

# White Paper Final Report

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## Semester Goals

The purpose of the team this semester was to create professional, consistent material that can be used to explain the AguaClara technology to other engineers, using photographs, diagrams and concise descriptions. By the end of the semester the team has produced documentation that can be taken to any conference or seminar, sent anywhere to any engineer, that presents AguaClara as a professional organization. The team has created “white papers” for the general AguaClara technology, the Chemical Dose Controller, the Foam Filter and the Educational/Organizational model. In addition, the AguaClara logo was revised, templates were created for consistent future white papers and the website was redesigned.

## Software

The entirety of the White Paper project was produced in Adobe Creative Suite. Specifically, the templates and pages for the White Papers were created in Adobe InDesign. The AguaClara General White paper book was created as an InDesign Book file (which compiled all of the necessary individual files necessary). The rest of the pages/booklets (ex: AC Model, Foam Filtration booklet, etc) were created as individual files with a series of pages within it. This was done so different sections could be edited while others would be left untouched (minimizing the risk of accidental changes). Different files were constructed for the materials that would be printed versus distributed as a PDF. These can be noted within the various file names.

The [diagrams](#) that were rendered for the White Papers were done in Adobe Illustrator. The photo editing that was done in order to create high quality images, etc. was done in Adobe Photoshop. It was extremely important to use high quality images for this project. Sometimes photos were opened in Photoshop and saved with a larger image size (300-500 dpi, instead of 72 dpi). Originals of the photos were sought in order to minimize poor quality images (degraded in the sending and uploading process).

## Consistency Details

The first initial challenge that this team faced was finding the font that was used in the AguaClara logo. Drew Hart suggested getting in touch with Alex Krolick (amk283) who had worked on the logo in the past. He was able to specify that the logo was done with *Helvetica Neue* Font. Comparing the font with the logo, it was determined that the kerning was set to -60 for the logo. This setting was used for the headers on each page of the White Paper. The headings for the copy sections were also done in Helvetica Neue, but with a lesser kerning, either -40 or -20, depending on how spacing was.

The body font for the White Paper is Calibri. It was important, stylistically, to choose a font sans-serif, so that it was less cluttered and easier to read.

The header, footer, and textured background on each page (the banner with the page title and the website with water droplet) are connected in a “group” and can be copy and pasted onto each new page, centered in place.

## General AguaClara White Papers (English and Spanish)

The general AguaClara white papers are meant to be a clean, professional overarching presentation of AguaClara, focusing on the water treatment technology. Each component of an AguaClara plant is highlighted and briefly explained. Innovative, new aspects of each technology are emphasized (example: CDC is semi-automatic, gravity powered). Costs, frequently asked questions, optimal uses and comparisons to conventional technologies are included. There are 20 pages that can be presented in a pdf format or in a flip book. All pictures are from AguaClara plants taken by students or engineers who have worked on AguaClara designs. No one aspect of the plant is gone into great depth, this document is meant to sell the technology to someone who would want more specifics on operating details later on in the process. A target audience would be someone with a technical background but has no familiarity with AguaClara technology yet. There is an english version and a spanish version available. A brief summary of the content is below.

### General White Paper Table of Contents

Page 1: Introduction page, highlights the simple, innovative, electricity free technology

Page 2: Great pictures that look at the different aspects of the AguaClara project

Page 3: The AguaClara Process 1- CDC, flocculator and entrance tank are labeled on plant schematic, with blow up picture of each component.

