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Andrew Smith's individual contribution page

I initially joined the AguaClara team in 2010 because I wanted to supplement my classroom experience with a real-world project that applied technical knowledge to better the lives of others. At the time, I had worked with a family friend's contractor, and so I understood what was needed to translate a good technical design into something that could be constructed quickly and correctly; this is, namely, relatively simple designs that are well documented and can be clearly communicated to field employees through drawings. For us, this was, and still is, a particularly pressing concern because designs are developed at Cornell in English, but must be available in Spanish for the team in Honduras.

My time on the team has given me a new understanding of what it means to work collectively toward a common goal, as well as an appreciation for our responsibility as engineers to use our knowledge to better the world. By working with many different team members on design projects, I've learned new approaches to solving problems and I've come to understand the importance of effectively communicating what has been accomplished. On a team with so much turnover, it is essential that new members be able to easily pick up where others have left off.

After graduation, I will continue searching for simple, yet beautiful design algorithms, documenting my work extensively so that others can understand where I'm going, and soliciting input from other team members before completing design work.

Following is a summary of my specific contributions to the team, broken down by semester:

Spring 2012:

I am now enrolled in CEE 4550 and working with the design team. After completing the design training assignments to reorient myself with the team, I helped revise the LFOM (linear flow orifice meter) design file. Before my revision, the existing file assumed a horizontal orifice orientation, in which the height difference between a given vertical location and any point on the orifice was assumed equal. In reality, the LFOM orifices are vertical, as shown here . If there is sufficient head available upstream of the orifice, the horizontal approximation is almost 100% accurate; however, if not much head is available, the equation will overestimate flow through the upper portion of the orifice.

To fix this error, I integrated the following vertical orifice equation into the LFOM code: http://il.water.usgs.gov/proj/feq/fequtl98.i2h/4_7aupdate.html. The new code calls for one additional orifice in the top LFOM row. Additionally, I reorganized the LFOM code by dividing the code into clear sections, providing an explanation for each equation, and renaming variables so that names are now more consistent with AguaClara conventions.

For the balance of the semester, I will be working with Julia Morris to design and draw a low-flow sedimentation tank. This will be extremely useful if we want to make AguaClara plants available to smaller communities with more limited demand for water.

Winter 2011/2012:

I had the opportunity to build upon my experiences in class and with the team when I traveled to Honduras. I interacted personally with our clients and got a new perspective on the plants; this is something I will keep in mind as I work on the design team this term. Additionally, I served as the "team accountant", keeping track of group expenses and collecting the appropriate amount of money from each team member.

Fall 2011:

I took Monroe's capstone design course (CEE 4540) this semester in order to get a better understanding of how drinking water treatment is carried out in a conventional setting, and how AguaClara builds upon this to treat drinking water on a small scale, using no electricity. Specifically, I accomplished this by working with a group of three other classmates on assignments in which we created or updated design algorithms for the rapid mix unit, the flocculator, the sedimentation tank, and the stacked rapid sand filter, among others.

At the end of the semester, we completed a capstone design challenge, in which we performed a cost analysis of the AguaClara sedimentation tank. Traditionally, the team has employed 3 L/s bays, adding more as needed for larger plants. We proved, by using the appropriate metrics for concrete and PVC cost, that the team would save money by switching to 5.8 L/s sedimentation bays once the plant flow rate surpasses 10 L/s; similarly, we showed that they would save money by switching to 14.5 L/s bays once the plant flow rate surpasses 55 L/s.

Spring 2010:

I was a member of the design team. I spent the first few weeks of the semester getting acclimated to the Aguaclara class in general, and the design team in particular. I learned how to use MathCAD and Microsoft Word Fields, and I got accustomed to working on long-term projects in a team setting.

After that, I worked with Josiah Pothen and Julie Pierce to design an automated, customized specifications report. This document is geared primarily toward the engineers working on the plants in Central America, and it provides a description of the Aguaclara process and facilities, along with a brief overview of the equations used to design the plant. Because the document relies heavily on Microsoft Word Fields, Josiah and I learned how to use fields to automatically generate equations, figures, captions, etc. Before spring break, we completed a preliminary document with sample equations, figures, and captions. Monroe then integrated that document into a new version of the design tool over the break. Once that was complete, we worked with Tai, Gonzalo, and Nicolas to generate a final version of the report with fewer bugs and technical omissions.

Since May 2010, the document has seen substantial upgrades; a complete version of the report now exists in both English and Spanish and is integrated into every AguaClara design generated via the design tool.