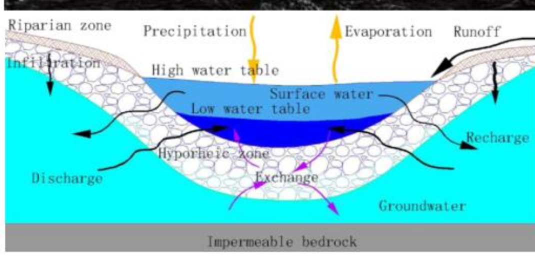

VELTWATER DISTIL-LERY

KEEP CALM, THERE IS A SOLUTION

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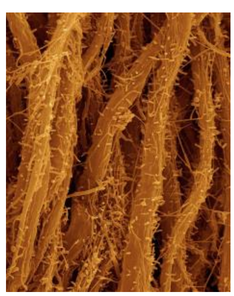
Topic #1 – Domino Effect of Seismic Activity



Topic #2: A Look Under the Microscope

Topic #3: Gaining or Losing

#1: DOMINO EFFECT OF SEISMIC ACTIVITY

What does Seismicity have to do with anything?

Can deep seismic activity influence my functioning well-field? In short, possibly.

The volcanic eruptions at the Fagradalsfjall volcano in Iceland has the geological community buzzing. Stunning images of this occurrence have been widely shared and appreciated for it truly encapsulates the beauty and destructive power of nature. First eruptions were recorded on 19 March 2021 and began to ooze lava on 9 April, attracting many spectators walking near this marvel as it is still deemed safe enough due to the low flow rates.

Back in South Africa, a 6.2 magnitude earthquake on 26 Sept 2020, 1900 km away, rocked some Capetonians and a 3.5 magnitude earthquake was recorded 47 km off the West Coast at a depth of 5 km on 17 Nov 2020. On the Volcano Discovery website, the map indicates that this earthquake took place west of Yzerfontein. The Seismology unit from the Council for Geoscience noted that, as a rule of thumb, similar sized earthquakes can be expected in the same regions in the future.

Yes, yes, but does this affect my groundwater?

Groundwater occurs in fault zones, fractures, joints and contact zones within hard rock formations.

The type of fault/(s) may change over time due to a change of the crustal driving forces (WRC (2015)). Simply put, dependent on the phase and intensity of crustal movement, the strata and rocks may be completely reconstructed.

The USGS reports 2 main types of effects on groundwater levels, namely oscillations and offsets. Offsets is when a fault creates permanent expansion and contraction of the surrounding rocks and confined aquifers are more likely to show a response to permanent deformation caused by a fault offset. However, the same study speculated that changes caused by permanent deformation will only last until the pressure equilibrates, and depending on the aquifer characteristics and changes undergone, tend to recover either within a few minutes or a few months.

Some widely documented hydrogeological responses to earthquakes includes changes in groundwater level and aquifer parameters (permeability or storativity), stream flow, water temperature (sudden mixing of different water) and chemical composition (also mixing related). The mechanisms for most, as well as recovery, is still unknown, and this writer would argue that there is a remarkably interesting study waiting to be done. ***Any takers?***

Join in the conversation:

- Should we consider seismic risk when choosing target areas in seismically active regions?
- If so, who has measured data?

#2: A LOOK UNDER THE MICROSCOPE

What the heck is Biofouling, you ask? Here is a short introduction…

Have you noticed your borehole not preforming the way it should and the pump constantly clogging up?

The television and radio waves these days are flooded with the latest and greatest on viruses and bacteria. Believe it or not, this inspired a look under the microscope at the “wee little beasties” (imagine a scottish accent) governing our daily lives, and subsequently reminded that biofouling (and chemical borehole rehabilitation) is a big issue in parts of the country, especially the Northern and Western Cape.

Biofouling or more commonly, biological fouling is defined as the accummulation of microorganisms, plants, algae, or small animals where it is not wanted. This can include surfaces, water inlets, pipework, grates, ponds, and rivers that cause degradation to the primary purpose of that device. This is a natural phenomenon affecting a wide range of situations and industries, from medical devices to ship hulls, pipelines and reservoirs.