- Page 4: The AguaClara Process 2- sedimentation tank and stacked rapid sand filter labeled on plant schematic, with blow up picture of each component.
- Page 5: Chemical Dose Controller 1- brief description of system features (semi-automatic, gravity powered, coagulant, chlorine, safety)
- Page 6: Chemical Dose Controller 2- Schematic drawing of entrance tank, LFOM, lever arm, dosing tubes. Explains how chemical flows through the dosing system based on elevation difference.
- Page 7: Flocculation 1- defines flocculation, highlights AguaClara's reduced flocculator size, high efficiency and simple structure.
- Page 8: Flocculation 2- pictures of flocculation (includes plate settlers)
- Page 9: Sedimentation 1- defines sedimentation, highlights "sludge-less" tank design and simple inlet/outlet channel.
- Page 10: Sedimentation 2- explanation of floc blanket, daily operation
- Page 11: Stacked Rapid Sand Filter 1- diagram showing filtration mode and backwash mode, highlights AguaClara's unique features (stacked geometry, siphon for backwash, small area)
- Page 12: Stacked Rapid Sand Filter 2- Expanded diagrams showing filtration and backwash mode, including the siphon and entrance and exit boxes.
- Page 13: Compared to Conventional Plants, Qualitative: low costs, long lifetime, ease of operation, universally available chemicals, reliable, environmentally friendly
- Page 14: Compared to Conventional Plants, Quantitative: no electricity, small filter area, less backwash water, reduced sedimentation sludge, small flocculator
- Page 15: What Problem does AguaClara solve 1?- discusses turbidity range, flow rate, community size AguaClara plants are designed for
- Page 16: What Problem does AguaClara solve 2?- AguaClara plants can treat chemicals, innovative solutions to new problems (EStARS and Foam filters)
- Page 17: Institutional Organization 1- Describes the AguaClara organization including Cornell University, APP, the LLS, local water boards and municipalities
- Page 18: Institutional Organization 2- pictures of APP, construction, education
- Page 19: FAQ 1- Questions include: Does AC have a solution to my community's water quality problem? Have AC projects in Honduras been successful? Do you expect the AC technology to continue to evolve?
- Page 20: FAQ 2- Questions include: What are the largest costs in an AC plant project? How are AC plants constructed? How long do AC plants take to build? Who can build AC plants? Does the plant need a full time operator? Is the technology proprietary?

## **Collaborators**

Drew Hart (original outline, copy, editing, translating), Mary (copy, design), Savannah (Illustrator diagrams, copy), Caroline (copy, design, final formatting, book production), Monroe Weber-Shirk (edited)

## Chemical Dose Controller White Papers

The CDC white papers are a technical set of papers describing the AguaClara Chemical Dose Controller and explains the fluid mechanics behind the system's operation. There are eight pages, formatted consistently with the general AguaClara white papers (text, color, spacing, etc.) that go into detail about how the system works. The intended audience is for engineers looking for a chemical dose controller and could consider using the AguaClara model. The reader must have a basic understanding of fluid flow and mechanics to understand the major and minor loss component of the system. Potential operators would also be able to use this document to familiarize themselves with components, fluid flow and operation and maintenance, however further details would be necessary for full operation. As of now there is only an English version available.

### Chemical Dose Controller Table of Contents

Page 1: Chemical Dose Controller: Introduction to CDC, goals, purpose

Page 2: Benefits compared to other chemical dosing systems

Page 3: The Chemical Dosing System: Full-system schematic and list of components

Page 4: LFOM and entrance tank

Page 5: Constant head tanks and lever arms

Page 6: Dosing tubes/ major vs minor losses

Page 7: FAQ 1: Question Include: How does the operator select the coagulant dose? How does the operator select the chlorine dose? Why are there redundant components?

Page 8: FAQ 2: Questions include: What type of maintenance is required for the AguaClara chemical dose controller? Can the linear chemical dose controller be adapted for use apart from an AguaClara plant? How long do the chemical stock solutions last?

### Collaborators

Drew Hart (original outline, editing), Mary (design), Savannah (Illustrator diagrams, initial copy), Caroline (technical writing copy, design, final formatting, book production)

## Foam Filtration White Papers

The primary objective of the Foam Filtration White Paper was to have a pamphlet/brochure to bring to the EPA P3 (People, Prosperity, Planet) Competition. The Foam Filtration team traveled to Washington, D.C. to present and requested technical documentation of the technology that would be audience friendly. A white paper was made for the particular audience of the P3 judges. This would highlight not only the technical aspects of the Foam Filtration technology (including the novel method of backwashing, the foam used, etc.) as well as the social implications (projected benefits and applications). There are four pages, formatted consistently with the general AguaClara white papers (text, color, spacing, etc.). Since the audience for the Foam Filtration white paper is generally quite broad (not necessarily technical) the content is not too specific with regards to the fluid mechanics concepts that back the technology. The content of this white paper is foreseen to change with

the progress made of the team, and was thereby developed with space to change the content (perhaps make it more technical). As of now there is only an English version available.

