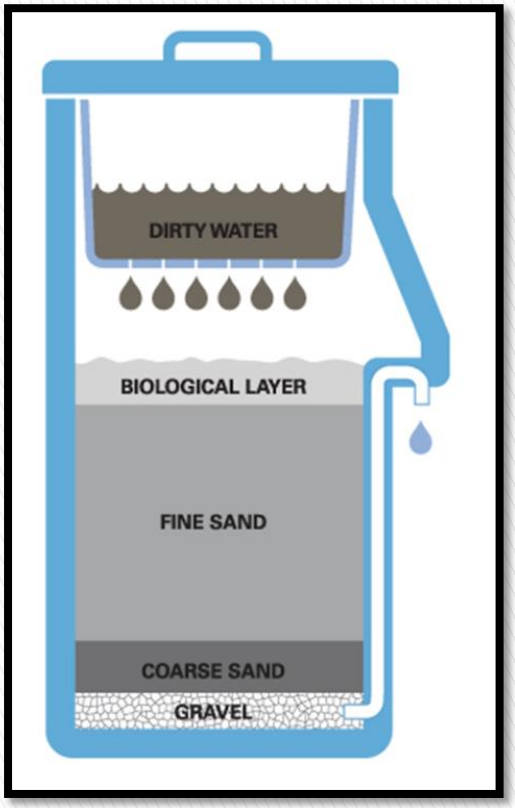


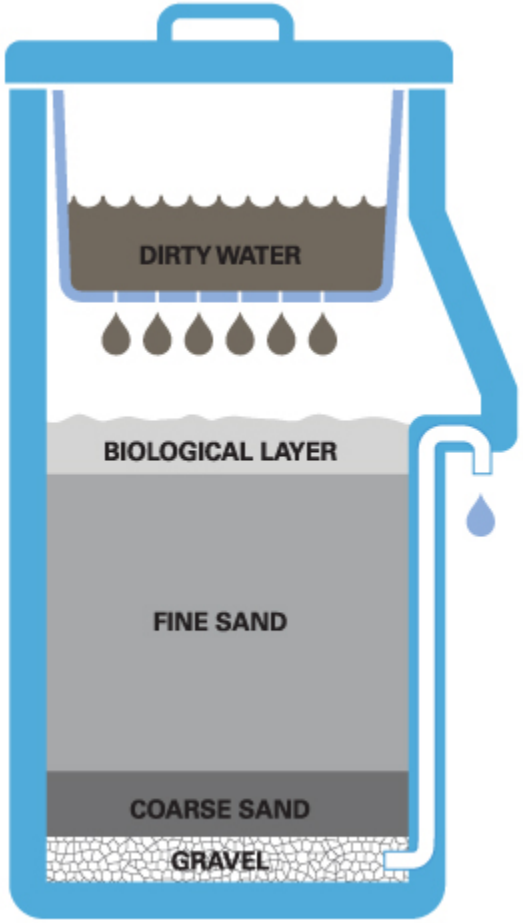
Image: charitywater.org

Biosand Filtration: General Overview

- Uses mechanical and biological removal methods to treat water
- Entire system costs approximately $300
- Already used world wide

Conceptual Design Prototype

How Do Biosand Filters Work?



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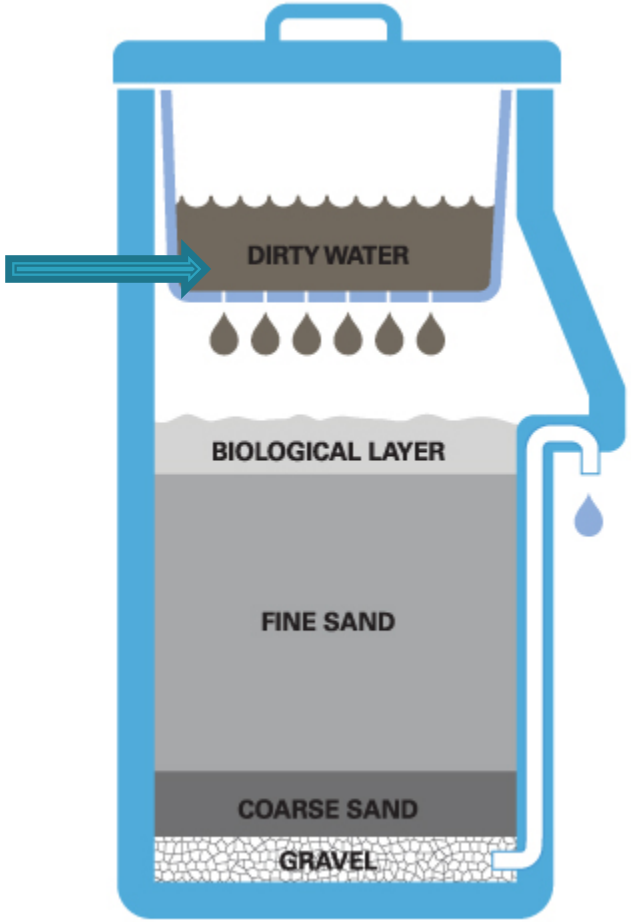

