

Drilling Deep for Nigeria's Borno State

Drilling water wells beyond 6-700 meters is a serious commitment. Dedicated deep drilling water-well rigs with high torque rotary heads are required, careful project management is needed and a substantial amount of consumables including casing and drilling mud must be accounted for and prepared. Water wells drilled to such depths are increasingly common in locations across Africa and the Middle-East; locations where the search for water often leads to aquifers at depths well beyond 600m. In 2012, the Borno state government in Nigeria received the final six of a total of ten new top-drive rotary rigs for their water well drilling projects in the region. The Borno Rural Water Supply (BRWS) scheme is a long-term initiative that will ultimately provide 480 water wells in areas of high need across the state.



6 meter rods are loaded for deep well drilling in Borno State, Nigeria

Abubakar Maigana, a specialist in water well drilling in Nigeria and consultant to the government, explains their choice of **Dando Drilling International** Watertec 40 rigs for the project, "We had worked with a previous commission of four Dando water well rigs in Edo and Yobe state and they had been very successful. Most of the boreholes in Yobe and Edo were to shallower depths, around 200m, but in extremely hard formations. The rigs worked very well. Some of the deeper wells in Edo state reached 450m. Our knowledge of existing aquifers in Borno state meant we knew that we would have to drill much deeper than this in Borno state. From our positive experiences with these top-drive rotary rigs for deep well drilling the government was confident that they would be capable."

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Around Maidugari, the Borno state capital, where the BRWS has initially been focused, there are three main aquifers. The first aquifer located at between 75-150m is contaminated whilst the second aquifer, located between 250-350m, has a very high iron and fluoride content

making it unsuitable for use as potable water. The third aquifer, which contains uncontaminated clean drinking water, is situated between 450-600m on average, and this is the focus of the project. However, some of the wells drilled so far have exceeded this including one to 800m which is believed to be the deepest water well in West Africa. Borno state

chose rigs with 40,000kgf of pullback for the project ensuring the capability to drill to depth with enough power to spare when expected difficult drilling conditions were encountered.

In order to reduce the number of ancillary vehicles and help reduce operating costs and space at the drill site, they decided on a heavy duty truck mounted rig with enough deck space to house an onboard 540hp engine, a 7 1/2" x 8" (19cm x 20cm) duplex mud pump and a 900CFM/350psi compressor. The compressor allows use of air drilling methods and equipment such as DTH hammers where needed, and for well development once the bore is completed. Unlike the very hard rock in Edo state, the Chad Basin which extends into Borno state has a much softer geology in a sequence of argillaceous and arenaceous sedimentary rocks. These consist of shale and clay

interbedded with sand and influence the driller's choice of tooling. Maigana explains the method favored by the Borno state drill teams. "They use mud-rotary and usually start at 375mm using drag or tricone bits and case with 356mm casing. Then they'll downsize to 324mm and 244mm for completion. A 168mm screen is installed to finish the well." Using this method the drill teams average around 120m per 8 hour shift. One interesting feature of the Borno state water bores is the placement of the well pump. *Adrian Scott*, chief contact for the project at Dando,

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describes the system: "The pumps are mostly secured at depths of around only 200m from the surface because the static level of water in the bore is very high. By the time the pressures have equalized the water level may rise from the deep aquifer to around the 100m mark." When asked to evaluate the impact the BRWS is having in Nigeria, Maigana says, "All ten rigs in Borno State are in

constant service providing new wells to the people on a daily basis. It's difficult to estimate the number of people who now have access to clean water through this project because some of the wells are in highly populated areas. I would estimate the scheme has benefitted hundreds of thousands of people since 2012." ■

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