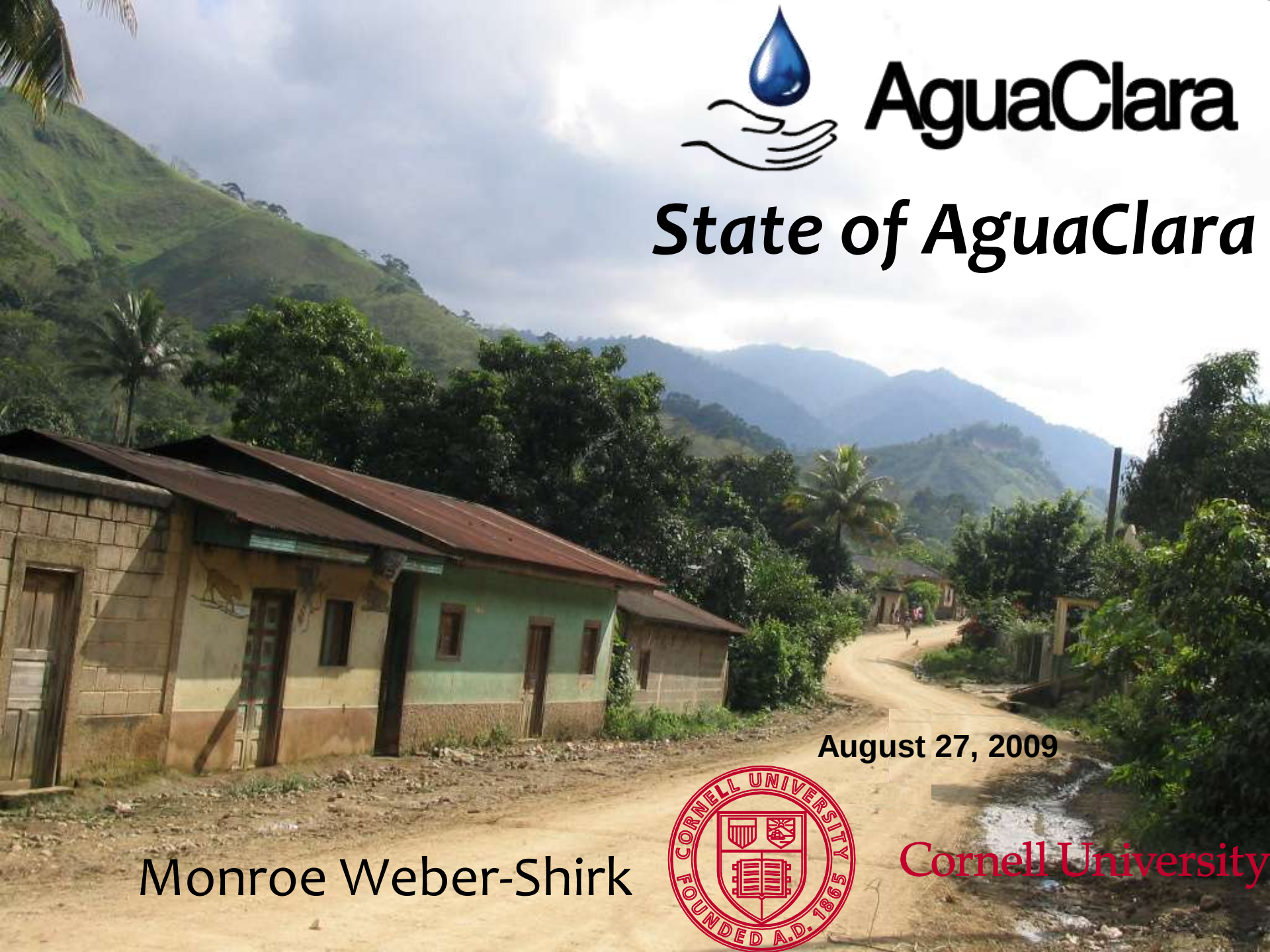


AguaClara

State of AguaClara

August 27, 2009

Monroe Weber-Shirk

Cornell University

Agenda for first meeting

- Introduce team leaders
- Julie
  - How to get to the wiki
  - Announcement re club fair
  - Team challenges/survey
- Which course is this?
- Intro to AguaClara/State of AguaClara
- Introductions
- Intro to AguaClara/State of AguaClara

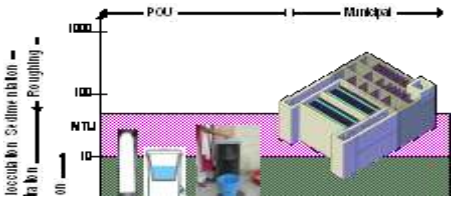
Which course is this? AguaClara project (Tuesday, Thursday) 1:25

- CEE 2550 – for students who have not taken CEE 4540
- CEE 4550 – for students who have taken or are taking CEE 4540
- CEE 5051 – exclusively for M.Eng. Students who are using AguaClara as their design project

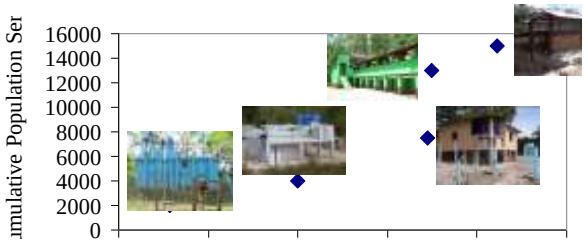
- CEE 4540 meets on MWF at 11:15 and is a lecture course on the theory of water treatment