- Untreated water is slowly introduced to system

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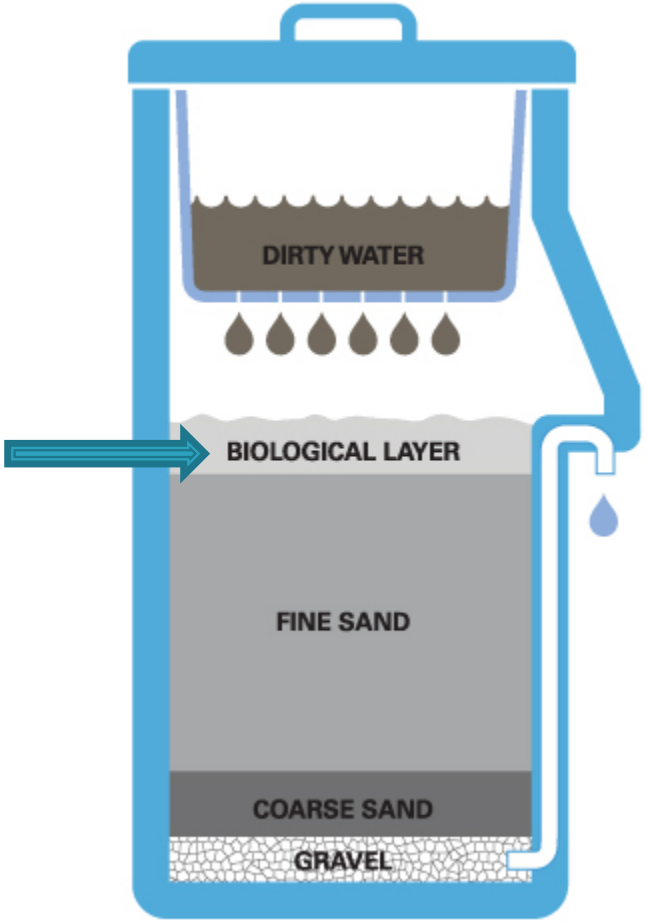

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- Non-harmful microbes consume harmful microbes

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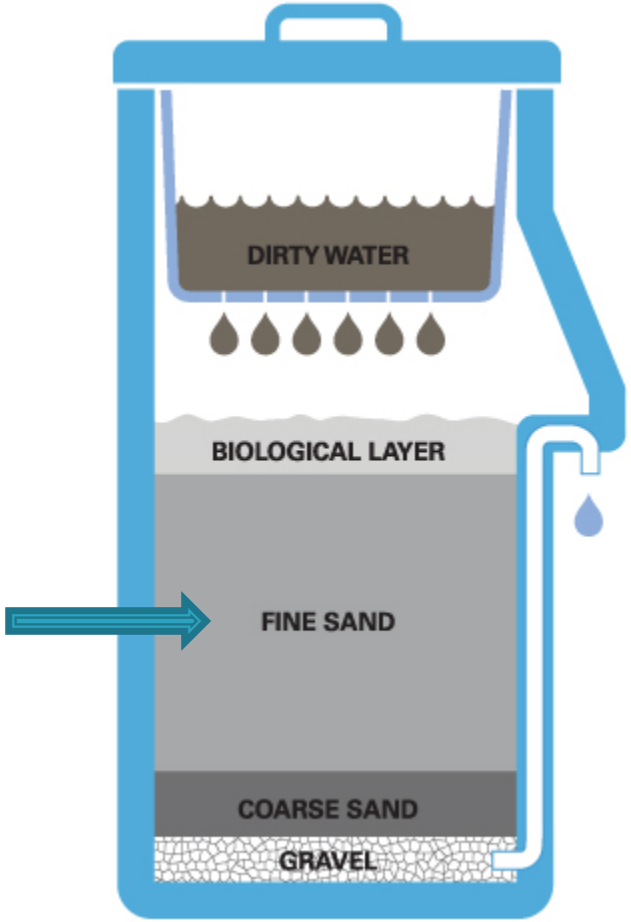

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- Contaminants are trapped in the fine sand layer

