Stacked Rapid Sand Filtration-Full Scale

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Part I
Inlet/Outlet Manifold Fabrication

In Tamara, the slotted pipe inlet and outlet manifold has been causing problems due to loose and broken connections. This has resulted in sand entering the inlet and outlet plumbing, which creates multiple problems in the system.

1 Subtasks

- Develop a molding technique for the slotted pipes to enter the trunk line
  - Our current plans include heating the ends of the PVC pipe in boiling water and then pushing them into an aluminum mold, which will cause the ends to taper off. This should reduce the outside diameter of the pipe sufficiently (approximately less than $\frac{1}{5}$") and allow it to fit into the holes (drilled with an $1\frac{1}{4}$" hole saw) properly. Note, we are no longer slotting the pipes all the way to the end where they connect to other pipes, which should make them less breakable.
- Explore options of sealing to prevent sand entry
  - Our main options are PVC cement or just sliding the connections together. Some other options include caulking, plumber's putty, etc.
- Build a small scale model of the slotted pipe manifolds
  - This will allow us to test the connections and various other modifications that we have made. The small scale model will be made from three regular 1" PVC pipe in place of the typical slotted pipes. These three pipes will be reduced in length to 24". The trunk line (4") and the 2" pipes on the side will also be reduced in 20".

  - Test to see if the small scale model can sufficiently withstand the pressure created when the manifold fills with water, while making sure the connections are tight. This will also give us insight into what construction methods should be used.
  - Preliminary testing and brainstorming how the stainless steel cable can be wrapped around the ends of the manifold most efficiently and productively.

- Construct the full scale model of the slotted pipe manifolds
  - Taking the results from the small scale model and making any necessary modifications, we will then being constructing the full scale model. One of the challenges we face here is to be able to assemble the manifolds using the stainless steel cable to help hold everything together and then easily lower the filter down as a unit. We need to ensure that the manifold is build-able in Honduras.

2 Scheduled Completion Date

- March 2, 2012

Part II
Design a low-flow filtration system for flow rates between 0.3 and 3 L/s

There is a large number of small communities that would benefit from a filtration system of this scale. We need to take the system that we have now and make the necessary modifications so that it works on this smaller scale. We are looking into brand new design ideas as well as previous ideas to determine which method will be most successful.

3 Subtasks

- Begin by reviewing the capstone design results from CEE 4540 Fall 2011 for ideas
- Brainstorm ideas for a new design and making possible modifications on previous designs
- Perform the necessary calculations in order to ensure the low-flow filtration system is functioning as it should

- Upon completion of calculations, conduct hydraulic testing using a 3 L/s flow rate
- Overall, we will take the conceptual design to the detail design to fabrication and testing. Testing will be done using the Hydraulic Test Facility.

4 Scheduled Completion Date

- April 1, 2012

Part III
Develop a new construction method for manifolds

This is somewhat related to the first two parts. After we develop a low-flow filtration system, we also want to develop a new way of fabrication. We want to be able to determine a way that these manifolds can be fabricated at a dimension small enough so that a person does not have to enter the filter box.

5 Subtasks

- Explore large diameter PVC pipe options
- Take parts of the Part I Inlet/Outlet Manifold fabrications that worked well and see if they apply in the small scale

6 Scheduled Completion Date

- April 1, 2012

Part IV
Evaluate Pressurized vs. Open Filter Boxes

Determine whether it is possible to allow the filter and controls to be at a similar elevation if the filter box is under a negative pressure during backwash.

7 Subtasks

- Conduct calculations and testing, check previous CEE 4540 groups to see their evaluations. Also, research past literature or design guidelines about pressure filters.

8 Scheduled Completion Date

- April 15, 2012

Part V
Automated Backwash Control

By adjusting the length of the siphon tube, it could be possible to design a way so that the backwash begins at a set filter head loss. This would eliminate the need of an onsite operator at all times.

9 Subtasks

- Find a method to end the backwash cycle and revert to filtration with a 10 minute delay
- Research, brainstorming, and testing

10 Scheduled Completion Date

- April 29, 2012