



World Aral Region Charity

Engineering through Education

# PROJECT REPORT 2022





# INTRODUCTION

The World Aral Region Charity's mission is to provide ecological, economic, and cultural aid to the Aral Sea region specifically, and to Eurasia more broadly, through the support of local initiatives. The Charity also aims to foster international cooperation to ecological issues by engaging youth volunteers from Central Asia and all over the world.

Over the course of two weeks in March and April 2022, WARC launched a pilot program called "Engineering through Education" in Karakalpakstan, Uzbekistan. Through this project, we worked with mainly high school students, as well as some precocious middle schoolers, from School 12 and School 41 of the village of Kegeyli. This community faces the brunt of the Aral Sea crisis: dirty and saline drinking water, dust storms and northern winds carrying salt that crystallizes in clusters over the soil, and excessive heat and desert climate that makes farming a challenging endeavor.

The core of the program was an environmental engineering curriculum, taught by volunteer engineers from Uzbekistan and the United States. The students of Kegeyli then implemented the concepts and methods learned to develop and test their own small-scale prototypes, created to address the ecological problems of their own community. WARC paired the educational program with in-kind investments in the ecology and public health of School 12: a garden of 160 native fruit trees and a 100 L/hour reverse osmosis filtration system that will provide the community with clean water.

The program culminated in a community-wide Science Fair, in which students showed off their projects to fellow students, teachers, community members, government officials, and local news channels, and were empowered to continue to monitor and test their solutions long after the program's culmination.

Smaller educational seminars were organized in Muynoq School 1 and Qonliqo'l School 7. A 500 L/hour filter was installed in Qonliqo'l, where students were introduced to the mechanics of the filter and drafted a community monitoring plan.





# ENGINEERING THROUGH EDUCATION



The Engineering through Education curriculum was designed to teach the students of Schools 12 and 41 the core concepts of environmental engineering.

Through hands-on exercises, students learned about the unique properties of water, calculated formulas for water transport and dynamics, put together sensors to measure temperature and humidity, and built water filters out of plastic bottles. Students learned about water usage and statistics by filling out a daily worksheet designed to track daily and weekly water usage.

Students learned about design thinking, the method by which engineers bring out implementable solutions from identified problems. Students discussed ecological issues directly facing their community and brainstormed small-scale engineering solutions to address these problems. With a budget of around \$250 per project, the students were split into six groups to bring their ideas to life.



# IN A GLANCE

Get to know the scope of our project!



## Participants

7 volunteers from WARC were involved:  
4 from the USA, 2 from Tashkent, 1 from Nukus



## Outreach

131 students in the Engineering through Education program  
62 students in additional satellite seminars



## Schools

Our project conducted seminars in 4 schools:  
Kegeyli 12, Kegeyli 41, Muynoq 1, Qonliqo'l 7



## Water Access

6,000 residents across two Karakalpak communities gained  
access to clean water



## Reverse Osmosis Filtration

2 RO Filters installed:  
1) 500 L/h in Qonliqo'l 7, serving APJ Janakala community  
2) 100 L/h in Kegeyli 12, serving APJ Janabazar community



## Farming

2 drip-line irrigation systems installed  
160 adaptable fruit trees planted



## Financial Support

The Engineering through Education program provided  
\$1000 USD of financing for 6 micro-projects in Kegeyli



