

Borehole Drilling

From Earthwise

[Jump to navigation](#) [Jump to search](#)

[Africa Groundwater Atlas](#) >> [Resource pages](#) >> [Developing groundwater resources](#) / [Groundwater Development Procedures](#) >> Borehole Drilling

Please cite page as: Africa Groundwater Atlas. 2019. Borehole Drilling. British Geological Survey. Accessed [date you accessed the information]. *Weblink*.

This page is still in development - please check back soon for updates.

□

Contents

- [1 Drilling Boreholes](#)
 - [1.1 Drilling with a rig](#)
 - [1.2 Manual drilling](#)
- [2 Drilling Supervision](#)
- [3 Collecting Data during Drilling](#)
- [4 Professional Water Borehole Drilling](#)
 - [4.1 RWSN - Professionalising Borehole Drilling](#)
 - [4.2 Drilling Associations](#)

Drilling Boreholes

*Note: in this Atlas, the word **borehole** is generally used to mean a drilled hole (by manual or mechanical rig), and the word **well** is generally used to mean a dug hole. Elsewhere, the word well is often used interchangeably with borehole to also mean a drilled hole.*

There are two main approaches to drilling boreholes : drilling with a mechanised rig; and manual drilling. The most appropriate technique will depend on the hydrogeology, the required yield, and available funds.

An introduction to borehole drilling techniques that are appropriate for rural water supply can be found in the chapter **Designing and constructing water points** in [MacDonald et al. \(2005\)](#), which can be freely downloaded online.

Drilling with a rig

Most boreholes worldwide are drilled using a motorised drilling rig. There are different types of drilling rig and methods of drilling, and the most appropriate should be chosen to suit the local hydrogeological environment.

There are two main motorised drilling techniques: cable tool percussion (also known as shell and auger); and rotary drilling. Rotary is the most common method used for water borehole drilling. Rotary drilling can be air flush, sometimes with down-the-hole hammer; mud flush; or reverse

circulation.



Drilling a water borehole with a rotary rig in Northern Region, Ghana. Photo credit: British Geological Survey.

[Manual drilling](#)

Manual drilling refers to several drilling methods that rely on human energy to construct a borehole. It is appropriate in some hydrogeological environments, where aquifers are shallow and unconsolidated (and therefore easier to drill through) and depth to groundwater (depth to the water table) is shallow. When done effectively, manual drilling can reduce drilling costs and increase cost-effectiveness of groundwater development programmes, compared to the costs of drilling using motorised rigs.

A separate Atlas resource page on [manual drilling](#) provides more information and resources.



A manual drilling operation in Chad, using the sludging method. Image credit: [PRACTICA Foundation 2009](#)

Drilling Supervision

Experienced supervision of drilling is essential for the provision of successful and long-lasting water boreholes.

The RWSN has produced a series of resources to support effective drilling supervision, including:

- a guidance note on [Supervising Water Well Drilling](#), which details the responsibilities of the drilling supervisor at different stages of borehole construction.
- materials from a [short training course](#) on drilling supervision, which was delivered to engineers and WASH professionals in Sierra Leone.

Collecting Data during Drilling

Whichever drilling technique is used, collecting data during drilling is a very important part of successful groundwater development. Drilling is usually the only opportunity to look below the ground and find out what the geology and hydrogeology is at depth, where it is usually hidden. One of the main aims is to identify groundwater-production zones at depth in the geological sequence – at what depths is groundwater found? Data on the local geology is also invaluable for developing understanding. It is good practice for the drilling supervisor (see above) to collect data during drilling.

A good introduction to what data to collect during drilling, and how best to collect it, is in the chapter **Designing and Constructing Water Points** in [MacDonald et al. \(2005\)](#), which can be freely downloaded online.

The activities in the table below are a summary of good practice in data collection during water borehole drilling.



Drilling supervisor recording drilling penetration rates with stopwatch and notebook. Photo credit: British Geological Survey.



Drilling supervisor examining rock cuttings with a hand lens. Photo credit: British Geological Survey.



Rock cuttings from drilling laid out in sequence to be geologically logged by drilling supervisor. Photo credit: British Geological Survey.

Data collection during water borehole drilling: good practice

Activity

A field logbook or notebook should be kept, with notes of all drilling activities and what data are collected

Why do this?

Recording all information while in the field means that nothing is forgotten. A detailed field notebook is an invaluable record in case any details need to be checked later.

The borehole should be flushed clear of cuttings at the end of every sampling interval (e.g. every 1 m or every 3 m; or every drill rod) and an accurate sample of drill (rock) cuttings/chippings collected for observation.

Rock chip samples from the borehole should be washed and described consistently: e.g. rock type, colour, texture. In this way, a geological log is built up showing changes in geology with depth.

