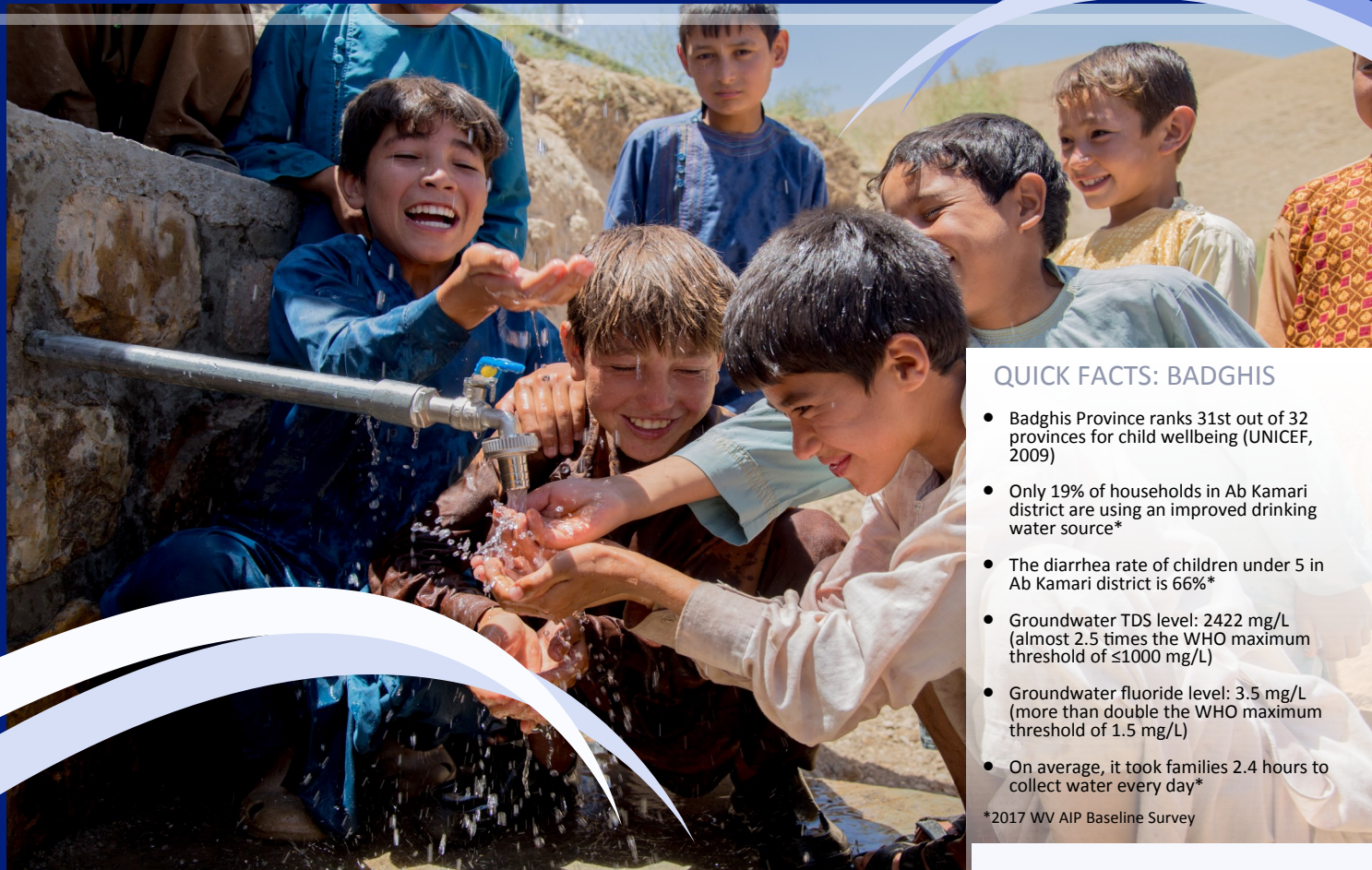


CASE STUDY: REVERSE OSMOSIS FOR WATER PURIFICATION IN BADGHIS PROVINCE, AFGHANISTAN



QUICK FACTS: BADGHIS

- Badghis Province ranks 31st out of 32 provinces for child wellbeing (UNICEF, 2009)
- Only 19% of households in Ab Kamari district are using an improved drinking water source*
- The diarrhea rate of children under 5 in Ab Kamari district is 66%*
- Groundwater TDS level: 2422 mg/L (almost 2.5 times the WHO maximum threshold of ≤ 1000 mg/L)
- Groundwater fluoride level: 3.5 mg/L (more than double the WHO maximum threshold of 1.5 mg/L)
- On average, it took families 2.4 hours to collect water every day*