# WATER USAGE IN KEGEYLI

## Results of survey tracking water-consuming activities

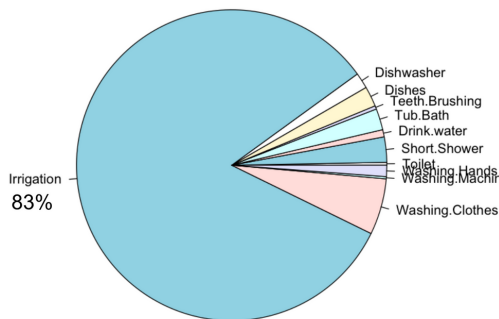


Figure 1

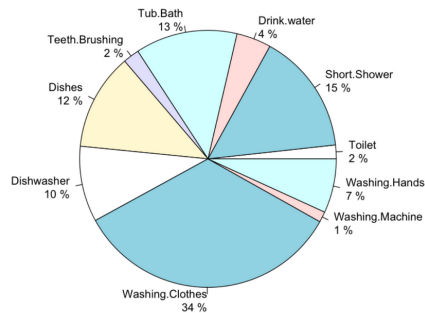


Figure 2

65

students from Schools  
12 and 41 participated

5

visits to different houses  
within the community



As part of our curriculum, the students at School 12 and School 41 were responsible for filling in a daily worksheet that tracked how much water they used for different tasks on a weekly-basis. Some key takeaways from our survey:

- **Irrigation** - required the largest amount of water by far, making up 83% of water consumed weekly (Figure 1). Crop irrigation, on average, consumed 550 liters per day.
- **Laundry** - washing clothes required the second largest amount of water. When factoring out irrigation, washing clothes made up 43% of weekly water consumption (Figure 2).
- **Sustainability** - Overall, the villagers of Kegeyli have a keen understanding of how much water they use. Excluding irrigation, villagers consume an average of 94 liters per day, a value slightly over half of the global average. It is not that water waste is a problem, but rather that water is difficult to access, often dirty, and high in salinity.





# DESIGNING PROTOYPES

After learning the basics of environmental engineering, students from School 12 and School 41 worked with our team of volunteer engineers to design and build a prototype of their own to address the ecological needs of their community, with WARC providing the necessary materials.



## Drip Line Irrigation

Students from both schools developed a drip line irrigation system, which utilizes thin tubes to maximize irrigation efficiency and minimize water consumption. School 12 built an open-air drip irrigation system, whereas School 41 built their system for a greenhouse.

## Tree Planting

Students from both schools conducted a *hashar* ceremony, planting 160 adaptable fruit trees on the grounds of School 12. They then designed and implemented an irrigation system to help the trees grow.



## Evaporative Water Cooler

Students from School 41 designed and built an evaporative water cooling system, an energy-effective way of reducing ambient temperature in this arid desert region where temperatures can climb up to 50°C in the summer months.

## Compost Station

Students from School 12 designed, built and installed a three-stage community compost station to help convert organic waste and plant matter into much-needed fertile soil, which can reduce the amount of water needed and produce higher crop yields.



## Filter Station

Students from School 12 worked together to install a new filter station powered by a reverse osmosis filtration system. This three-tank system has a capacity of filtering 500 liters per hour with a desalination rate of 95%.



# CONCLUSION



After developing plans for their prototypes, students continued to test and modify their projects prior to the Science Fair. They are continuing to test and monitor their prototypes after the end of the two-week program, reporting back to their group leaders via social media.



Students presented their prototypes at the Science Fair on the grounds of Kegeyli's School 12 on April 1. They gave speeches on their project's purpose, process, and results, and performed live demonstrations to attendees and regional TV news reporters.



In addition to our curriculum in Kegeyli, WARC worked in two other regions of Karakalpakstan. In Qonliqo'l we install a large 500 L/hour reverse osmosis filter on the grounds of School 1, followed by an interactive lesson using plastic bottle filters to explain the process of filtration.



In Moynaq School 1, we led a eco-theater lesson on the theme of developing solutions for local ecological challenges.



In total, WARC worked with 131 students across both schools in Kegeyli, and provided clean drinking water to over 2,500 members of the communities in Kegeyli and Qonliqo'l.



WARC presented the results of the program at a Forum at Tashkent Institute of Irrigation and Agricultural Mechanization Engineers (TIAME) on April 3. The forum provided a space for students, volunteers, and engineers to discuss plans and solutions for the Aral region.



# ACKNOWLEDGEMENTS

This project would not have been possible without the dedication and support of our wonderful volunteers and donors. We are especially grateful for:

- The volunteers who designed the curriculum and participated in the program
- Our partners from the Uzbekistan Ecological Party
- Our contributors and donors

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*We thank you for your continued support of our efforts to bring awareness and relief to the Aral Region.*

