

**School:** University of Florida **Title:** University of Florida Engineers Without Borders: Clean Water for Maras, Peru  
**Country:** Peru

**Project Leader (UF):** Karyna Villalba **Team Members (UF):** Paola Mendoza, Brenna Rowland, Robert Feder **Project Date Range:** July-Aug. '19

The UF Engineers Without Borders is a team of undergraduate students committed to the vision of a world in which the communities we serve have the capacity to sustainably meet their basic human needs. We also encourage our members to enrich their global perspective through the innovative professional and educational opportunities that the EWB-USA program provides. Our mission is to create a community-driven development program in Maras, Peru by collaborating with local partners to design and implement sustainable engineering projects.

Our team is working in Maras, Peru — a small, rural village located near the base of Machu Picchu — to address their critical water and irrigation needs. Maras has a largely agriculture-based economy, with approximately 70% of its residents either owning or being employed on farm land. Therefore, proper and effective water management is crucial for improving the livelihood of the residents.

In the summer of 2017, after the community reached out to Engineers Without Borders for help finding solutions to their water shortage and water quality issues, our team traveled to Peru to assess the extent of Maras' water problems. In the summer of 2018, we installed an antibacterial/antimicrobial water basin for the village's elementary school, *Virgen del Carmen*. Previously, the school only received running water for thirty minutes a day, but with the implementation of the new storage tank, the school now has access to upwards of 1100 liters of water daily. Additionally, we restored the water supply to one of the school's classroom buildings by rerouting 120 meters of the school's pipes to a preexisting underground storage tank in their courtyard. Our team trained the school staff how to properly maintain these projects, and these projects continue to function properly today.

During our implementation trip in May 2018, our team also conducted informal community surveys at twenty homes to assess their future water-based needs and identify the problem that they considered to be of the utmost importance. About 80 - 100 community members and leaders including Damian Castro, the President of the Farmers' Union, came together for an informational seminar with our team to discuss various possibilities of what a future UF EWB Peru Team project might entail. At the seminar, community members themselves introduced and echoed their support for the idea of building an irrigation reservoir. Considering the irrigation reservoir and other project ideas brought forth by our team members, the community members in attendance ensured our team that, of the ideas presented, the reservoir would be the most valuable to them. Their support for the irrigation reservoir was matched with a willingness to contribute labor and additional funds in order to see this project through.

Currently, the community irrigates its crops from a nearby spring source, the Chiupawa river, and rainwater. The Chiupawa river provides the majority of the community with its water for both residential and agricultural use. However, farmers with agricultural land east of the community's center do not have access to irrigation water from Chiupawa and must rely solely on rainwater. The community had previously channeled water from the Chiupawa river to a nearby reservoir to irrigate this eastern farm land, but the reservoir is no longer functional. Efforts to restore its function were limited since the reservoir is located on private land. The community's dependency on rainwater proves insufficient for maintaining their crops during the approximately three-month dry season (July - September), and without this reservoir, the surrounding agricultural area east of the community is without a reliable source of irrigation during this time. According to local farmers, the previous dry season was the longest ever experienced by the community, and because of this, their crops failed.

Therefore, the town's current irrigation methods are not sustainable for the development of the community as a whole. Per community request, we are designing a new reservoir that will provide the region with a source of irrigation water during the three-month dry season. The reservoir will allow this land to produce crops year-round, providing necessary food and income for the local farmers of Maras.

A select team will travel to Peru in August 2019 to meet with community leaders and construct the irrigation reservoir. Our communications team has been incredible in developing strong contacts in the community, despite the language barrier (the town speaks mainly Quechua, the region's indigenous language). Our primary in-country contact, Rocio Mora, assists in translating between Spanish and Quechua as well as obtaining and relaying all project-related information to and from the community. Rocio helps us to ensure that the community is involved in and aware of the project and its implications. Our partnership agreement with the government of Maras states that the community will contribute 5% of direct construction costs, and we expect their contributions to increase as the implementation-date approaches.