### **Foam Filtration White Paper Table of Contents**

Page 1: Foam Filtration Objectives and Impact

Page 2: P3 aspect of Foam Filtration- A Global Educational Tool, Comprehensive Outcomes, Current Implementation, Future Developments

Page 3: Foam Filtration Features- labeled photograph of the foam filtration apparatus in El Carpintero, Honduras.

Page 4: Foam Filtration Process- Downflow and Backwash step-by-step

### **Collaborators**

Caroline (edited copy and design), Alicia Peters (suggested outline and content for poster), Monroe Weber-Shirk (edited)

## **Educational/Organizational Model**

The AguaClara Program Model White Paper is a technical document that describes the educational and organizational aspects of the AguaClara program at Cornell University. There are eight pages, formatted consistently with the general AguaClara white papers (text, color, spacing, etc.) that go into detail about how the program works from different perspectives. The intended audience is for administrators (and parents) seeking a better understanding of the benefits of the AguaClara program. Since the content is more social, the audience is very general and does not require any technical background. This white paper would be good to show to administrators who are not fully familiar with the program and the benefits it has for the participating students (as well as the communities AguaClara impacts). As of now there is only an English version available.

### **Foam Filtration White Paper Table of Contents**

Page 1: Introduction to the Educational model- R.I.D.E. (Research, Invent, Design, Empower/Engage) acronym

Page 2: Description of the Educational Model- Theory, Research & Design, Engaged Learning

Page 3: Student Perspectives- this page contains several quotes and pictures of students

Page 4: AguaClara in Numbers & Figures 1- A large infographic describing different aspects of the program

Page 5: AguaClara in Numbers & Figures 2- A large infographic describing different aspects of the program

Page 6: AguaClara Timeline- notes the 10 plants built over the past 10 years as well as important dates regarding the program.

Page 7: AguaClara Awards & Accolades- EPA P3, Katerva, Intel Tech

Page 8: Student research areas- a brief description of four research areas

## Collaborators

Larry Ge, Skyler Erickson, Alicia Peters, David Gold, Cinthia (Hai Young) Kim, Victoria Parces (copy, images)

Caroline (copy, design, final formatting, book production), Monroe Weber-Shirk (edited)

## Logo



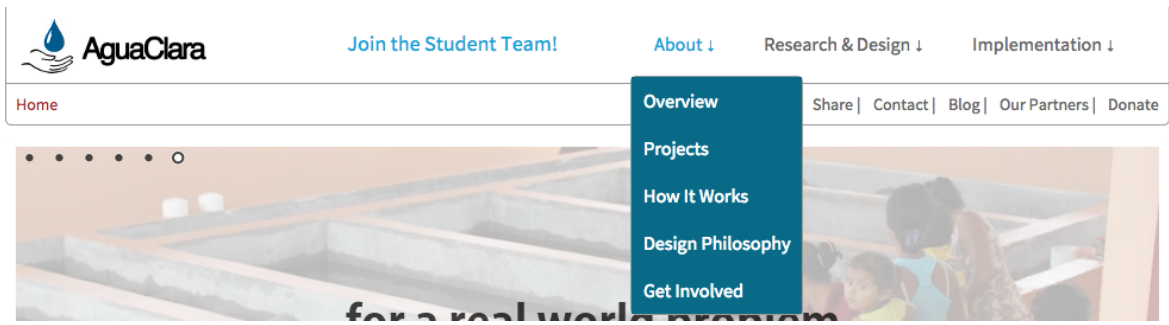
One of the first things that the team made sure to do, in addition to determining the font used in the logo, was to reproduce the logo (for purposes of quality). The versions of the logo that were found on the AguaClara Drive were all too low of quality. They appeared to be fuzzy and pixelated. Caroline created an updated version of the logo, using a new hand and rasterized image of the same water droplet used in the old logo. Different versions of the logo were created: only the hand and the water droplet, only the text, the image and the text together, the water droplet alone, etc. The files were saved in different formats, including: pdf, ai (illustrator file), eps (encapsulated postscript), jpg, png (for transparency). The files can be found in the Technical Communications Folder in the AguaClara Team Drive: AguaClara Team > Technical Communications > Logo > [AguaClara Reprod.](#)

## Website Design

The AguaClara website was updated to address formatting issues that occurred with the old website design and to enhance the overall aesthetics. The website was updated with the new logo produced by Caroline and a new font, Century Gothic. This font is close to that used for the logo, but chosen over Helvetica Neue because research showed it is a poor choice for web design due to parsing issues that make words blurry and unreadable on some browsers. Savannah is also in contact with CIT infrastructure to try and fix the website server so that photo and pdf files can be added, but for now all new photos are being stored in the Picasa.

