



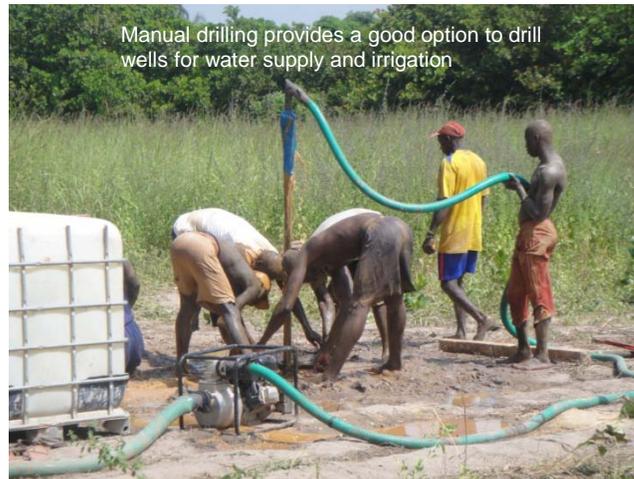
Program Response to the Needs in Africa

Achieving the Millennium Development Goals (MDGs) for water supply in Sub-Saharan Africa is a daunting task because the magnitude of the problem is ever increasing. There are 284 million people living in rural areas without access to potable water. Radically different approaches are needed to reach these people and more emphasis must be placed on solutions that are affordable, allowing households and communities to meet their need for potable water.

284 million people in Africa do not have access to clean water and must use polluted sources



Manual drilling provides a good option to drill wells for water supply and irrigation



The goal of this EnterpriseWorks (EW) initiative is to develop the professional private manual drilling sector in Africa. This program will require substantial investments in time and money to provide the necessary training and on-site follow-up with local drilling businesses to ensure that the quality of wells drilled will be consistent with national legislation and policies and will respond to the demand for safe water points from governments, donors, villages, and individuals. EW believes this is a good investment to deliver cost-effective boreholes to address Sub-Saharan Africa's water supply issues.

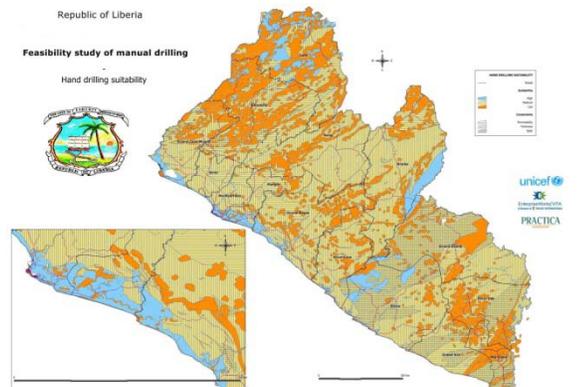
Professionalized Manual Drilling: A Smart Option

Low-cost manual drilling has already demonstrated its effectiveness in Asia, Africa and Latin America as a means of increasing the availability of potable water. When there are substantial populations in areas with hydrogeology that is favorable for manual drilling, then the investment in developing a professionalized manual drilling sector is recommended. There are many advantages of professionalized manual drilling:

- **Cost Effective:** 4-10 times cheaper than a machine drilled borehole of the same depth and takes much less time than a hand dug well
- **High Quality:** a manual drilled well has the same quality as a machine drilled borehole
- **Reaches Unserved Communities:** Ideally suited to small, remote rural communities where other options are simply not economically feasible
- **Easier Access:** Access to sites far from paved roads is easier for the lightweight manual drilling equipment than for large rigs or materials for concrete lined wells
- **Not Dependent on High Cost Imports:** Tools are made locally and require less than \$3,000 for a drilling enterprise to begin operations
- **Local Employment Creation:** Manual drilling creates employment by substituting labor for capital investment and employing local enterprises rather than foreign contractors
- **Flexible:** Ready-to-go in emergencies and in unstable countries (lightweight equipment can be transported in a pick-up truck)
- **Proven:** Professionalized manual drilling sectors have been developed in Niger and Senegal
- **Sustainability:** Investment in professionalizing a local manual drilling sector means more wells can be drilled and existing wells can be better serviced and maintained