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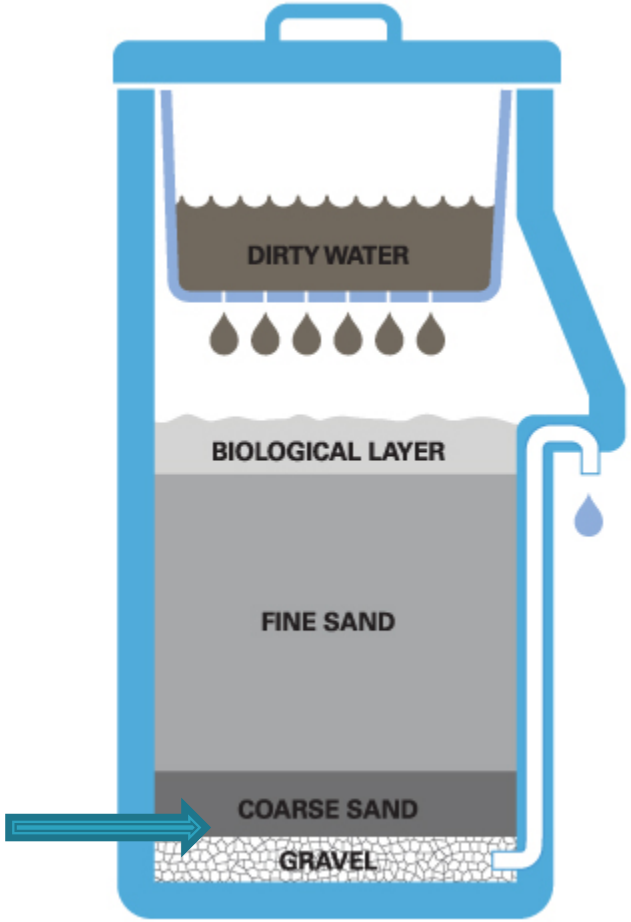

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- Contaminants are trapped in the fine sand layer
- Coarse sand and gravel prevent fine sand from clogging outlet

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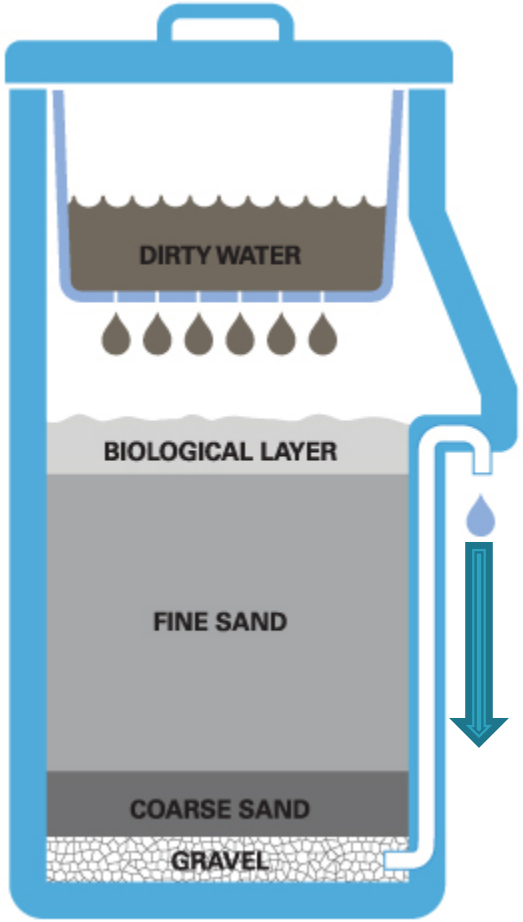
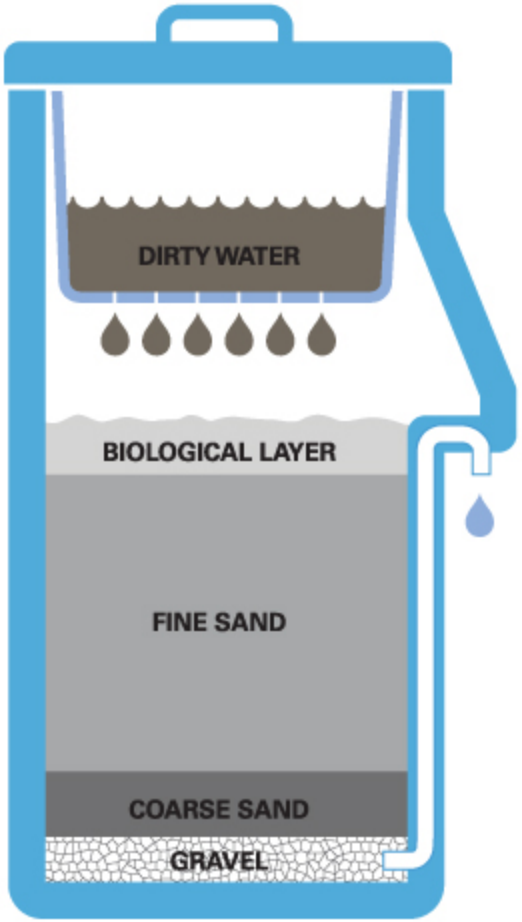