Below shows the old website navigation design, and then the new design when the screen is larger and when it is reduced. This new design is much more responsive and allows for easy navigation on screens that are zoomed in, smaller browsers, and on tablets and cell phones.

Old Website Navigation:



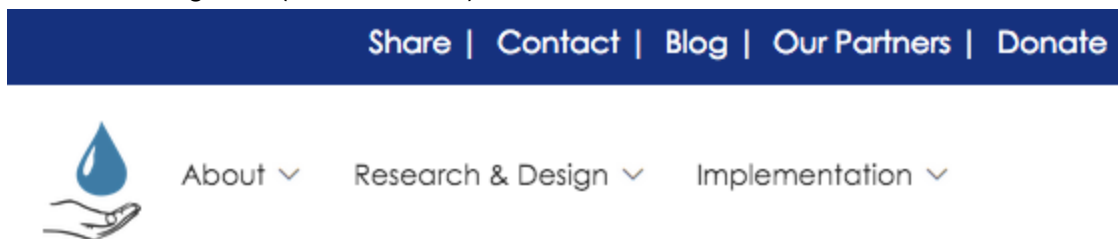
New Website Front Page/ Navigation (Large Screen):



AguaClara is a multi-disciplinary program at Cornell University that designs sustainable water treatment systems committed to long-term environmental, social, and economic sustainability. Our gravity-powered, electricity-free technology is scalable to fit the needs of any community and currently provides clean water to over 40,000 people.

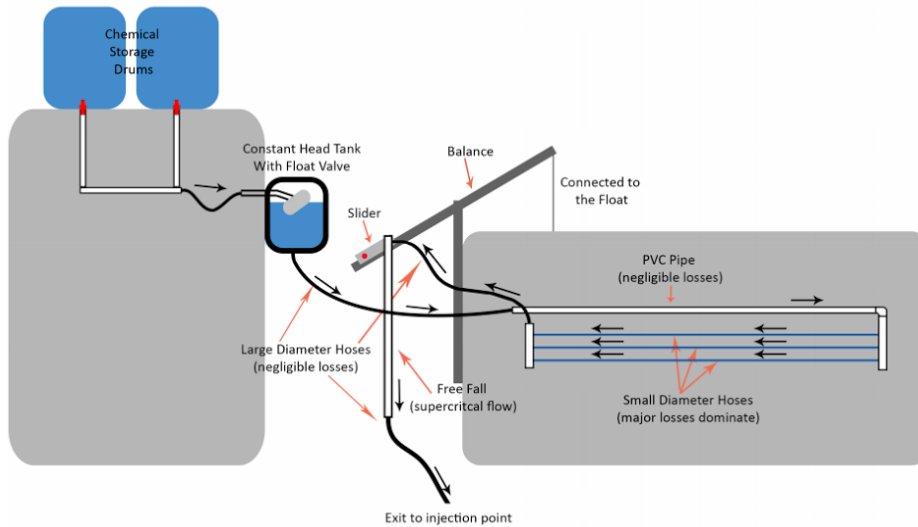
[How it works.](#)

New Website Navigation (Small Screen):



