



Learning Note 3: Good Practices in Manual Drilling Design and Construction — Nigeria, Madagascar & Kenya (25 February 2014)

Introduction

The third webinar focused on good practices in manual drilling design and construction, with case studies from Nigeria, Madagascar and Kenya.

Nigeria is currently witnessing a process whereby manual drilling (jetting) for domestic water supplies is becoming a mainstream and accepted approach in areas where it is feasible. Improvements are being driven by both the public and private sector. The client base mainly comprises of households. Some state governments have also employed manual drillers. Manual drilling is officially recognised within the Nigerian Code of Practice for Water Well Construction which requires that the drillers are licenced, but this is not being fully enforced. However, there are examples of manual drilling associations which impose sanctions on their members for producing sub-standard work.

Driven wells were introduced into Madagascar in the 1970's but are not considered by all stakeholders as a suitable drinking water supply sources. Other manual drilling techniques were introduced in 2004 and have been used to construct over 2,000 boreholes. These have been drilled for community WASH projects as well as for households themselves as drinking water sources. There may be considerable areas in the west of the country with a high potential for manual drilling, yet these remain relatively unexploited. National standards for manual drilling exist, but are not always adhered to. In Kenya, manual drilling is growing in popularity, and is primarily being undertaken as part of water supply projects. Efforts are spread out throughout the country and efforts are on-going to register the drilling organisations.

Case Study

Good practices - Case Study 1: Nigeria

Background

With a population of between 160 and 174 million, and access to improved water supply coverage standing at 54% (JMP 2012), between 73 and 80 million Nigerians are estimated to use an unimproved drinking water supply.

Manual drilling for domestic supply and irrigation is widely practiced in about 17 out of Nigeria's 36 states (Adekile, 2014). Jetting (known locally as washboring or hand turning) was introduced into Nigeria in the 1980's through Agricultural Development Programmes for irrigation supported by the World Bank. The practice continues to this day in Nigeria's alluvial lowland aquifers. The irrigation wells are lined with 2 or 3 inch diameter plastic pipes and water lifted with petrol driven pumps.



Manual drilling in Nigeria

Jetting has subsequently spread from irrigation to domestic water supply. It is estimated that in the region of 30,000 boreholes have been manually drilled for domestic water supplies in Nigeria (Adekile, 2010). Jetting equipment is manufactured in Nigeria.

In the southern part of the country, cities such as Benin, Calabar, Lagos, Port Harcourt and Warri are underlain by shallow sand aquifers, which are ideal for jetting. Over 200 manual drilling enterprises operate across the country. They can be found in nearly all of the big cities in Nigeria and there are up to 50 in Lagos state alone (Adekile, 2014). Practitioners include farmers, artisans, conventional drillers, graduates, religious leaders and retired government hydrogeologists.



Manual drilling in Nigeria

Professional ethics is a key issue. Manual drilling associations have been formed in a number of states and are sanctioning on members who do not adhere to the standards. The Nigerian Code of Practice for Water Well Construction (SON 2010) recognises manual drilling as one of the accepted methods for water well construction, and as part of its means to regulate the sector, stipulates that all drillers be licensed. However, the code has not been fully implemented.

According to Adekile (2014), it is difficult to differentiate between manual and mechanised drillers because many enterprises do both. Some manual drillers have progressed to owning mechanised rigs but still retain their manual drilling operations as it is lucrative. When one large enterprise (with mechanised rigs that drill to 500m) was asked why he uses both techniques he replied “Why kill an ant with a sledgehammer?”

In Nigeria, the clients for manually drilled wells are mainly private. They are interested in the final product - a borehole that is productive – rather than being concerned with how it was drilled. Most clients are householders, others include farmers, car wash owners, bottled and sachet water makers and conventional drillers. Until recently government agencies did not use manual drillers as the drilling specifications excluded them from the contracts but in the race towards the 2015 targets, some state agencies are now employing manual drillers.

The National Water Resources Institute (NWRI) has been conducting research to improve manual drilling equipment so that rotation, penetration and lifting are easier and the equipment can be “turned” by two or three people, rather than four to five. A second innovation incorporates an engine for rotation. NWRI has also trained 170 young graduates in manual drilling of which some have set up their own hand drilling outfit.