- Untreated water is slowly introduced to system
- Non-harmful microbes consume harmful microbes
- Contaminants are trapped in the fine sand layer
- Coarse sand and gravel prevent fine sand from clogging outlet
- Treated water is ready for consumption

Evaluation of Biosands

Advantages:

- Affordable
- Local materials
- Simple to use
- Improves taste and appearance of water

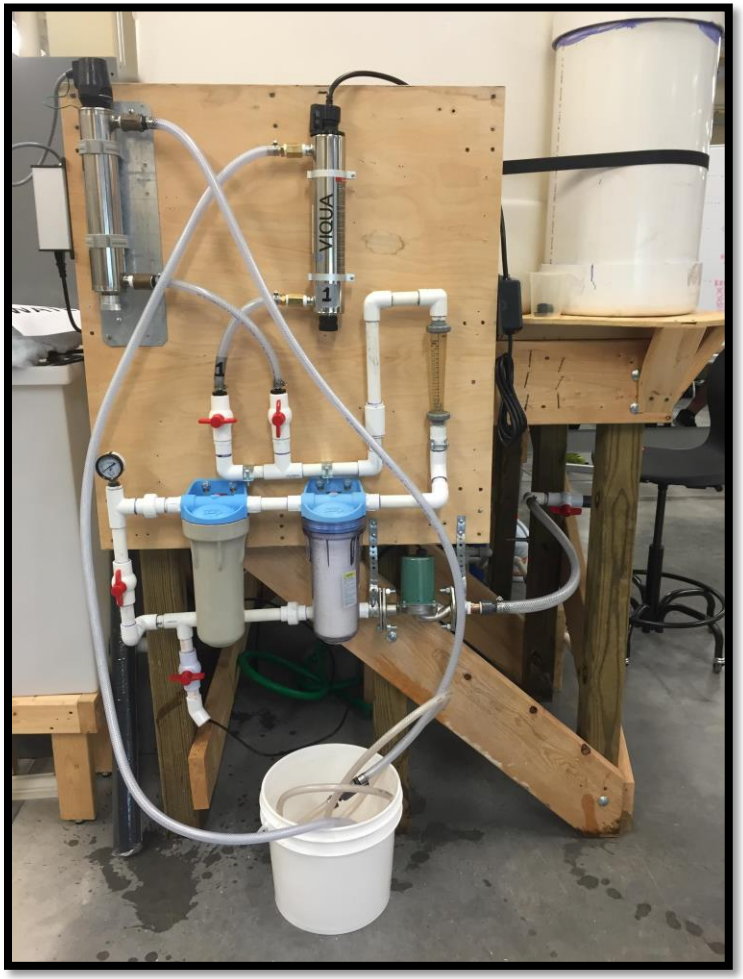


Disadvantages:

- Biolayer needs time to form
- No residual disinfection
- Requires maintenance
- Not mobile