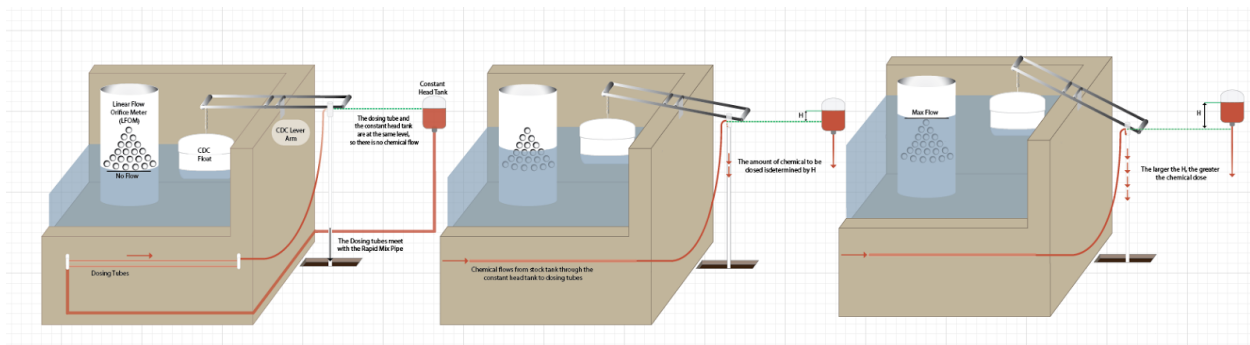
# Photoshop & Illustrator Diagrams

Mary worked on a schematic of the chemical dose controller with labeled parts and direction of flow for use in the CDC white papers.



Savannah also created schematics in Adobe Illustrator for the for the cdc / entrance tank and the sedimentation tank. The goal was to have neat, explanatory and consistent style for the diagrams used to show each unit of the plant.

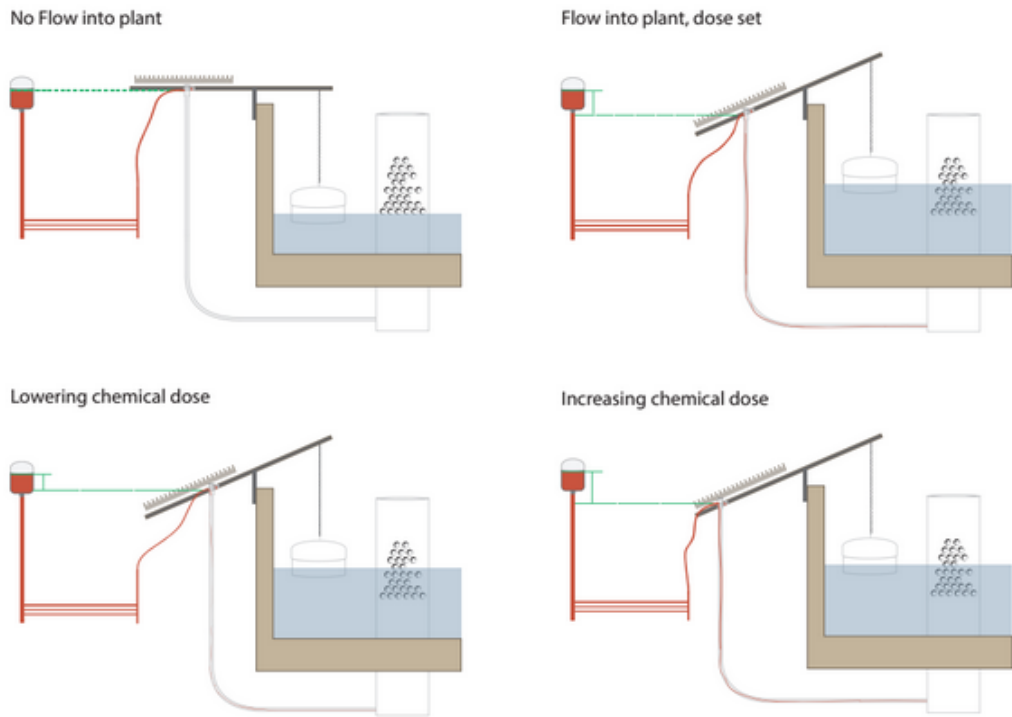
The first set of CDC diagrams show how the dosing can change based on by different flows into the plant, represented by the water height in the entrance tank.



The first schematic above (for no flow into the plant) has the most up to date version of the tubes leading from the constant head tank to the two major head loss tubes. The other two will be updated to be exactly the same. The LFOM will also be updated to represent a more realistic LFOM (See diagrams below.)



The second set shows the way the dose can be set and then changed manually by moving the slider on the lever arm.



Below is the sedimentation tank schematic, based off a previous design done by Drew Hart.