*2017 WV AIP Baseline Survey

EXPLORING NEW SOLUTIONS

For the first time in Afghanistan, World Vision (WV) has established a solar-powered reverse osmosis and ultrafiltration system to provide clean, safe drinking water for 700 families (approximately 4900 people) in Ab Kamari district of Badghis province. It is the first solar-powered reverse osmosis unit with ultrafiltration that has ever been constructed in Afghanistan.

WHY WAS THE SYSTEM NECESSARY?

A recent water quality analysis conducted in Ab Kamari district, where the RO system is located, showed that the groundwater is highly contaminated and is likely making people in the district sick. Water quality results found that water contamination exceeds acceptable WHO and Afghanistan National Drinking Water standards for many of the chemical and physical parameters. The Total Dissolved Solids (TDS) level, for example, is 2422 mg/L which is almost 2.5 times the WHO maximum threshold of ≤ 1000 mg/L. The turbidity level is 10.84 NTU, which is more than double the WHO recommendation of < 5 NTU. Furthermore, the fluoride level of 3.5 mg/L is more than twice the WHO maximum threshold of 1.5 mg/L. The fluoride level is particularly concerning due to the negative health impacts of prolonged fluoride consumption. Consumption of water with fluoride levels in excess of 2mg/L, for example, can lead to tooth discoloration and/or pitting of children's teeth during the formative period of tooth growth. Consumption of drinking water with fluoride levels in excess of 4mg/L can lead to crippling fluorosis, a condition characterised by pain and tenderness of the major joints. In its current state, the groundwater in Ab Kamari is not fit for human consumption according to WHO and Afghanistan National Drinking Water standards.

WHAT IS REVERSE OSMOSIS?

Reverse osmosis is a technology that is used to remove a large majority of contaminants from water by pushing the water under pressure through a semi-permeable membrane. It is often used in situations where water contains chemical contaminants which are difficult to remove with more rudimentary water treatment methods. It is commonly used as a desalination technology.



According to WASH Engineer Ahmad Seyar Haqmal, “When I came to Badghis with WV Afghanistan as a WASH Project Manager in mid-2105, I realized that water in this province has high salinity and people suffer a lot due to the lack of sweet and safe drinking water. The heart-touching scenes of school-age children traveling 4 to 5 hours to fetch a few buckets of water, high diarrhea rates especially in the hot season, and the school drop-out rate as children are responsible for fetching water, convinced and inspired me to find a solution.” He went on to say, “I started searching for a solution to this problem and after a few months, I proposed the solar-powered RO system. I was looking in the Afghanistan markets for the spare parts to the system and the service providers to make this work easier. Fortunately I have found a few of them and in coordination with the WV Afghanistan WASH team and senior management in Badghis and Herat, we have started working on this trial with the support of donors from the United States. After almost one year, we have succeeded in running the system and providing sweet and safe drinking water through the system.”

ABOUT THE SYSTEM

The RO system WV has set up in Ab Kamari District is the first of its kind in Afghanistan. It was constructed with the assistance of a local company that supplies RO systems in Afghanistan. It can produce up to 4300 litres of clean, safe drinking water per hour. It removes the majority of contaminants including chemical, physical and microbiological contaminants. The removal of microbiological contaminants is also very important as a 2017 baseline study conducted by WV found that 66% of people surveyed in Ab Kamari district had at least one child under the age 5 who had experienced diarrhea in the last two weeks. High diarrhea rates are often linked to poor water, sanitation and hygiene conditions in communities.



The flow rate at each tap is approximately 33.3 litres per minute, well within the Sphere standard of 7.5 litres per minute. On average, it takes each family no more than 24 minutes to travel to the tap, collect the water, and return home. This is within the WHO standard of 30 minutes. The wastewater from the system is currently being used to irrigate salt-tolerant grasses.

