Well-Pump System for the Bondo Teachers Training College in Bondo, Kenya

Problem Statement:

The Bondo Teachers Training College (BTTC) currently houses over 650 students and faculty and is surrounded by an additional 700 members of a community within a one-mile radius of the school. During the rainy season, the school pumps water from a nearby river to help students with cleaning, drinking, and feeding livestock. For the rest of the year, the river runs dry, leaving the BTTC having to pay for water that is usually contaminated, leaving many sick and causing a financial burden to the school and surrounding community.

Design Team and Stakeholders:

Students:
-Three project leads
-15 members
-Mix of engineering and non-engineering majors

Industry Mentors
-Two professional engineers with a combined >40 years of experience
-Both experts in civil engineering pertaining to water distribution

Faculty:
-Provided feedback on designs
-Gave advice based on expertise needed outside of our professional engineers

Bondo Teachers Training College:
-Met with our team in July of 2023 to explain their needs
-Communicated with the team constantly throughout design of the project to give feedback and recommendations
-Ensured 24/7 protection of our system when implemented

External Entities:
-EPICS: Provided feedback during design reviews from other industry professionals
-Engineers Without Borders (EWB): Provided funding and helped with organizing travel to Kenya

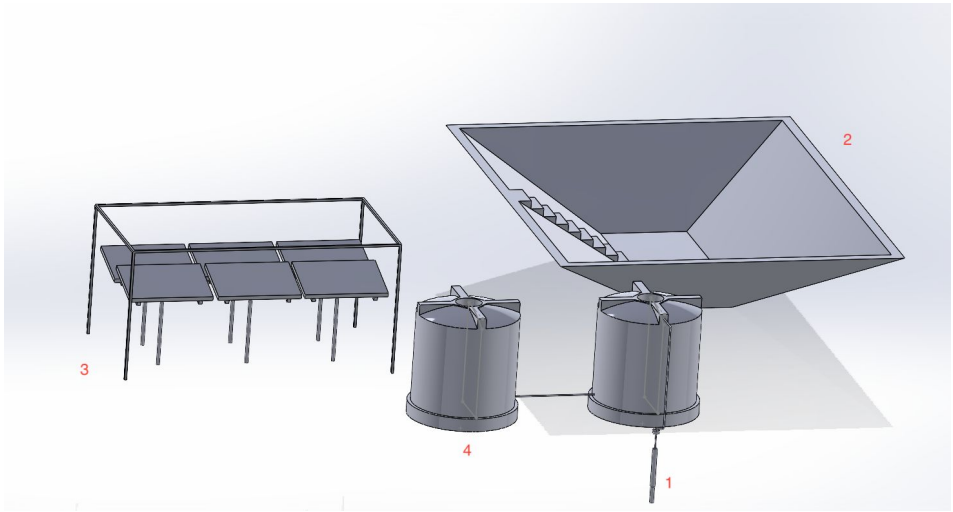
Project Impact:

Reliable Water Source: By implementing this project, the Bondo Teachers Training College and the surrounding community will finally have access to a reliable water source year round.

Safe Drinking Water: In addition to providing a reliable source of water for the BTTC and surrounding community, our project will also ensure a clean and safe drinking source. The BTTC and surrounding community will no longer need to drink contaminated water during the dry seasons.

Lessons the Financial Burden The BTTC and surrounding community will no longer have to pay the expensive fees for having water delivered to them when the nearby river runs dry. This financial burden is usually placed on the school, as the community cannot afford to pay for it, and our project will be able to both lower the financial burden for both entities and simultaneously ease tensions due to financial reasons between the two communities.

Engineering Design:



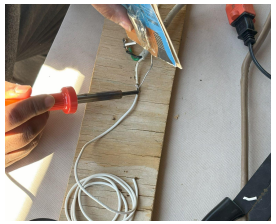
Key:
1) Pump
2) 70,000 L tank team will restore in July of 2024
3) Six 410 W Solar Panels within a chainlinked fence
4) Two 10,000 L tanks

Knowledge and Skills Gained:

Technical Skills:
-SolidWorks -MATLAB
-Wire Soldering -Structural Analysis
-Budgeting/ Accounting –Experimentation

Application:
The technical skills our team members have acquired throughout the project taught each member how we can take concepts learned in the classroom and apply them to real life engineering problems.

Lesson Learned:
The team learned how vital technical skills are during engineering projects, specifically when it comes to modelling and making predictions.



Non- Technical Skills:
-Cultural Competency -Critical Thinking
-Communication -Ethics
-Dependability -Collaboration

Application:
The soft skills our team members have learned showcased how being a great engineer is more than being able to solve difficult problems, it's about doing so effectively within a team.

Lesson Learned:
The primary lesson learned was the importance of soft skills and combining them with our technical knowledge to function as a successful team.

Pump: One 3 HP (2.2 kW) pump with a head of 210m (~690 ft) and a flow rate of 3.5m^3/s at 125 m (~400 ft)

Storage Tanks: Two 10,000 L tanks will be purchased and one 70,000 L tank will be repaired using a fiberglass laminate or an HDPE sheet, all used for storage for our system and for excess storage to the schools' pre-existing pump from the river Yala

Power System: Six 410 W monocrystalline solar panels will be connected in series to provide power for the pump

Piping: 1.25" HDPE pipe rated for 200 psi at 73 °F

Project Timeline

Team Visit: (July 2023) The team visits Kenya and acknowledges need

Project Issued: (August 2023) The project begins development

Head Loss Analysis: (October 2023) Design team creates a MATLAB program to assess head loss

Experimentation: (November 2023) Before prototyping, experimentation occurs

Bill of Materials: (December 2023) The bill of materials is finalized

Final Cad Design: (April 2024) The CAD designs are finalized after numerous revisions

Final Prototype: (April 2024) Prototyping is completed