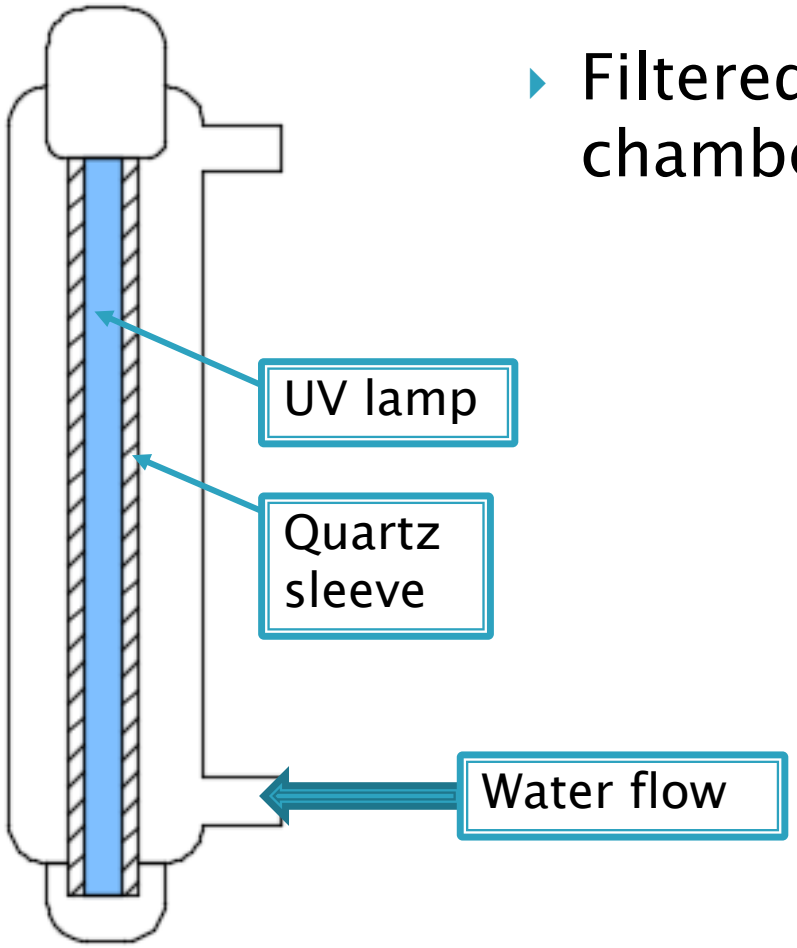
UV System: General Overview

- Uses filtration and UV radiation to purify water
- Small and Compact
- Entire system costs approximately $600



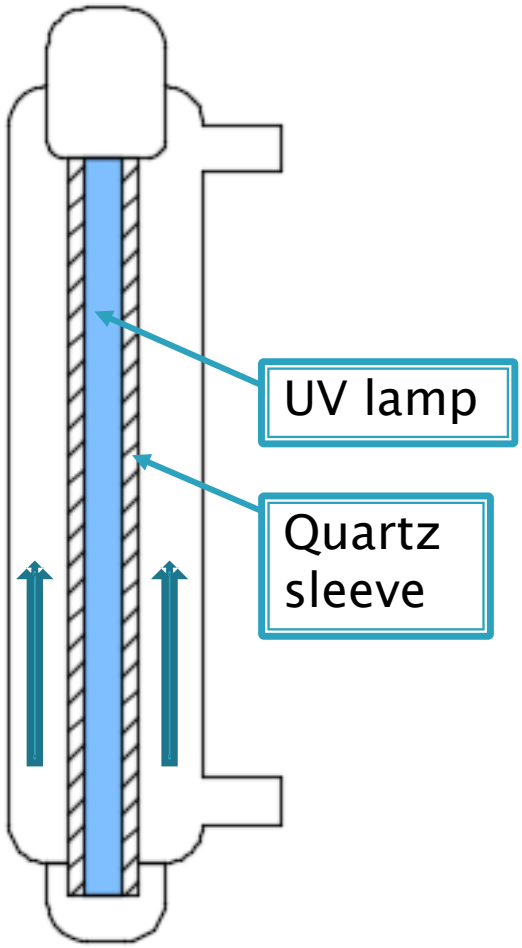
Our testing setup can be found in the Project Space

How Do UV Systems Work?



- Filtered water enters the UV chamber

How Do UV Systems Work?



