

SITING YOUR BOREHOLE

by John Weaver, SANBWA Chairman and Consulting Hydrogeologist.

Locating a suitable position for drilling a borehole for mineral water— do you use a hydrogeologist or a water-diviner?”

Charlotte Metcalf asked me to write this article after a previous potential author did not deliver. With great reluctance I agreed, it was only the looming deadline for Ripples and Waves that persuaded me. So the first thing I tried was to contact some of my colleagues in the Groundwater Industry in the hope that they had at some time in the past written just this article. All around the answer was a resounding “NO”. Perhaps Graham Hubert of Golder Consulting’s response was the most illuminating “Oooh no – this is trying to compare the scientific method with miracles and witchcraft”.

So what I am going to do in this article is give a rather dry overview of the scientific method (pun intended), and then some experiences of colleagues and myself with water-diviners.

Water under the ground, or rather groundwater, occurs in cavities in the rock formations. These cavities can be the interstices between sand grains, cracks (we call these faults) where the solid rock has broken because of stresses on the Earth’s crust, or in the case of limestone and dolomite rocks, actual cavities caused by solution of the rock by percolating water. The job of the hydrogeologist is to locate a suitable cavity that has the probability of yielding water. Thus, we do not “find” or “locate” water, we interpret all the geological features and then decide on a drilling position that will have the best chance of intersecting a cavity and that will yield water.

We use a number of tools, first and foremost are geological maps, aerial photography and satellite images. Unless I have these available, I will decline to go out to site a borehole. Quite often I get a call from a farmer who has drilled one or two unsuccessful holes, still has the drill-rig on-site, and wants me to come out to site the next day to locate a new drill-site. The temptation is high to pop out to site and charge a stiff consulting fee, but so far I have always been able to persuade the fellow to let the drill-rig move on, and for me to locate a new drill-site after having obtained the air-photos from the Surveyor-General. The air-photos take about 10 days to process, the geology maps are available off the shelf and satellite images are obtained either from Google-Earth or from the Satellite Application Centre at Hartebeeshoek. The next important tool is existing groundwater information. This we obtain from local knowledge of successful and unsuccessful drilling, from existing groundwater reports from that area or nearby areas, and from the Department of Water Affairs National Groundwater Data-base (NGDB).

For some geological terrains it is only these tools that are needed to be able to properly interpret the geology. In other terrains we will use one or more hydrogeophysical instruments. These use a variety of measureable geophysical pulses such as electrical currents, earths

magnetic and gravity variations, sonic pulses and electromagnetic pulses to measure responses of the rocks. The results are used to give more information regarding what lies below, thus further filling in the picture of the underground strata.

Then comes the drilling: depending on the diligence with which this work has been done, the experience of the hydrogeologist and most importantly the area one is working in, the success rate will vary from as low as 60% to 100%. An example of this type of success variation is the granites of Johannesburg’s Northern suburbs where the drilling success rate is 90% plus, versus the granites of Sir Lowry’s Pass outside Somerset West where the drilling success rate is about 15%, typically 1 out of 6 to 8 boreholes on a property in this area will yield a trickle of water. With some intensive geophysical surveys I have been able to lift this success rate to 1 out of 2, which is a rather poor rate for South Africa, but excellent there.

This leads to the first divining story. One of my geology pals from University days is a very good minerals exploration geologist, and he made a lot of pocket-money soon after leaving university by divining drilling sites in Johannesburg’s Northern suburbs. Here the best drilling-sites are usually in the entrance driveway - where the drill-rig has easy access! He was very successful and developed a very good name. However we are able to tease him endlessly about two of the boreholes that he located, the first for one of our class-mates that was a duster, and the second was in his very own garden that proved to be only damp, and to make it worse the water is too brack for garden use.

The second divining story occurred in the mid-80’s, during one of the largest rural village water-supply projects I have been involved in and early in my hydrogeology career. The consulting firm I was working for was given a 120 borehole project in Bophuthatswana, mainly in the Pilanesberg area. Myself and an even more junior geologist had carried out all the field mapping, and the necessary geophysics. We had discussed all the results with the senior partners, decided on the priority sites, and were then left on our own to supervise the drilling