The AguaClara Story

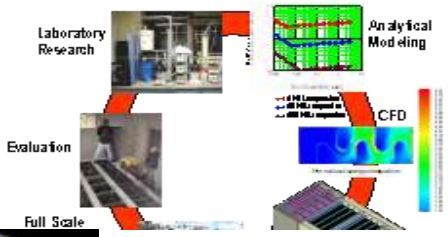
- The Niche



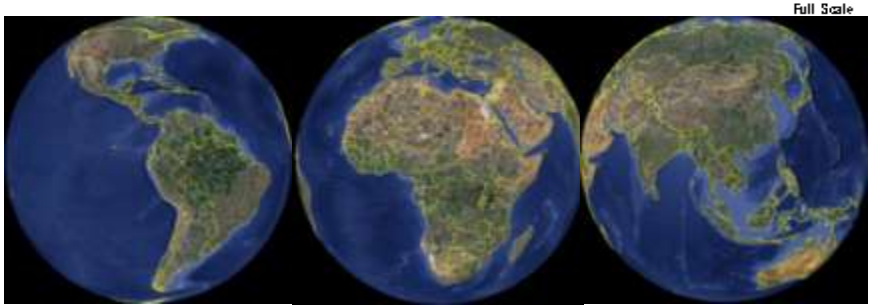
- 5 years of growth



- Research – Design - Education



- Opportunities



Overview

- The UnSafe Drinking Water Problem
- Technology Misfits – the failure of the private sector in the Global South
- The AguaClara story

Checking in…

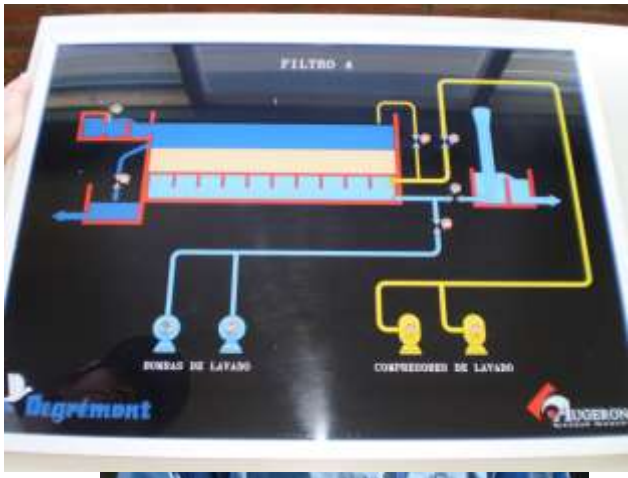
- Where does water come from?
- How long has Cornell had safe water?
- Do you drink tap water?

Examples of Technology Misfits in the Global South

- El Progreso, Honduras
  - Modular Package plant
  - Dependent technology
- Siguatepeque
  - Built in place
  - Dependent technology
- Marcala, Honduras
  - No chemical feeds
  - Upflow filtration
  - Worthless technology

Something isn't working!

- The majority of the water treatment plants in Honduras don't reliably produce safe drinking water
- What do all of these plants have in common?
  - Honduran operators (the too easy answer)
  - Honduran infrastructure
  - Private firms with patented technologies
- Why does the Honduran government continue to build these failures?
  - Bilateral Aid Requirements
  - No real alternatives (Inadequate documentation of robust technologies)



The AguaClara Hypothesis

- The technology should be designed for the conditions under which it will be operating
- The planet needs a new model for disseminating knowledge that empowers rather than creating dependency
- Open Source Engineering combined with Smart, Robust Technologies can succeed where private enterprise has failed

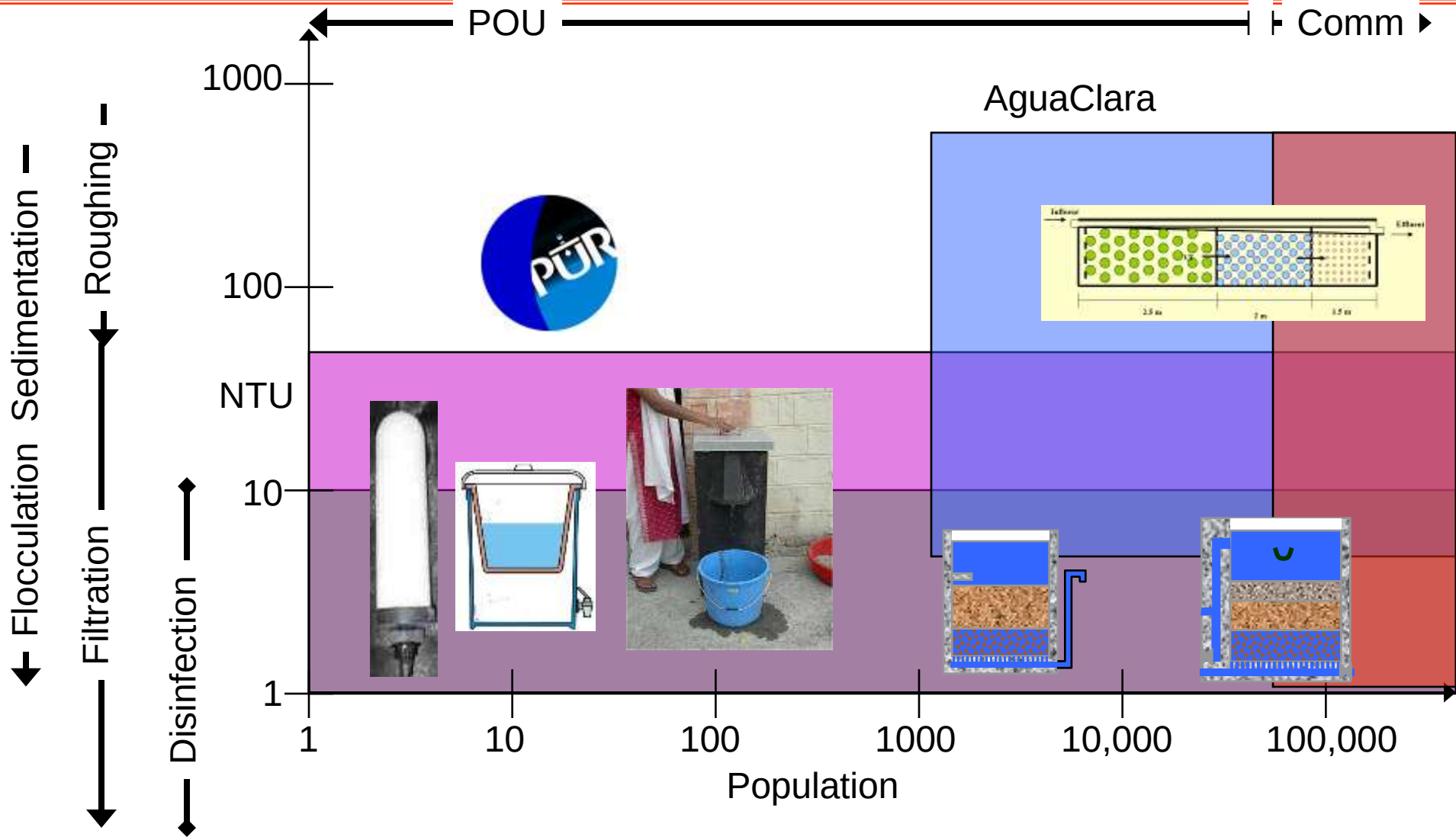
Why has the Private Sector Failed to Optimize Municipal Water Treatment?