In groundwater, biofouling creates a thick irregular layer of slimes and biofilms along the borehole casing, piping and/or equipment, bedrock fractures, gravel pack and ultimately, within the aquifer itself. The biofilms consist of metal oxides of iron, manganese, aluminium and other trace metals.

According to the Water Research Center, biofouling is one of 5 major causes for decreasing borehole yields and the development of poor borehole water quality.

Various areas in South Africa with different aquifers are heavily affected by borehole clogging that is caused by physical, chemical, or biological factors and many boreholes have been abandoned or re-drilled at great cost. Conventional preventative and control strategies are chemical-based, but biotechnological approaches involving the utilization of micro-organisms or their metabolites might provide effective alternatives to using chemicals (Ji-Dong Gu, 2012).

Our friendly superhero sub-contractors (yes, there is such a thing) and fellow hydrogeological professionals are involved in these types of rehabilitation projects and experimenting with different types of solutions to determine which approaches work best.

We will swing back to this topic in the next issues with a more in-depth look at the facts and findings over the years.

Join in the conversation:

- How many boreholes have been lost, only to discover it just needed a bit of cleaning and tender loving care?
- Would you like to share your experiences and solutions you found most useful?

#3: GAINING OR LOSING

Who ultimately decides which is on the winning or losing side?

Are you noticing a loss of groundwater from your borehole? Is the stream gaining some? The ever-increasing focus on groundwater and surface water interaction.

More often these days we hear concerns from water users regarding "how much water is the newly drilled borehole of a neighbour extracting from "their" river water". These are serious questions with serious repercussions for sustainable use and economic development. No one wants to lose what they have invested in. On the other hand, from a groundwater perspective, this is very one sided…

Who will lose and who will gain?

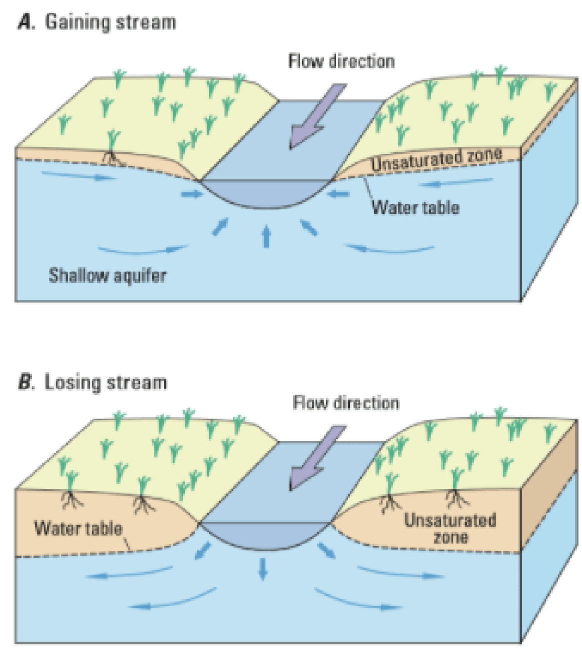
See what I did there? Here is a hint: It has to do with groundwater and surface water interactions. Lightbulb moment: assuming there is almost always either a gaining or losing stream.

Khan & Khan (2019) discussed it simply by saying that surface water (rivers, wetlands, dams, streams, estuaries etc.) interact with groundwater either through the loss of surface water to groundwater (losing stream), seepage of groundwater to a surface water body (gaining stream), or a combination of both.

Numerical modelling solutions are often proposed as an accurate method of quantifying this interaction with the addition of volumes removed from the modelling domain to present the quantities to decision makers. This is expensive and time-consuming and will most likely incur additional cost to accumulate sufficient meaningful data sets for input into these models.

Good news!!

A more cost-effective midway does exist.



A robust combination of analytical and numerical solutions, while keeping aquifer assumptions conservative, where a lack of regional data exist, is useful in quantifying this interaction and associated volumes better. This solution is a key step in providing cost effective solutions to a client with the support of a defendable numerical model based on actual field data.

Join in the conversation:

- Which solution would you prefer?
- Is a regionally calibrated numerical flow model still the golden egg?

Veltwater GROUNDWATER SPECIALISTS