SUSTAINABILITY

To ensure the sustainability of the system, WV and the RO company trained a community technician to manage and maintain the system. In addition, the community Shura is collecting water user fees of approximately US\$0.07 per 20 litres (much more affordable than the current market rate for water of approximately US\$0.40 per 20 litres). If the system is producing 30,100 litres per day (4300 litres per hour, 7 hours per day), this fills approximately 1505 20-litre jerrycans per day, generating US\$105.35 per day (US\$38,453 per year). This is more than enough to cover the cost of operation and maintenance of the system, including the payment of the community technician and replacement parts. The membrane filter, for example, costs approximately US\$750 and will only require replacing every 4-5 years. The total cost of consumables is approximately US\$2422 per year and technician’s wages are approximately US\$1056 per year. Subtracting these costs, the communities can make a projected annual profit of US\$34,975. By adding the ultrafiltration component to the system, WV extended the life of the RO’s membrane filter from 6 months to approximately 4-5 years. All of the parts were sourced from a local RO supplier in the neighbouring province of Herat and the system is supported by the company’s technical services through a guarantee in the first year and fee-for-service after the first year. The community is in direct contact with the company

ENVIRONMENTAL CONSIDERATIONS

The system is powered by solar energy which is considered to be a more environmentally sustainable option than systems powered by diesel generators. Furthermore, recognising the increasing scarcity of water in Afghanistan, WV considered the environmental sustainability of the aquifer that the system is extracting water from. WV sited the RO system where there is a known abundance of groundwater, regular aquifer recharge, and where demand for water is unlikely to outstrip supply. Ab Kamari district has also been identified as an area where WV plans to conduct Farmer Managed Natural Regeneration (FMNR) – a land restoration technique which supports groundwater recharge.



ENABLING PRIVATE SECTOR ACCESS

The relationship that WV has established between the local RO company and the communities in Ab Kamari has opened up a new market for the company; a market that they might never have been able to access without the support of WV. By initiating these relationships, WV can act as an enabler for the private sector in such a way that is mutually beneficial for both the companies and the communities.

PLANS FOR THE FUTURE

WV Afghanistan hopes to scale-up this innovation in other parts of the province that are experiencing similar issues with groundwater salinity in order to ensure children and their families have access to safe drinking water, in their communities, schools and health centres.



IMPACT

Suleiman, 14, used to spend 4 hours each day, traveling by donkey to collect water from a river. By the time he reached school, he would feel very tired and have difficulties concentrating. He would also often complain of stomach pains from drinking the river water. With the RO system now in his community, this is no longer the case. “Today, I slept more in the morning and just walked 20 minutes to collect the water from the tap. I had enough time to do my school homework and play with my friends. In school, our biology teacher always said that clean water is tasteless and without color and smell. Today for first time I was able to taste the real clean water.”

According to Rosanna Keam, World Vision Afghanistan’s WASH Specialist, “This is a very exciting innovation for everyone – WV technical staff, the Afghan Department of Rural Rehabilitation and Development, and most importantly the communities WV seeks to assist. Not only does it provide us with a great learning opportunity, it also solves the complicated water contamination issue that has been plaguing these communities for many years. I’m most excited about the positive impact this is going to have for women and children in the district. No longer will they have to spend hours searching for water which will most likely make them sick and force children to miss school. I am glad to see this is a success and hope we can do more work like this in the future.”



ABOUT WV AFGHANISTAN



World Vision began emergency relief operations in Afghanistan in 2001. The initial five-year programme was aimed at addressing the urgent needs of children and families affected by drought and decades of conflict. Since then, World Vision has transitioned to long-term sustainable, community-based development, primarily focused on the wellbeing of children and their families in health/nutrition/WASH, education, child protection, and food security/agriculture/livelihoods. WV’s work is well established in Badghis, Ghor, and Herat Provinces in the Western Region of Afghanistan.

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CONTACT DETAILS

World Vision Afghanistan
Walayat Street
Amiriat Boulevard,
Herat,
Afghanistan
+93 (0) 402231174
<http://www.worldvision.org/afghanistan>