- Low volume of units, customized designs, long unit life
- Market incentives stifle innovation
  - Design firms want to minimize liability for design
  - Design firms use equipment vendors and hence develop designs that include equipment that can't easily be purchased elsewhere
  - Equipment vendor designs must remain proprietary to prevent other firms from benefiting
- Can't risk failure on a unit – conservative design prevails
- Very little research and almost no feedback for product development

A Role for Universities

- Develop new knowledge
- Test the designs in full scale field trials
- Make that knowledge available to the global community
- GNU open source engineering!
- Capacity building: training the trainers

Robust Surface Water Treatment Technology Solution Space

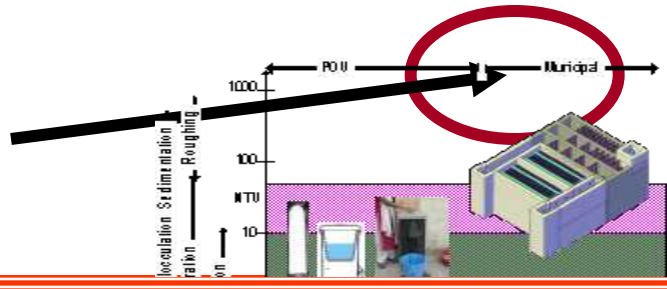


Chlorination?

- Chlorination only provides protection when the water is clean!
- If you can see that a glass of water is cloudy, then it is too dirty for chlorine to do much good.

River water that is about to be chlorinated (Tela, Honduras – January 07)

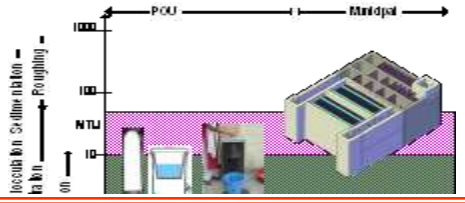
The AguaClara Niche



- Globally we estimate that 125 million could benefit from AguaClara water treatment plants
- To meet that need in 10 years our partners would need to be building approximately

  3 plants per day

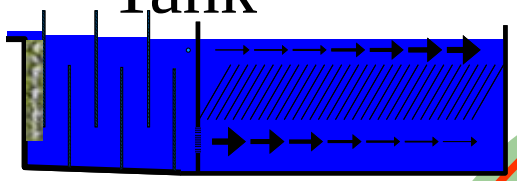
Gravity Water Supply



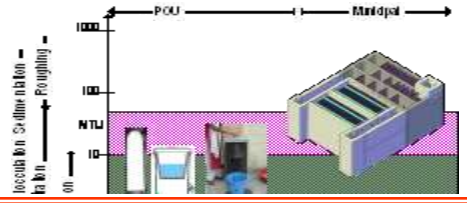
Spring box or dam

Drip Chlorinator

Distribution Tank



Flocculation – Sedimentation



Shear collisions

Without any electricity!