- Filtered water enters the UV chamber
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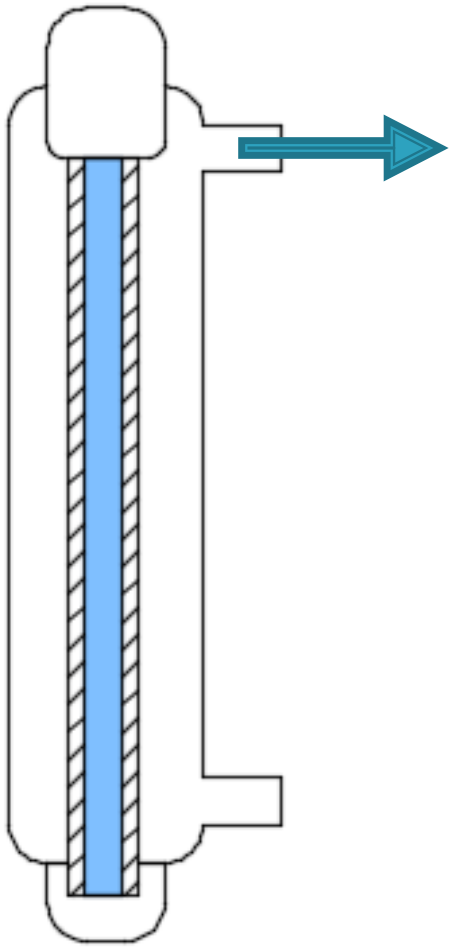
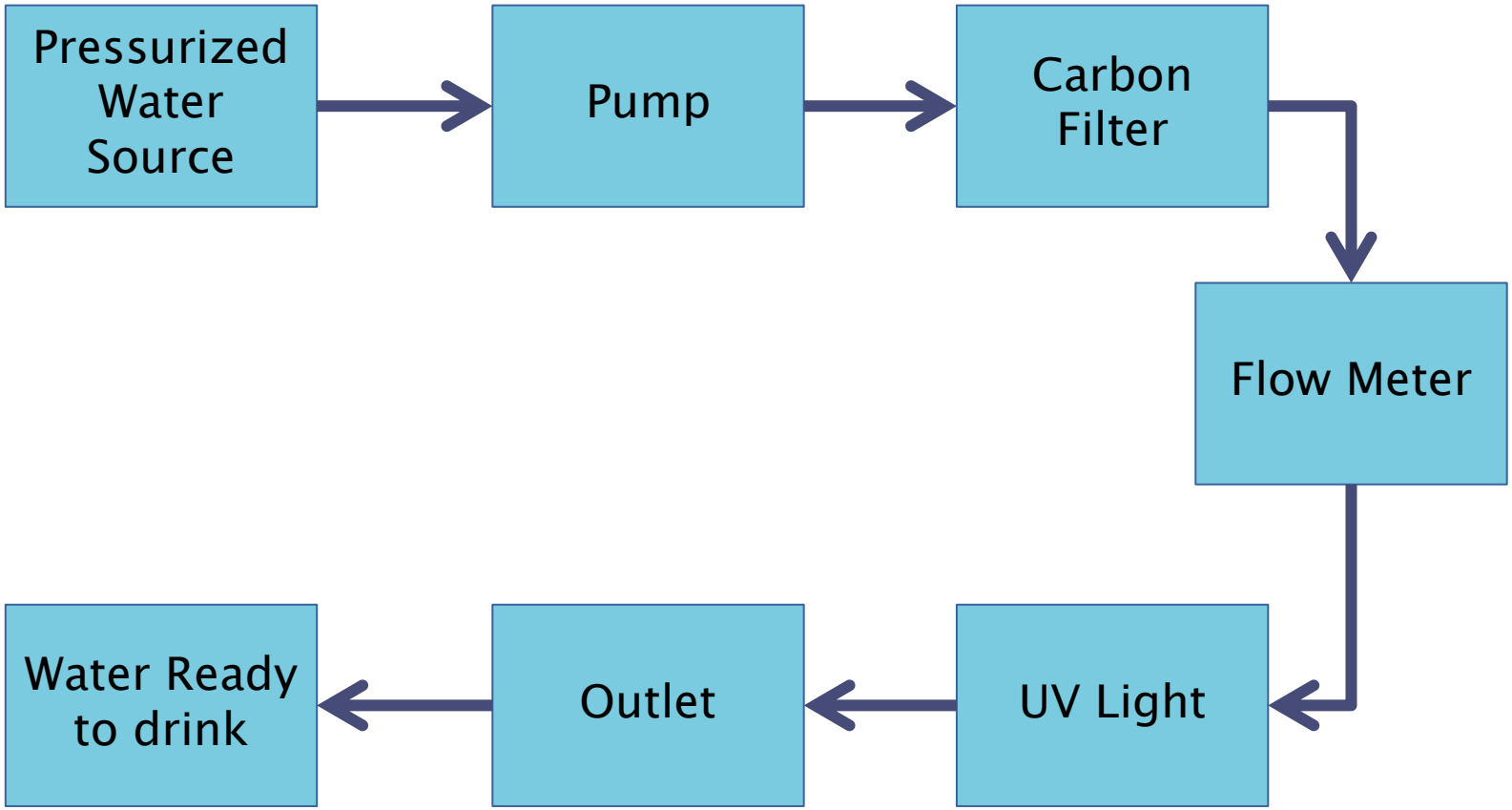


- Filtered water enters the UV chamber
- UV light is transmitted through quartz sleeve into the water
- Bacteria and virus DNA are damaged by UV radiation
- Longer contact time with UV increases the level of treatment
- Treated water is safe to consume

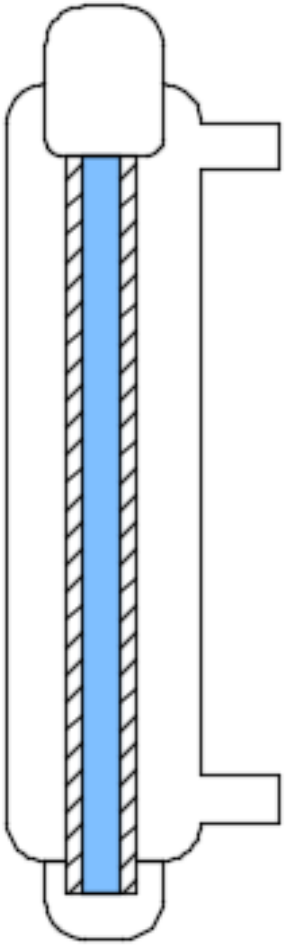
System Flow Design



Evaluation of UV Treatment

Advantages:

- Affordable
- Potentially mobile
- Clean water on demand
- Easy to use



Disadvantages:

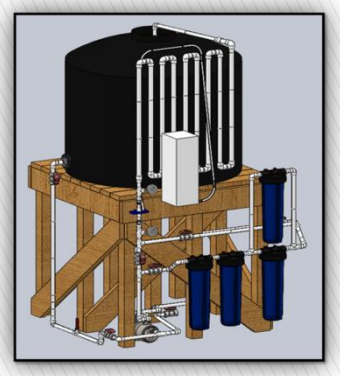
- Sensitive to maintenance
- Fragile
- No residual disinfection
- Hard to monitor effectiveness

System Option Recap

UV Purification

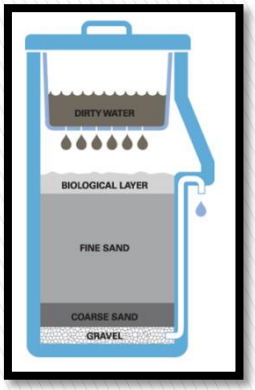
- $600
- Filters and damages pathogen DNA

Ozonation



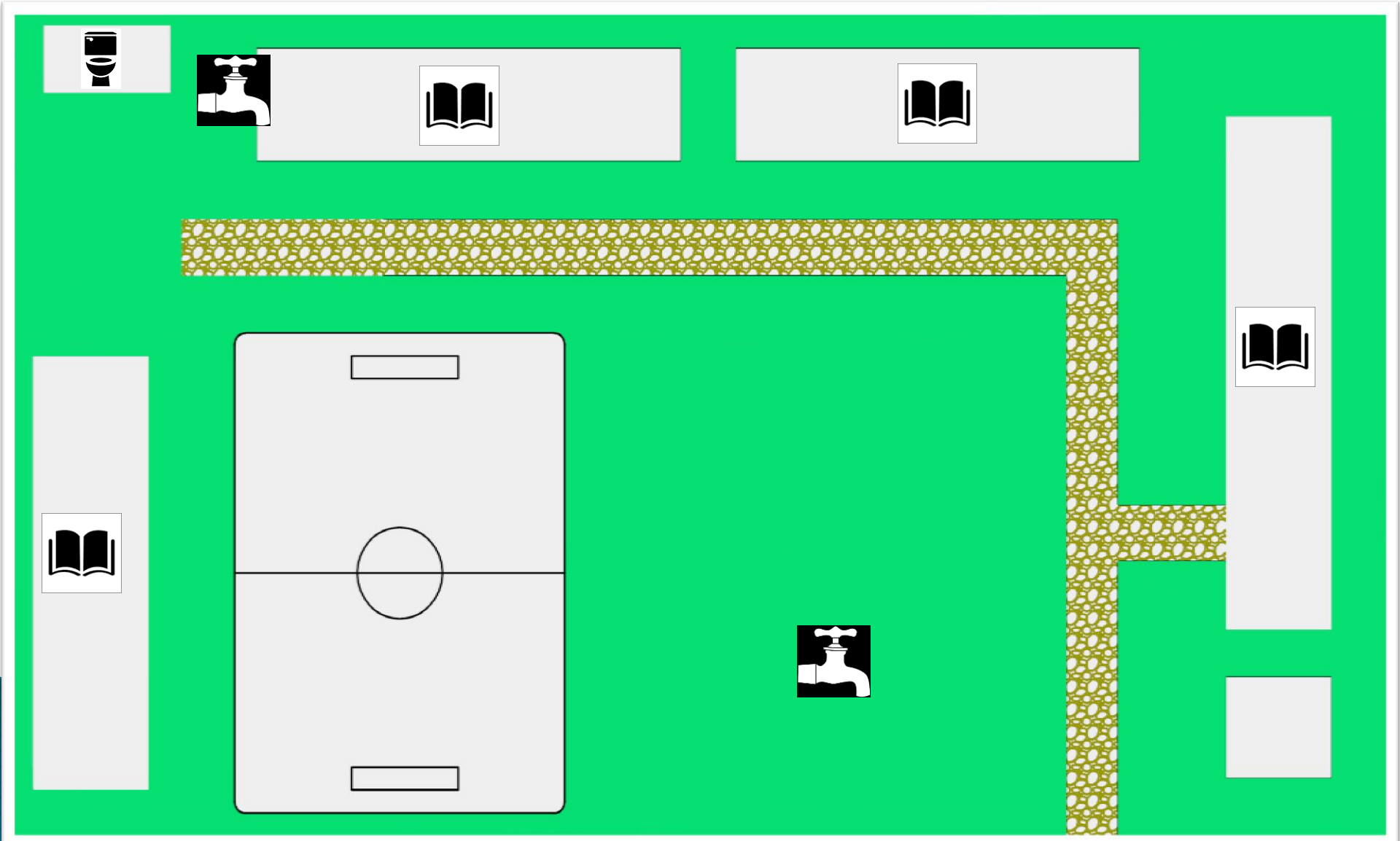
- $3500
- Filters and kills pathogens

Biosand Filtration



- $300
- Filters and digests pathogens

Los Prietos School Layout



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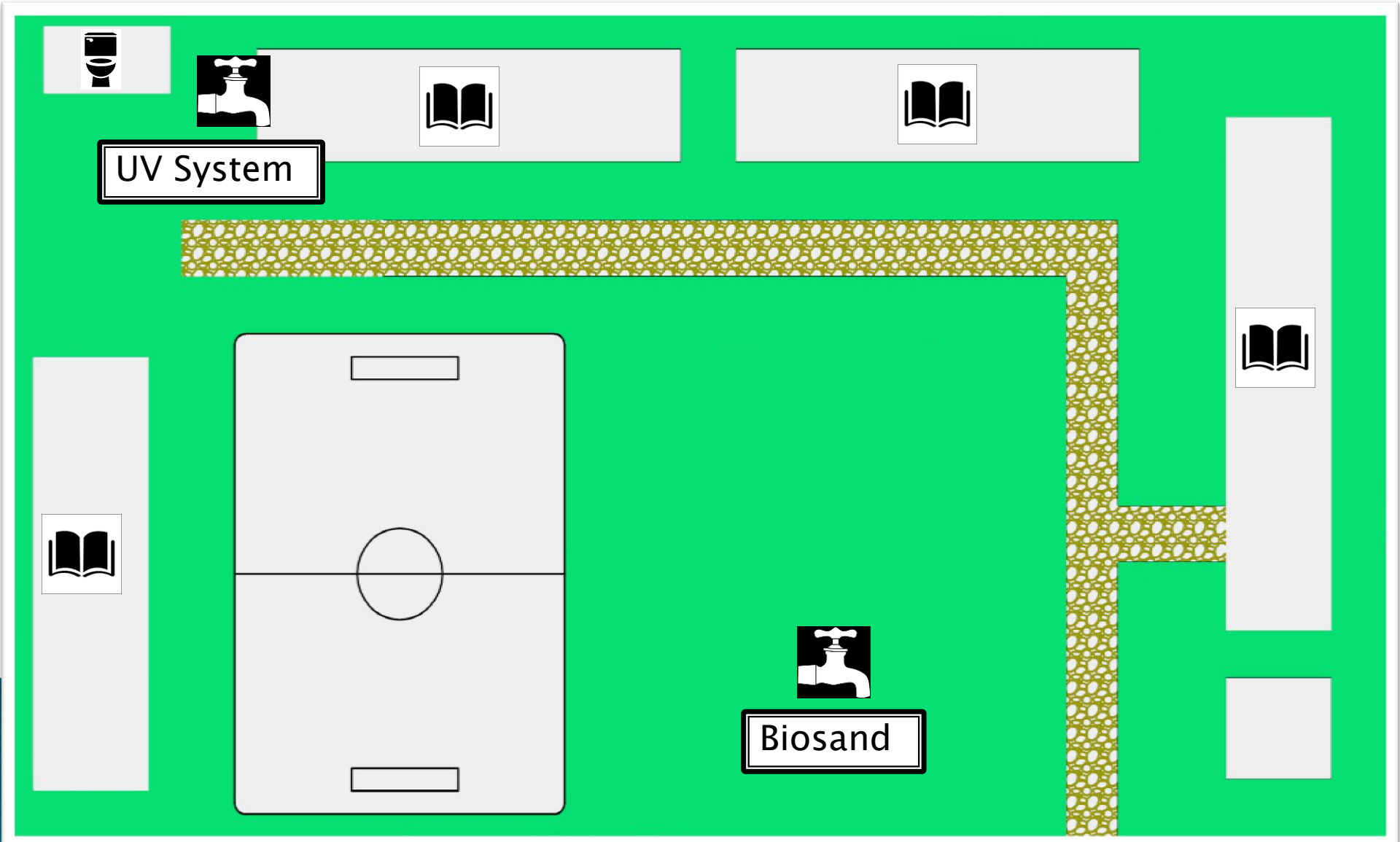

Future Work

- Create a sensor to monitor the UV lamp
- Finish developing and testing the Biosands system
- Develop a business plan for Los Prietos

Acknowledgements

Grace Bachman: Economic Development
Cory Brubaker: Electrical Engineering
Brant Meier: Electrical Engineering
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Bruce Brubaker: MVP Panelist
Bruce Hulshizer: MVP Panelist
Dr. Thomas Soerens: MVP Panelist
Erik Weenink: MVP Panelist
Dr. Tesfa Yacob: MVP Panelist
Collaboratory Staff and Leadership
Engineering Department Faculty
Water Testing Team

Questions?

Check out our poster and talk with us more:

Poster Session
Frey 070
3:00-4:00

Free Food and Drinks!