Information should be recorded in the field logbook on: the penetration rate of drilling (how long it takes to drill a given interval, e.g. every 1 m or every drill rod); breaks or irregularities in drilling observed or reported by the driller; water strikes and/or flows; and dust production.

If possible, water conductivity (SEC) should be measured at regular intervals/depths during drilling, to observe any changes.

An initial estimate of potential borehole yield should be made during airlifting (cleaning the borehole) at the end of drilling.

Rock samples collected at depth during drilling provide a record of the geology and how it changes with depth. The geology is the main control on the groundwater potential.

This allows people to assess where the best groundwater potential is with depth in the borehole, and therefore make the best decisions on the final borehole construction; and also to estimate how successful the borehole is likely to be. It also provides hugely valuable hydrogeological information to allow a wider assessment of groundwater resources beyond just one borehole.

This information supports the description of geology in the geological log and helps improve understanding of the geology and the groundwater potential of the rocks.

Water conductivity indicates how mineralised a water is. If water conductivity changes suddenly, it can indicate that the borehole has entered a different aquifer with depth.

This can help assess if the borehole is likely to be productive enough to be worthwhile installing screen and casing, and what size of pump to use for a pumping test.

Professional Water Borehole Drilling

For successful and sustainable groundwater development, it is very important that borehole drilling is done in a professional way. Collecting data during drilling, as summarised above, is part of this, but it is a much bigger issue.

RWSN - Professionalising Borehole Drilling

The Rural Water Supply Network ([RWSN](http://www.rural-water-supply.net)) does much work to promote **professional water borehole drilling**. On its website you can view and freely download RWSN's resources, which have been used to improve projects and have been incorporated into the curricula of some academic and training organisations.

Some of the specific resources produced by RWSN to support professional water borehole drilling are:

- A guidance note on **Professional Water Well Drilling**, available in [English](#) and in French / [\http://www.rural-water-supply.net/en/resources/details/796 **en français** (Danert and Gesti-Canuto 2016). This is written for people who manage or support water borehole drilling programmes and projects, and provides guidance on project design, implementation and monitoring; groundwater information; capacity; institutional frameworks; investment; and

dialogue and awareness.

- A series of short [animated films](#), in English and in French / en français. These films explain borehole siting, drilling supervision, drilling contract management and why some boreholes are better than others.
- [National assessments](#) of the water borehole drilling sector (its cost-effectiveness and professionalism) for a number of countries, including at least 14 African countries.
- A [professional drilling management online training course](#), providing an introduction to the professional management of water borehole drilling projects and programmes.

Drilling Associations

There are a number of national or regional drilling associations in Africa, which work to improve professionalisation in the drilling sector, and improve the success and sustainability of water borehole drilling. Some of the most active of these associations are listed below:

- The [Borehole Water Association](#). The BWA is a membership organisation whose aim is to promote the sustainable use of Southern Africa's groundwater. It produces a journal - the Borehole Water Journal - with articles on groundwater issues, and useful advice for those looking to drill water boreholes.
- The [Association of Water Well Drilling Rig Owners & Practitioners \(Borehole Drillers Association\) of Nigeria](#) is a membership organisation that aims to advance the professionalism of the drilling industry and support its members. Its website provides news relating to groundwater and directions to water borehole drilling services.
- The Mozambique Drillers Association (Associação de Perfuração de Moçambique - APM) was established in 2006, with support from the World Bank. For a few years it actively worked to improve standards in the drilling sector in Mozambique, but it struggled to overcome the many challenges facing it, and it no longer has an active online presence. More information on its development and achievements, and some of the challenges, can be found in this [Case Study](#).

Return to: [Africa Groundwater Atlas](#) >> [Resource pages](#) >> [Developing groundwater resources / Groundwater Development Procedures](#)

Retrieved from 'http://earthwise.bgs.ac.uk/index.php?title=Borehole_Drilling&oldid=46097'
[Categories](#):

- [Additional resources](#)
- [Africa Groundwater Atlas](#)

Navigation menu

Personal tools

- Not logged in
- [Talk](#)
- [Contributions](#)
- [Log in](#)
- [Request account](#)

Namespaces

- [Page](#)
- [Discussion](#)

Variants

Views

- [Read](#)
- [Edit](#)
- [View history](#)
- [PDF Export](#)

More

Search

Navigation

- [Main page](#)
- [Recent changes](#)
- [Random page](#)
- [Help about MediaWiki](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Cite this page](#)
- [Browse properties](#)

- This page was last modified on 16 June 2020, at 08:47.

- [Privacy policy](#)
- [About Earthwise](#)
- [Disclaimers](#)