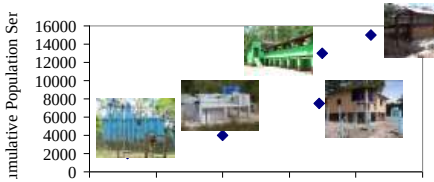
Chlorine

Rapid Mix

Flocculation

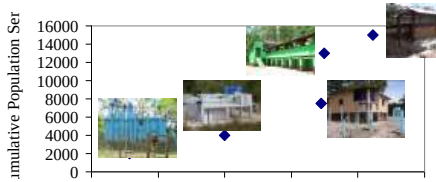
Sedimentation

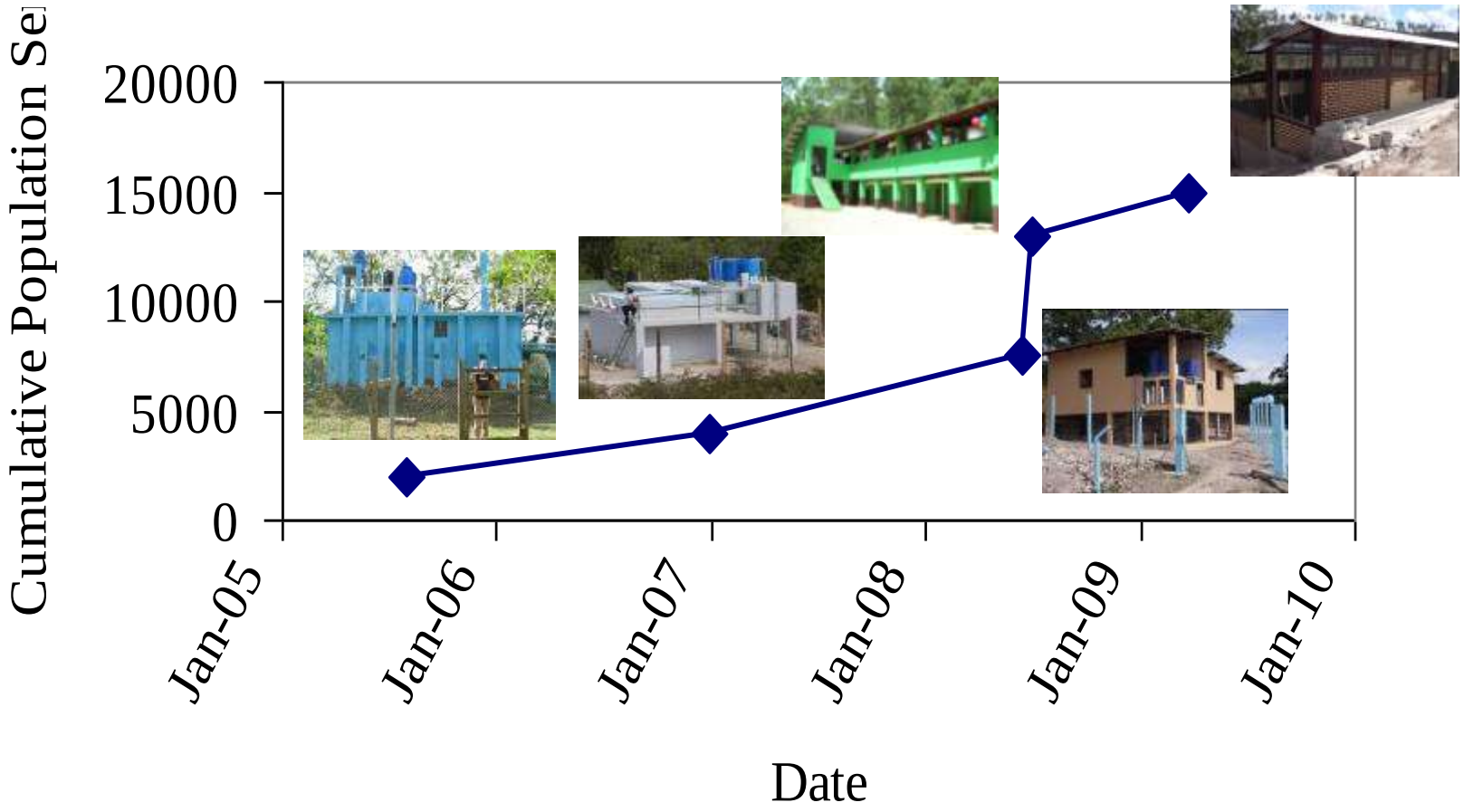
Team growth

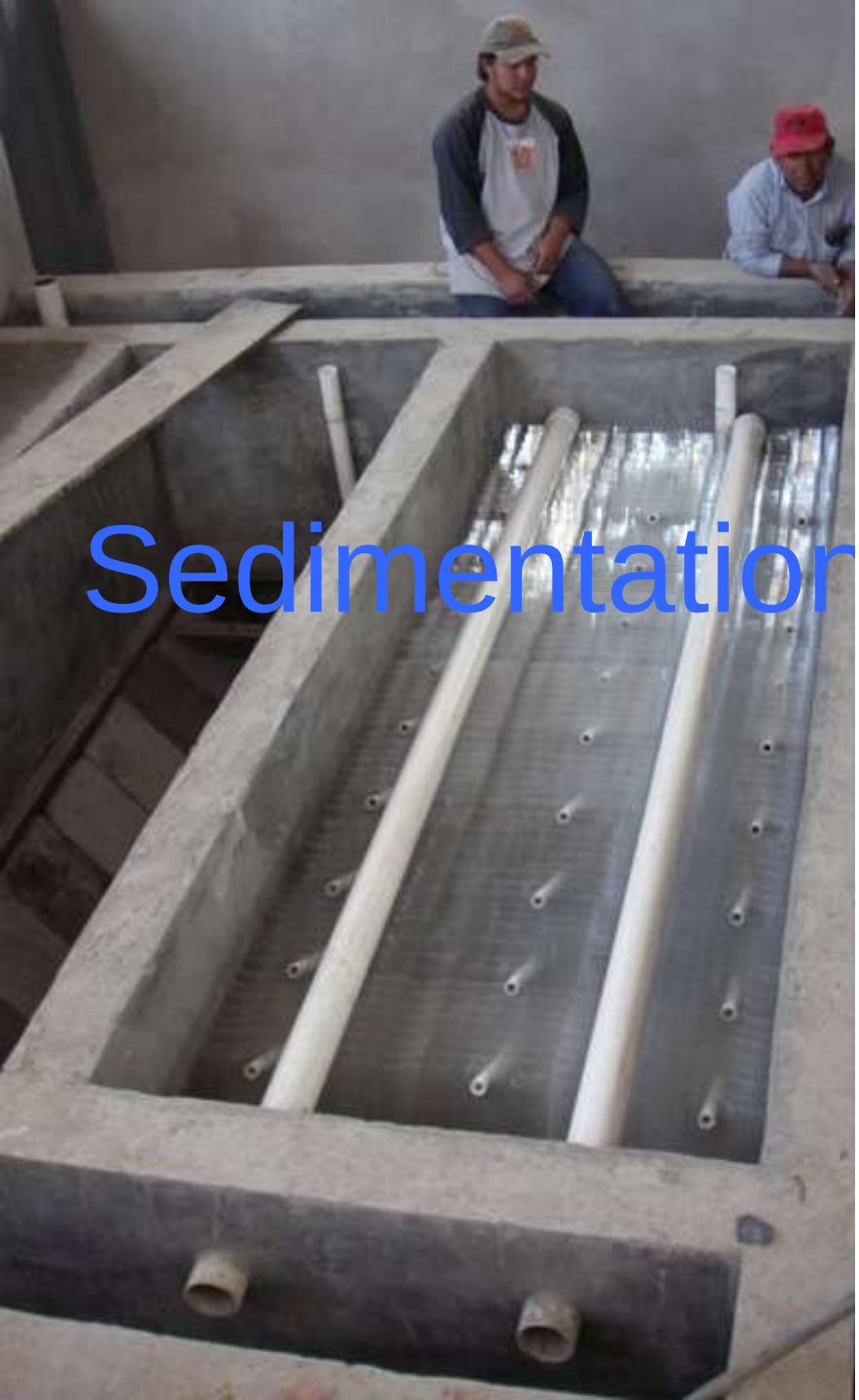


Over 60% women. Student team leaders have been women.