Manual Drilling in Nigeria: Key information	
Type of manual drilling:	Jetting (known locally as washboring or hand turning).
Scale:	Implemented across the country
Regulation	Manual Drilling Associations have been formed and the Nigerian Code of Practice for Water Well Construction stipulates all drillers be licenced (but not fully implemented)
Types of pumps:	Various handpumps and petrol driven pumps
Drilling costs:	Manually drilled wells cost about \$1,500 for a 35m deep well; machine drilled wells to 35m cost about \$4,000.

Case Study

Good practices - Case Study 2: Madagascar

Access to drinking water in Madagascar is estimated to be around 61% and 42% in urban rural areas respectively (MINEAU 2012). The remoteness of some rural communities in Madagascar is particularly pronounced.

Well jetting in particular, was introduced Madagascar in 2004 with about 350 wells drilled over the subsequent two years. In 2006, rota-sludge technology was introduced to the country, with support from UNICEF/ Practica. A national map of manual drilling feasibility was published in 2010 (ME 2010). Over 2,000 manually drilled wells have been constructed in Madagascar. About 63% of these have been drilled by private enterprises. About 94% of these wells were financed through WASH projects (Abric, 2014).



Masons cut slots in casing in Madagascar

One of the webinar participants pointed out that there is also a significant unsubsidised self-supply market for “driven wellpoints” fitted with suction pumps in shallow alluvial aquifers, primarily along the east coast of Madagascar. MacCarthy et al (2013) estimate that over 12,000 of these household systems, which use 'Pompes Tanys', or 'Pitcher Pumps' have been installed. In the eastern port city of Tamatave, there are over 50 independent, small-scale manufacturers of Pitcher Pump systems. In his response, the presenter (Stéphan Abric) raised concerns about the suitability of these supplies to provide potable drinking water.

Abric (2013) notes that the manual drilling efforts in Madagascar to date have not properly exploited the western sedimentary areas, which are likely to have a higher potential. To date the WASH projects that have exploited manual drilling have been concentrated in areas where weathering is relatively low and water is often rich in iron. Also, problems have been encountered in siting manually drilled wells for schools, given that many are located on elevations that are not always appropriate.

Standards for manual drilling (referred to as “alleges” or “light” drilling) are included in the procedures manual of the Ministry of Energy and Mines (MEM 2005) and include requirements for water quality testing, well development and pumping test as well as the sanitary seal. However, in practice, striving for low-cost solutions has been central for manual drilling in Madagascar with the result that these standards are not always adhered to. There are improvements currently taking place with respect to well development but Abric (2014) recommends that WASH projects should push for higher standards with respect to diameter, casing quality, drilling fluid and well development. Unlike in Nigeria, factory-slotted casing is not readily available.



History of manual drilling in Madagascar

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Manual Drilling in Madagascar: Key information	
Type of manual drilling:	Driven wells, jetting, rota-sludge & “mad drill”
Scale:	Relatively small scale - 350 water points so far
Regulation:	Standards for manual drilling are included in the procedures manual of the Ministry of
Types of pumps:	Rope pumps & various hand pumps; Pompes Tany/Pitcher Pumps on driven wells.
Drilling costs:	\$1,000 to \$3,000 for manually drilled wells with the rota-sludge (<30m depth); \$4,000 to \$6,000 for hand dug wells (<30m depth); \$9,000 to \$13,500 for wells drilled with the rotary rig

Case Study

Good practices - Case Study 3: Kenya

The popularity of manual drilling (referred to locally as low-cost or small scale drilling) for drinking water supplies in Kenya is growing but it is on the periphery of government programmes and is viewed as something that can be used when there are no other options (Adenya 2014).

However, thanks to advocacy efforts, manual drillers are now recognized by the Ministry of Water and Irrigation and can now be awarded tenders of up to US\$55,000. To date, manual drilling has been utilised in projects implemented by several bilateral agencies, government and civil society organisations. World Vision is one of the major players in Kenya with respect to its promotion. Experiences of the technology are to be found in many parts of the country.



Sludging technology being used in Kenya

The WASH Coordination committee has established an inventory of organisations undertaking drilling in Kenya (private sector as well as NGOs). Current efforts are being made to ensure that these entities are registered as an official water contractor (MTAC/C). Adenya (2014) described the following key design parameters for manually drilled wells but the extent to which they are adhered to is not clear:

- Diameter - 8 inches
- Casing - normal 6 inch PVC or Steel
- Screen - pre-slotted PVC or manually done
- Gravel pack/formation using 5mm coarse sand
- Sanitary seal/grouting done for the upper 6m.

