GROUNDWATER LOCATION PROJECT

- A unique 501(c)(3) charity
- Flexible and responsive to end-user needs and ideas
- Provides crucial, otherwise-unavailable information to stakeholders
- Empowers women and children
- Builds capacity on a regional scale
- Reduces costs associated with water development

MISSION: We use science and technology to find clean groundwater for poor communities, and we create groundwater maps for saving and improving lives on a regional scale.

IMPETUS: Very few charities use modern technology to determine where to drill water wells. Consequently, they often waste a lot of time and money drilling dry holes or constructing wells that yield only a little water, because they don't know where the water is. Furthermore, no charity to our knowledge creates groundwater resource maps for regional planning and development in poverty-stricken areas of the world. GULP was founded in 2018 by Gordon Sturgeon, Ph.D. to fill these voids in the nonprofit sector.

WHERE WE WORK: At present, we are working in the Teso sub-region of northeastern Uganda. Uganda is one of ten countries with the worst drinking water in the world (U.S. News, 2017), and the Teso sub-region, which is struggling to recover from 30 years of civil wars, receives little attention. In most districts, up to 60 percent of the people lack access to safe water for drinking and washing (Uganda Water and Environment Sector Performance Report, 2016). Women and children, the primary water fetchers, must walk for kilometers each day to find clean water, or they must rely on untreated river, seep, or lake water that is laden with pathogenic microorganisms. Not surprisingly, waterborne diseases are the main cause of infant mortality.

Groundwater is almost always safer than untreated surface water, because it is less susceptible to pollution. Unfortunately, the potential for groundwater development in Uganda is not well known. There is a desperate need for local-scale groundwater mapping to assist with regional planning and help well drillers locate the best drilling sites in areas where groundwater is hard to find.

Groundwater is hard to find in the Teso sub-region, because it is only found in: 1) the shallow overburden (i.e., the layer of soil and broken rock that lies atop the bedrock), and 2) deep, nearly vertical fractures in the bedrock. Most of the existing wells are installed in the overburden where the wells often run dry and are abandoned, or they only yield water in the wet seasons when the water table is high. Few if any wells are emplaced in the vertical fracture zones – which are filled with groundwater throughout the year – because their locations are hidden beneath the land surface.

WHAT WE DO: We combine several proven methods to locate these hidden fracture zones, identify the best drilling sites, and create groundwater maps. First, satellite data and aerial photographs are examined for traces of buried vertical fracture zones. Second, the orientations of vertical fractures exposed in rock outcrops are measured. Third, maps are created to show the locations of the fracture traces identified in step one that have the same orientations as the actual fractures measured in step two. Fourth, the maps are examined for potential drilling sites. Fifth, the potential sites are visited to verify the presence of buried fractures and pinpoint their exact locations using a combination of field observations and electric and electromagnetic surveys.

Sometimes there are no water-bearing fracture zones near a village that desperately needs water, so electric surveys are carried out to determine where the saturated soil and broken rock is thickest. Then a well can be placed as deep as possible in the overburden to minimize the likelihood of it running dry (Figure 1). The geophysical survey data are combined with hydrogeologic observations to produce overburden groundwater maps.

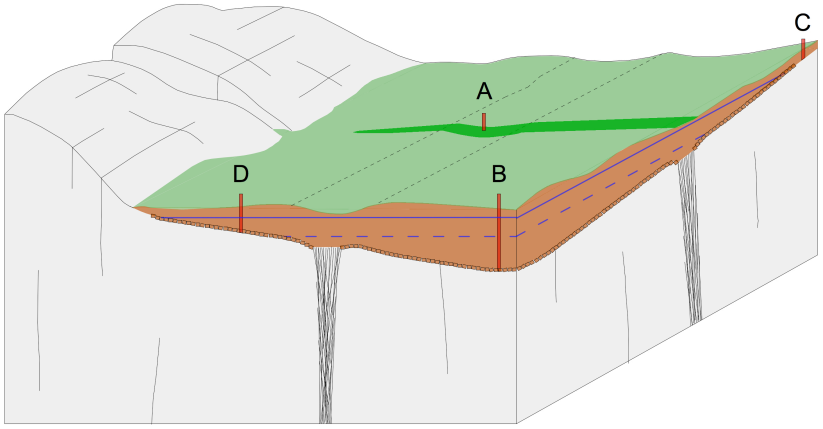

Figure 1. Simplified geology of the Teso sub-region. Gray represents bedrock. Brown is the overburden. Solid and dashed blue lines are the water table during a wet season and dry season, respectively. Red lines are wells. Gray lines in the bedrock represent individual fractures. Occasionally, fractures occur in large groups; two groups are shown. The best location for a borehole is in one of these fracture groups, especially where the groups intersect. (In this figure, they intersect at the location marked “A” where the line of darker vegetation that lies atop one fracture zone crosses the linear depression that lies atop the other fracture zone.) The next best location is “B” at the base of the deepest overburden. The well at “C” would always be dry, while the well at “D” would only yield water during the wettest times of the year.

PROJECT BENEFITS: GULP provides essential information that would otherwise be unavailable. With this information, well drillers, planners, and development workers can act to save lives and transform local and regional economies through the reduced rates of infant mortality and the improved health, access to education, and agricultural production that accompany water development.

The overburden and bedrock groundwater maps help district governments develop and manage their regional water resources. The database of optimum drilling site locations enables community leaders, charities, water-sector businesses, and government agencies to know precisely where to drill with a high probability of success, thereby decreasing the percentage of failed borings, decreasing costs, and increasing access to safe water.

The increased access to water relieves women and children of the burden of traveling long distances, waiting hours in long lines, and carrying painfully heavy loads of water, thereby freeing them to attend school and otherwise improve the quality of their lives.

FOR MORE INFORMATION: Please write to us at gulpgroundwater@gmail.com or visit our website at www.gulpgroundwater.org.