Population Served






Sedimentation


Flocculation

Cuatro Comunidades Plant

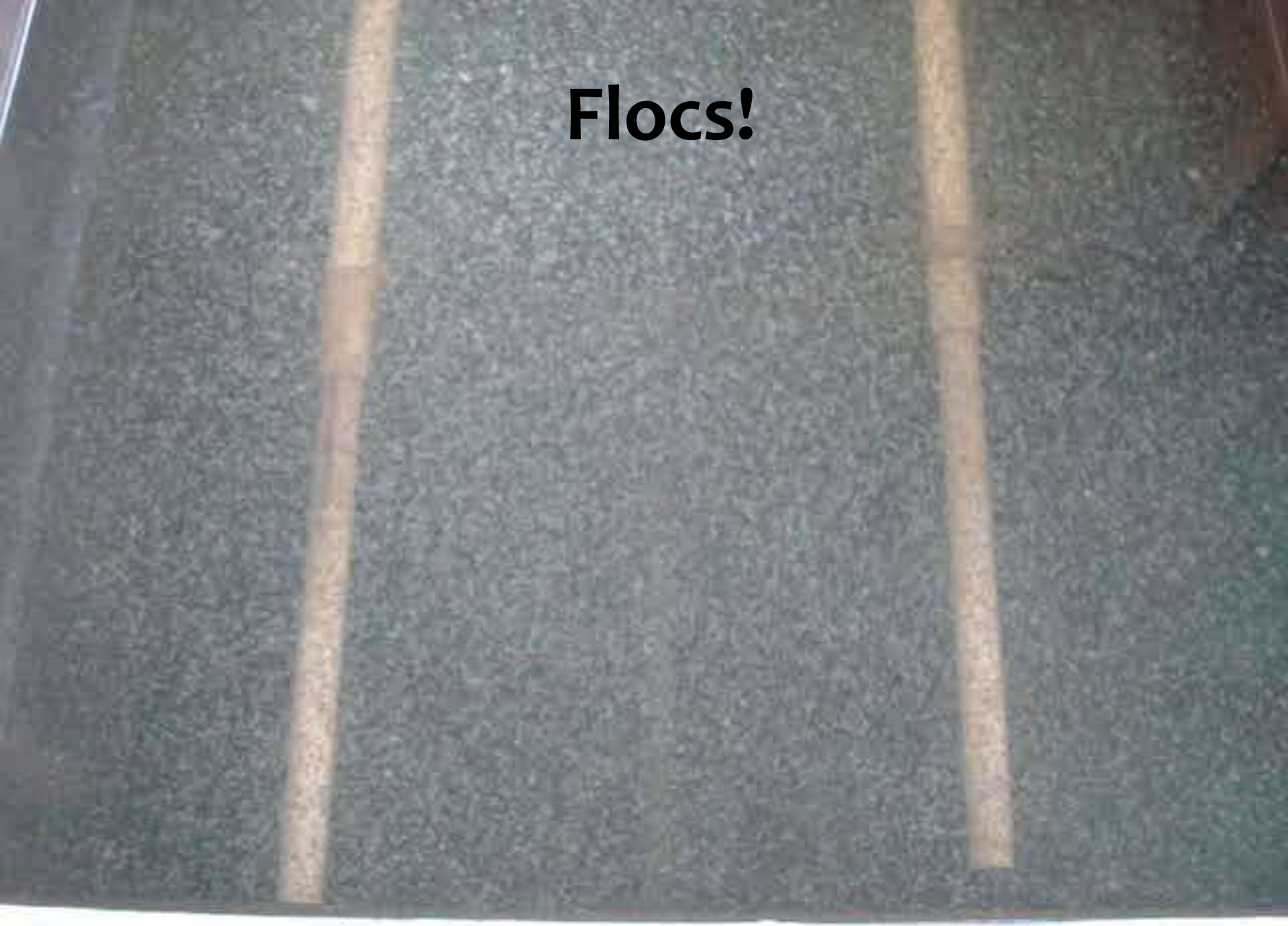
Chemical tanks

Raw Water (Entrance tank)


Chemical Doser


Water leaving the entrance tank


Flocculator


Flocs!


Sedimentation tank

Chlorinator

Desk for recording plant performance

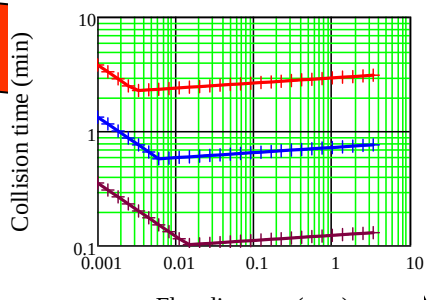

Inauguration Day

Workshop

Break for Introductions

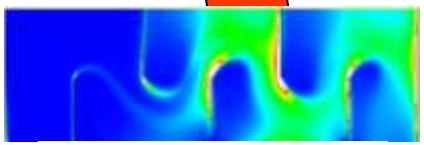
What does a team of 40 students do?