Manual Drilling in Kenya: Key information	
Type of manual drilling:	Auguring, sludging and percussion
Scale:	Small scale
Regulation:	Early stages: inventory of organisations and efforts to make sure they are officially
Types of pumps:	Afridev and Solar Pumps
Drilling costs:	Around \$3,700 to auger to 40m

Positive practices

Factory slotted screens (Nigeria): In the past, manual drillers providing domestic water supplies would fabricate screens on site with hack saw. However, they are starting to buy factory slotted screens from reputable manufacturers. This provides a higher percentage of open area, which can lead to higher withdrawals from holes.

Sanitary seal, gravel pack and disinfection (Nigeria & Kenya): Previously, there was no gravel packing, sanitary seal or disinfection following the completion of boreholes in Nigeria, but as better standards are being enforced all three are being more commonly used. In Kenya, a 6m sanitary seal/grouting is used for some manually drilled wells.

Larger diameter drill bits (Nigeria & Kenya): Manual drillers have adapted their bits to be able to construct 6 inch diameter finished boreholes if required in Nigeria and are reaming boreholes to 8 inch diameter in Kenya.

Training (Nigeria and Madagascar): In Madagascar active drilling teams have been trained by Practica/UNICEF whereas in Nigeria graduates are being trained by the National Water Resources Institute. The training covers siting, construction and well development as well as basic hydrogeology.

Innovation (Nigeria): efforts are being made to improve well jetting so that it is more effective, with better ergonomics and requiring fewer operators.

Recognition & Regulation (Nigeria, Madagascar and Kenya): Manual drilling has been officially recognised as a suitable technology for drinking and domestic water supplies in all three countries. Associations who regulate themselves (through sanctions) are coming up in Nigeria. Manual drilling enterprises are being formally registered in Kenya.

Did you miss the webinar?

You can watch the webinar on: <http://vimeo.com/87747145>. A summary as well as all presentations and scripts (English and French) is available on: <http://www.rural-water-supply.net/en/resources/details/565>

Additional Resources

ABRIC (2014) Le forage manuel à Madagascar/Manual Drilling in Madagascar, Presentation at the 3rd UNICEF-RWSN Webinar on Manual Drilling, 25th February 2014, Available on: <http://www.rural-water-supply.net/en/resources/details/565>

ADEKILE, (2010) Hand Drilling in Nigeria: Why Kill and Ant with a Sledgehammer? Rural Water Supply Network, Available on: <http://www.rural-water-supply.net/en/resources/details/163>

ADEKILE, D (2014) Good Practices in Manual Drilling Construction and Design – The Nigeria Experience/Bonnes pratiques dans la conception des forages manuels – l'expérience nigérien, Presentation at the 3rd UNICEF-RWSN Webinar on Manual Drilling, 25th February 2014, Available on: <http://www.rural-water-supply.net/en/resources/details/565>

ADENYA (2014) Manual Drilling : the Kenya Case Study/Forage Manuel: Etude de cas du Kenya, Presentation at the 3rd UNICEF-RWSN Webinar on Manual Drilling, 25th February 2014, Available on: <http://www.rural-water-supply.net/en/resources/details/565>

MINEAU (2012), *Base de données sur l'eau, l'hygiène et l'assainissement à Madagascar*, Ministre de l'Eau

MACCARTHY, M, ANNIS, J.E and MIHELICIC, J.R (2013) *Unsubsidised Self-supply in eastern Madagascar*, Water Alternatives 6(3): 424-438, Available on: www.water-alternatives.org

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ME (2010) *Etude De Faisabilite des Forages Manuels Identification Des Zones Potentiellement Favorables*, Republique De Madagascar Ministere de l'eau, Available on http://www.unicef.org/wash/files/MADAGASCAR_Raport_final_forges_manuels_FINAL.pdf

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SON (2010) *Code of Practice for Water Well Construction, Industrial Standard NCP 27:2010, Standards Organisation of Nigeria*, Available on http://www.awdrop.org/uploads/3/1/7/8/3178681/code_of_practice_for_borehole_drilling.pdf

UNICEF (2011) *Manual Drilling in Kenya, Briefing Note 1*, Unicef Kenya WASH Section, Available on <http://www.wescoord.or.ke>

UNICEF (2012) *Small Scale Drillers Association, Briefing Note 1*, Unicef Kenya WASH Section, Available on <http://www.wescoord.or.ke>

WESCORD (2014) *Water and Environmental Sanitation Coordination*, <http://www.wescoord.or.ke>