The educational diversity, commitment, and resourcefulness of our team is what qualifies us to take on this project. The majority of our members are studying various fields of engineering, with others studying non-engineering fields such as nonprofit management, environmental science and journalism/communications. With such a well-rounded team, we are also well-equipped to consider all the implications of our project, from technical aspects to its social effect on the community. All of our members are committed to furthering their education outside of the classroom in order to ensure the success of this project. This includes internship experience, supervised research, and extensive involvement in organizations on campus. However, we understand our own limitations as undergraduate students. We are resourceful in acquiring information and advice from professionals and the UF faculty, and not just from within the College of Engineering. We reach out to professional engineers to help with budgeting and establishing realistic goals for our project. Professors from the agriculture school and language professors have also helped us greatly. We strive to address our specific needs by

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developing strong relationships with highly educated, qualified contacts. All this, coupled with our experience working in the town the previous year, qualifies us to take on this challenge.

We firmly believe that a large part of this project is empowering the community to take charge of the reservoir and its maintenance after we finish the installation. The old, non-functional reservoir project that we discovered in the community has taught us that no matter how well-intentioned a project is, it cannot succeed without the continuing support of the community. While our team is in Peru, we will hold an informational seminar to teach residents, particularly farmers and prominent community members, about how to maintain the irrigation reservoir and how to use it most effectively. We will also be continuing a line of communication upon conclusion of this particular project, since we plan to work with Maras again in coming years to expand upon the irrigation reservoir and to implement new projects to increase their access to clean water.

Since the irrigation reservoir will be implemented in August 2019 during the region's dry season, we will not be able to fully assess project success during this trip. However, we have partnered with a local engineering firm that can provide necessary in-situ metrics. When the wet season begins in September 2019, a community member will be able to report the weekly changes in reservoir depth so that we can be certain that the amount evaporated will not exceed the inflow. The open channel depth will be reported weekly after completion as well to derive the flow rate.

As previously mentioned, a select group of team members will travel to the community during the first two weeks of August 2019. Around thirty days prior to travel, digging equipment will be transported on-site, and the excavation and channeling processes will begin in accordance with our design; these efforts will be coordinated remotely by our team and assisted by our community contacts. Upon our arrival, the majority of the excavation work will have been completed. Our team will oversee the finalization of the excavation process as well as the implementation of the impermeable liner and evaporation prevention cover. We will also evaluate the logistics of connecting a channel from the Chiupawa river to the reservoir and oversee any adjustments to the reservoir's distribution system. The remaining time on-site will be spent testing the system for potential failures and performing quality checks. With this timeline, the reservoir should be fully functional by when the wet season begins in late September.

To measure our project's impact and level of success, the team will be analyzing the increase in water quantity during the three-month dry season. One quantitative metric of success we will be evaluating is the increase in water access of the region's farmers. The team will also be evaluating changes in crop yield from the wet to dry season to see if and how drastically this measure fluctuates. Another useful indicator that will be examined is the change in income of affected farmers, if any. In terms of qualitative indicators of our project's success, we plan on heavily surveying members of the Farmers' Union with assistance of Damian Castro, their president, as well as Rocio Mora, our primary in-community contact, to reevaluate their level of satisfaction with the irrigation reservoir before, during, and after the dry season. We are confident in their willingness to report the aforementioned metrics as Damian, Rocio, Maras' treasurer, and mayor-elect have written letters of support for this project.

The main goal of our project is to promote peace and equality in a community that is divided by unequal access to the most basic human resource: water. The three-month dry season in Maras will only continue to lengthen as the planet continues to warm. Increasing access to effective irrigation infrastructure will have very positive economic and environmental benefits. The people of Maras have a right to clean water and a clean environment. An irrigation reservoir will deter farmers from siphoning contaminated water from nearby wastewater ponds to irrigate crops. Completing our project will contribute to a better standard of living and further peace within the community by lessening inequality among residents. By involving community members in project design, hiring community members to help implement the project, and teaching community members how to maintain the project, we help to ensure that the benefits continue to foster a culture of peace and prosperity for years to come. When people have the power to create the society they want to live in, our world becomes a little bit more beautiful. Website: <https://www.ufewbperu.com>