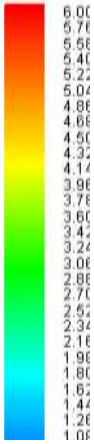
Laboratory Research



Analytical Modeling

CFD

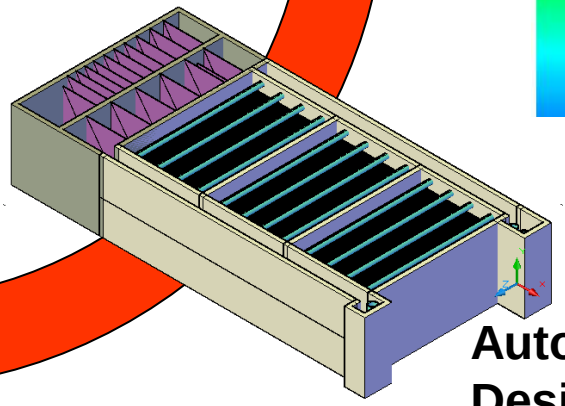




Normalized energy dissipation

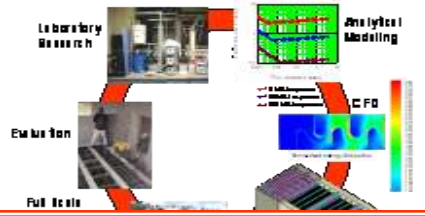
Evaluation

Full Scale Implementation, Capacity Building, Training, and Empowerment

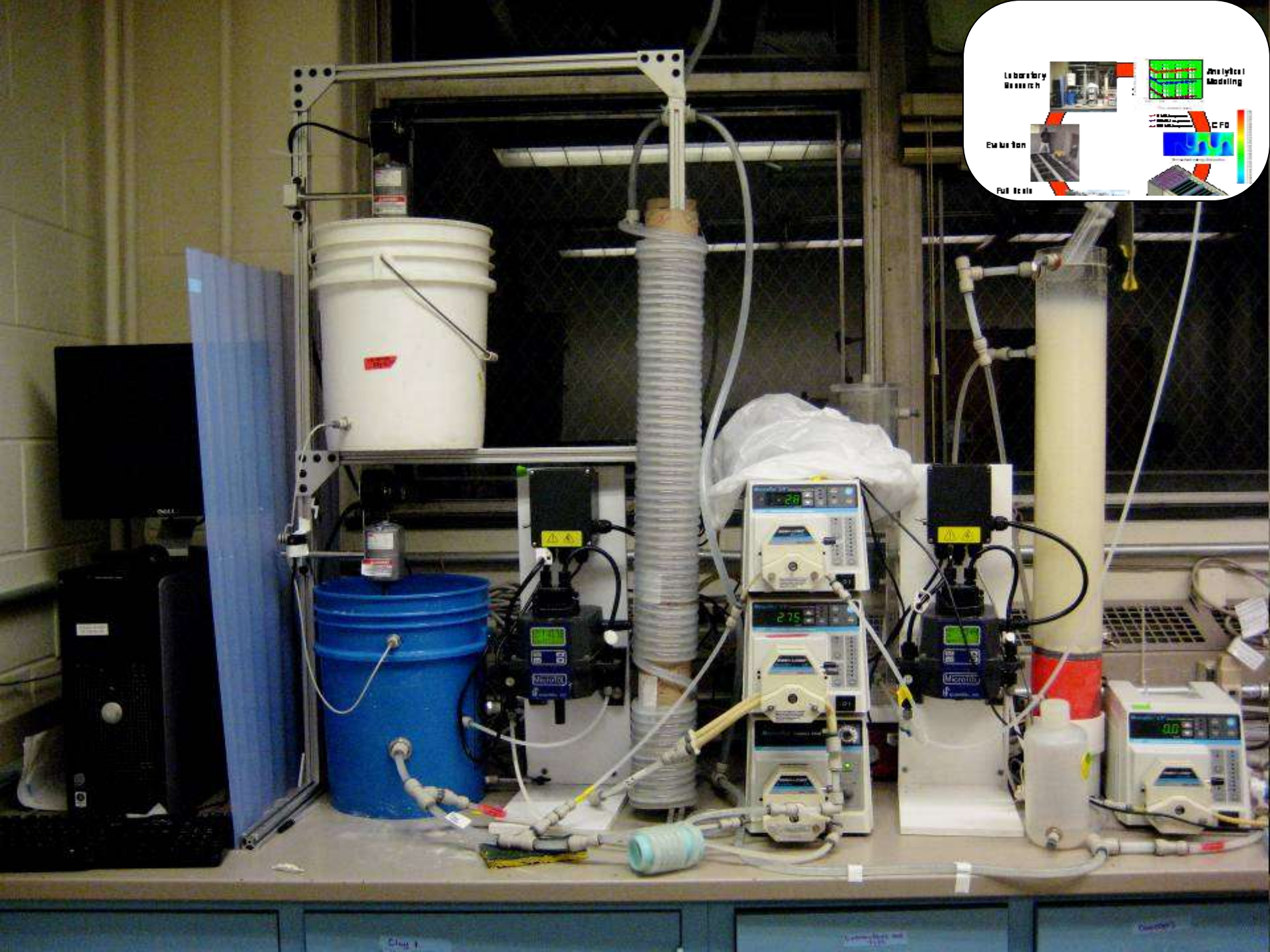


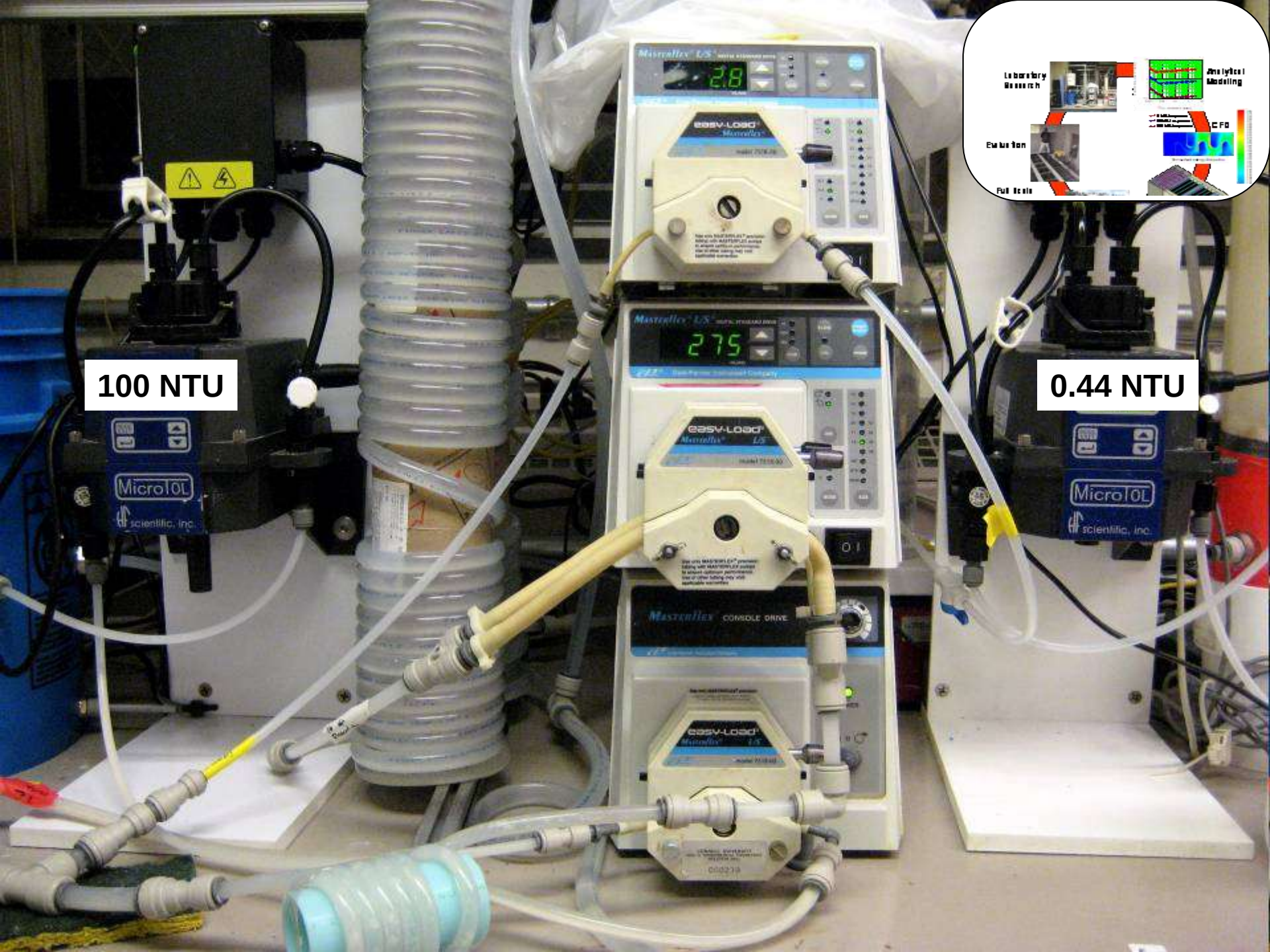
Automated Design

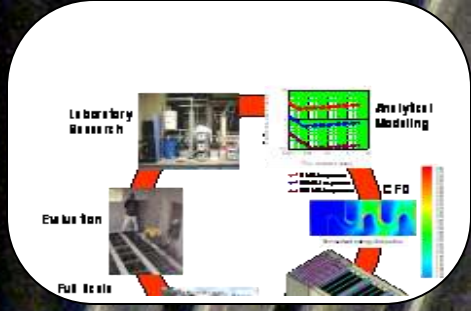
Research



- Approximately 2/3 of the student team is engaged in research to better understand the fundamental science of water treatment
- We have the goal of consistently producing water that has less than 1 NTU (turbidity unit) without using electricity.