Potential for Manual Drilling

Manual drilling is generally feasible in unconsolidated and sedimentary formations where the water table is within 25 meters of the surface. Most countries will have some favorable areas for manual drilling. However, it is important to ensure that there are enough favorable areas corresponding to zones with high numbers of underserved people in order to justify the investment in a program to professionalize the manual drilling sector. The first step in the introduction of manual drilling is to determine the potential based on available data including drilling logs, hydrogeology maps and satellite images. Maps are done at a national level in order to have an initial knowledge of areas where the environmental and hydro-geological situation could make hand drilling a suitable low cost and sustainable solution to increase the availability of safe water for the rural population. This will provide a clear indication of the regions within a country with the highest potential for manual drilling. If these favorable areas have substantial unserved rural populations then a 4 to 10-fold cost savings on the provision of water supply can be realized. These savings can be realized when manual drilling is used to complement other conventional means of providing safe water. To date preliminary mapping exercises have been completed in 15 African countries.



Map of Liberia showing favorable zones for manual drilling

Building Professional Private Sector Capacity

To benefit from manual drilling it is necessary to build the local capacity in the private sector. The approach used by EWV is fundamentally different from past approaches that built skills within government departments or NGOs. By training businesses to earn their livelihoods from manual drilling; a professional drilling sector can be developed. In order for small enterprises, often still in the informal sector, to be able to respond to demand from NGOs, local communities and individuals for improved drinking water, they need to upgrade their technical and managerial skills. Training in business management as well as drilling techniques and hydro-geology is essential for drilling enterprises. To support the drillers training is also needed for quality controllers who provide independent oversight during well installation. This requires training over a period of several years to ensure that the sector can provide consistently high quality well installations.



Business management and tendering training for well drilling businesses in Niger

Toolkit to Professionalize Manual Drilling in Africa

EWV and our partners have prepared manuals to assist national governments and donors to develop programs to create professional manual well drilling sectors. A general implementation manual *Professionalizing the Manual Drilling Sector in Africa* outlines the process that has been effectively used by EW in Niger and Senegal to develop and support the emergence of professional manual well drilling enterprises. In addition, the toolkit has detailed manuals covering the use of three drilling techniques (augering, jetting and manual percussion) with drawings for the manufacture of the necessary tools. Complementary manuals cover:

- *Understanding Groundwater and Wells in Manual Drilling*
- *Financing Options for Low-Cost Well Drillers and Communities for Rural Water Supply*
- *Improving Skills of Manual Drilling Enterprises –Business Management*

In addition, advocacy materials including case studies, videos and technical notes have been developed. EW organized a series of webex presentations for UNICEF WASH Officers and their government counterparts to launch the toolkit and to create awareness of the potential for manual drilling to complement conventional machine drilling.

By using the implementation guide and the technical manuals, countries will be able to begin to assess the existing capacity of enterprises and organizations in the manual drilling sector. EW will be able to assist with a training needs assessment and develop training programs and a social marketing campaign. Over a 3-5 year period the professionalized manual drilling sector will gain the capacity to respond to the demand for safe water points from donors, communities and individuals, benefiting hundreds of thousands of people in rural areas.

Choosing the best method for well construction

For the construction of safe groundwater points different well construction methods exist. Wells can be drilled with machines, drilled manually or dug by hand. The selection of the most appropriate method will depend upon geology, depth of the aquifer, yield and location. Machine drilled wells are very high in quality, but also very expensive. The cost of a machine drilled well varies but will generally be in the range of US\$ 5,000 – 15,000 for a 30-meter deep well. Hand dug wells are very useful in formations with low permeability due to their capacity to store water. They vary widely in terms of cost and quality. In some countries hand dug wells are dug in clay without any lining at a cost of less than US\$ 100 while a hand dug well lined with concrete rings will approach the cost of a machine drilled well. In many countries manual drilling techniques can be used to complement other methods. Costs of 30-meter deep wells vary from about US\$ 100 – 3,500, depending on the geology, country and application (small scale irrigation wells or high quality community wells for potable water).