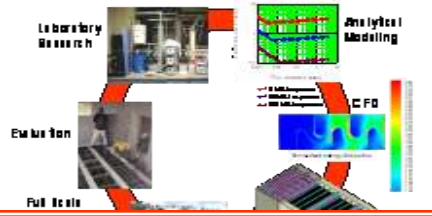

Laboratory Research
Analytical Modelling
CFD
Evaluation
Full Scale


100 NTU
0.44 NTU
Laboratory Research
Analytical Modeling
CFD
Evaluation
Full Scale

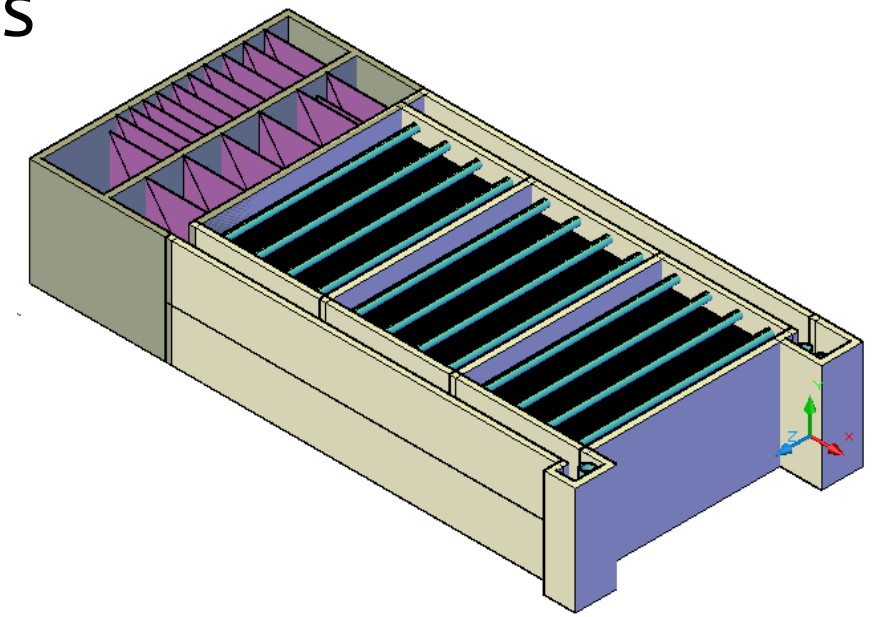


Floc Blanket Filtration

Automated Design Tool

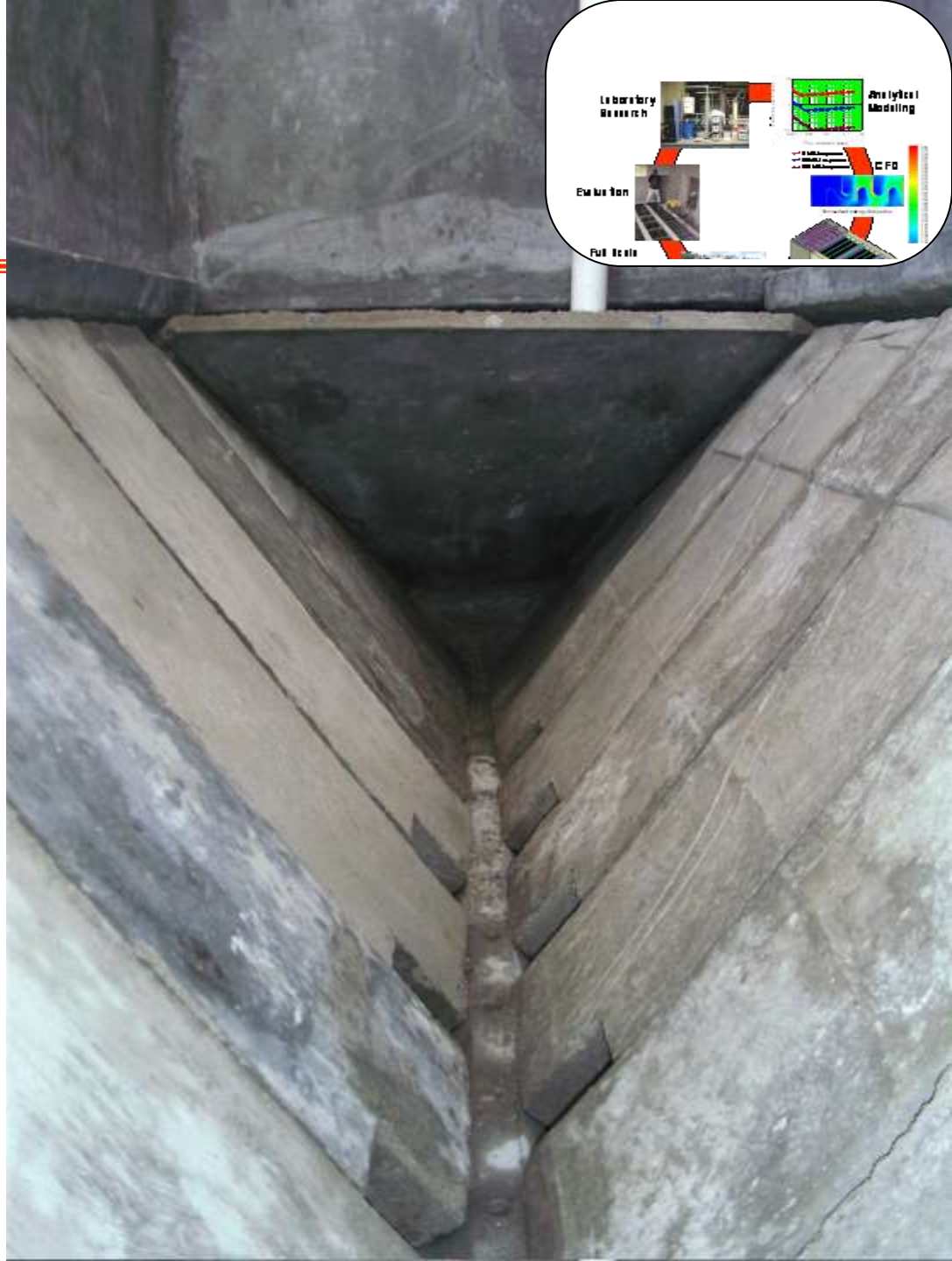


- A 3-year major team effort creating a tool that produces complete water treatment plant designs
- Placed online May 2009 for global dissemination of designs
- The tool is powerful and makes it possible to quickly check the effects of different design assumptions



Sedimentation Tank

- Innovative design
- Every dimension is based on a real constraint



Project Expansion

- When does it make sense to expand the project to other countries?
- How can we foster South to South spread of the technology so it doesn't require too much from the Cornell AguaClara team?

Project Objectives

- To create a rich educational experience that changes student lives
- To create the premier program in sustainable water treatment
- To research and enhance the performance of robust and sustainable water treatment technologies
- To provide a global service of free designs for municipal scale water treatment facilities that perform better than conventional high tech designs
- To build capacity in partner organizations and communities

Strategic Focus

- **Sustainable Infrastructure** is going to be the big focus (projected $41 trillion over the next 25 years)
- The most expensive infrastructure sector is the water sector with a projected cost of 22 trillion over the next 25 years
- AguaClara is for communities with minimal infrastructure **and** advanced infrastructure

Doshi, V., Schulman, G., Gabaldon, D. (2007) Lights! Water! Motion! Strategy+Business(46)

Partnerships

The Resource Foundation
Empowering Donors to Strengthen Communities

Cornell University
School of
Civil and Environmental Engineering

Funding
- Sanjuan Fund
- Cornell University
- Friends of AguaClara

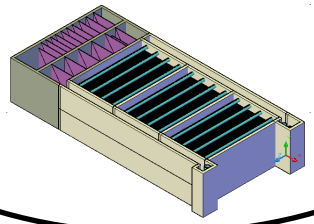
AguaClara

R&D
Design
Team trip to visit project sites

Sanaa
El Agua... Un Derecho Humano

AGUA PARA EL PUEBLO
APP

Water Treatment Plant



Municipal Government

RRAS-CA
Red Regional de Agua y Saneamiento de Centroamérica

A Few Reflections

- Creating the technologies that have the potential to make a real difference for the sustainability of the planet requires very hard (and rewarding) work
- The technology has to be well engineered and technically sound
- By distributing knowledge rather than distributing hardware we can reduce costs significantly
- Open source, open hand, empowerment are key components of sustainability.
- If your strategy doesn't include empowerment, then you aren't serving the BOP.

A few more…

- The AguaClara project is only possible through the very hard work of hundreds of people
- Special thanks go to the AguaClara team members who spend long hours conducting research and writing code to make safe water possible

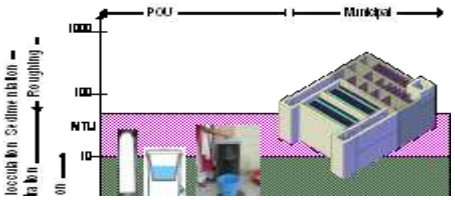
Your Turn

- How can the AguaClara project team with such a diversity of skill levels function?
- Who builds AguaClara Plants?
- Who designs AguaClara plants?
- Why don't AguaClara Engineers supervise the construction of AguaClara plants?
- Would it ever make sense to build an AguaClara plant in the United States?
- Why doesn't AguaClara include filtration?

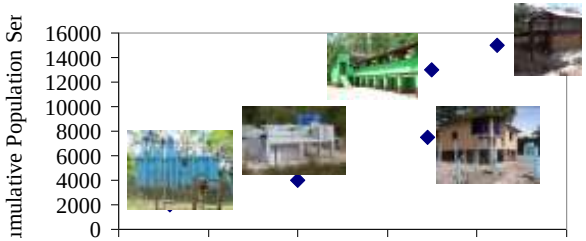
Questions?

AguaClara

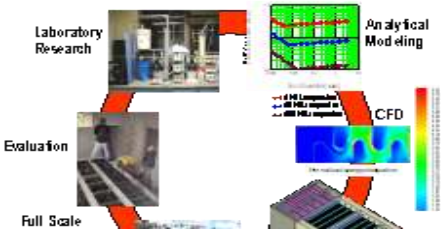
- The Niche



- 5 years of growth



- Research – Design - Education



- Opportunities

Why we do what we do...

Find out more at AguaClara.cee.cornell.edu