Machine drilled wells are very high in quality and a good way to construct safe water points for large communities and piped water supply schemes. However, the investment cost for an enterprise to purchase additional machines is high (estimated > US\$ 100,000), making it difficult to rapidly scale-up the capacity in the local private sector. In the case of manual drilling much less expensive tools are required, making the capital investment (US\$ 3,000) for an enterprise to enter the market or to expand capacity much easier. In addition, the drilling time required for manually drilled wells (1 day – 2 weeks) is much less than the time needed to construct a lined hand dug well (1-3 months). These factors make manual drilling an attractive option, where the hydrogeology is suitable, with a very high potential to scale up the capacity of the sector.

All existing drilling techniques can be classified in four main drilling principles: Hand Auger, Percussion, Sludging and Jetting.

The **hand auger** consists of extendable steel rods, rotated by a handle. A number of different steel drill bits can be attached at the bottom end of the drill rods. The augers are rotated into the ground until they are filled, and then lifted out of the borehole to be emptied. Different drill bits are used depending on the properties of the layer being penetrated. Augers can be used up to a depth of about 15-25 meters, depending on the geology.

Sludging uses water circulation to bring the cuttings to the surface. The drill pipes are moved up and down using a lever. On the down stroke, the impact of the drill bit loosens the soil and on the up stroke, the cuttings are transported to the surface. On the next down stroke the water squirts into a mud pit where the cuttings settle out and the water flows back into the well. The borehole stays open by water pressure. To prevent the hole from collapsing and to reduce the loss of drilling fluid, additives can be used. Sludging can be used up to depths of about 35 meters.



With **percussion drilling** a heavy cutting bit attached to a rope is repeatedly dropped into the open hole or inside a temporary casing. Usually a tripod is used to support the tools. By moving the rope up and down, the cutting bit loosens the soil or breaks the rock in the borehole, which is later extracted using a bailer. Manual percussion drilling is generally used to depths beyond 25 meters or to penetrate hard layers in combination with other methods.

Jetting is also based on water circulation and water pressure. Water is pumped down the drill pipe and the water and cuttings are transported up the hole between the drill pipe and the borehole wall. A motor pump is used to achieve an adequate water flow. The drill pipe may simply have an open end, or a drill bit can be added. Partial or full rotation of the drill pipe can be used. To prevent the hole from collapsing and to reduce the loss of drilling fluid, additives such as drilling polymer or bentonite can be used. Manual jetting is generally used up to 40 meters.

The impact

Manual drilling is being used to increase the number of wells drilled annually in Africa while developing the local capacity for the future. EW has been working to professionalize ten manual drilling enterprises in Niger where one of our staff even has a drilling company with two small portable rigs, the next step in the process. In Senegal EW with funding from USAID is working with nine manual drilling enterprises, providing business management and manual drilling technical training and tools on credit. All companies have reimbursed the credit for their tools and are drilling wells for the USAID/PEPAM project and other donors and individuals. These companies, using an improved rotary jetting technique developed by EW combined with percussion drilling are able to drill wells to 35 meters in 1-3 days.



growth

Currently there are manual drilling enterprises in Madagascar, Chad, Nigeria, Niger, Ghana, Tanzania, Ethiopia, DRC, Senegal, Mali and South Africa. More training is needed for these well drilling businesses to enable them to be accepted as professionals.



knowledge

The program is contributing to a better understanding of how the manual drilling sector can be professionalized in Africa. The toolkit provides a large collection of resources for manual drilling program and to support mainstreaming of the sector.



change

This program can directly contribute to poverty reduction by increasing awareness of the contribution that manual drilling can make toward achieving the MDGs. Governments are beginning to include manual drilling in their rural water supply strategies.

More Information

Toolkit for Professionalizing Manual Drilling in Africa including manuals, case studies, maps and videos is available at

<http://www.enterpriseworks.org/display.cfm?id=5&sub=23>

About Us

EnterpriseWorks a Division of Relief International is a US-based not-for-profit organization working to combat poverty through economic development programs based on sustainable, enterprise-oriented solutions. RI/EWV has worked with local businesses and organizations for more than 40 years in 100 countries. By supporting profit-making enterprises to create employment and to increase productivity and profits, RI/EWV addresses the challenges of rural, peri-urban, and urban development.

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