

Belfast Geoenergy Observatory Opportunity

Northern Ireland (NI) has a high degree of geological variation due to its position on the edge of a continental shelf, and by inference, its hydrogeology is similarly variable resulting in multiple ground water aquifer resources that could be utilised for Geoenergy projects. The Sherwood Sandstone Group (SSG) is the most predominant of these natural ground water resources. Downing and Gray et al (1986) estimated the SSG Geothermal resource at temperatures >20°C as approximately 523Mtce (million tons of coal equivalent). GSNI have identified five SSG target basins that could be harmonised for Geoenergy projects (Figure 1). The SSG Geoenergy resource remains untapped despite having been identified as a valuable source of Geothermal Energy in multiple Geothermal studies dating back to the 1970's. For example, "The best geothermal potential in Northern Ireland is controlled by the presence of good aquifers such as Sherwood Sandstone" J. Kelly et al (2005).

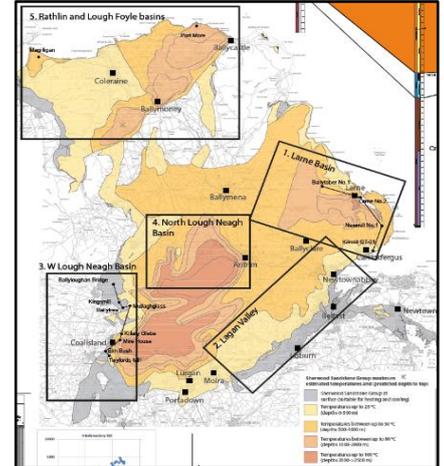


Figure 1 – GSNI identified SSG basins in NI

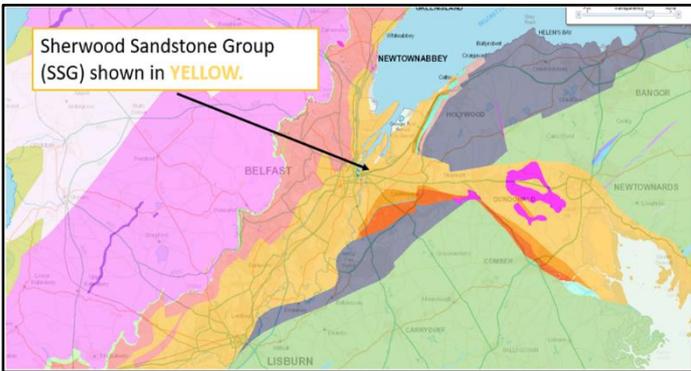


Figure 2 - SSG Lagan Valley Basin

The largest aquifer resource identified in NI is the SSG aquifer beneath Belfast and the Lagan Valley shown as basin #2 in Figure 1 and in yellow in. Figure 2 The depths to top of the SSG in this basin are relatively shallow and the aquifer is up to 300m thick, making it ideal for Geoenergy projects in the form of open-loop shallow geothermal installations. There are however, only two open-loop style Geothermal installations; The Lyric Theatre and the Queen's University, Belfast (QUB) School of Biological Sciences. There is a major opportunity to promote Geoenergy projects in this basin.

The installation at the QUB School of Biological Sciences is a doublet well open loop borehole style system, with the two wells drilled to 100m depth (Figure 3). The water at this depth ranges from 12-15°C seasonally. The doublet system is used to cool 14 no. lab rooms. Well A is used for groundwater abstraction and Well B is used for ground water thermal plume reinjection. The installation at the Lyric Theatre is a monobore open loop style system, with one well drilled to 100m. This single well is for abstraction and the Lagan River is used for thermal plume discharge.

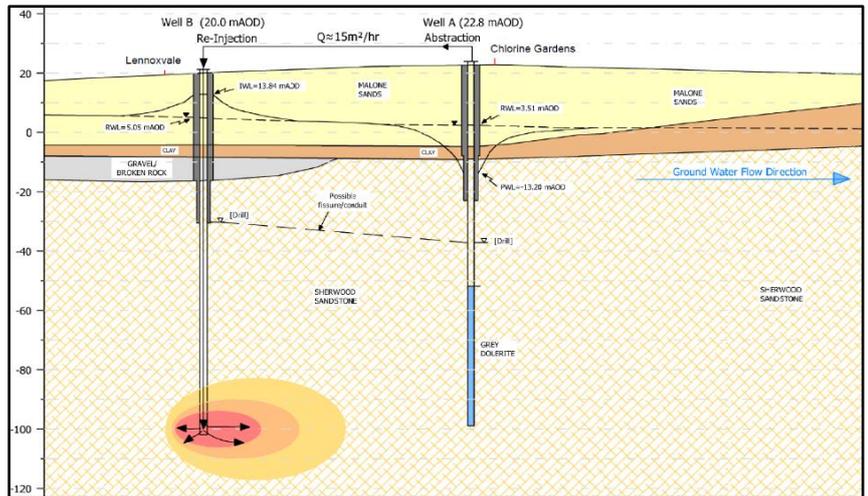


Figure 3 - QUB School of Biological Sciences Geothermal system

QUB have three test boreholes drilled into the SSG (BH#1-3) for Geoenergy research purposes. The wells are located on the QUB campus in the heart of Belfast city (Figure 6). The boreholes are located in a staff carpark between the David Keir and Ashby buildings of the School of the Natural and Built Environment (Figure 4). BH#1 and BH#2 were first to be drilled opposite each other at 28m apart, with BH#3 drilled at a later date 5m adjacent to BH#1 (Figure 4). The superficial geology consists of the Malone Sands, a superficial aquifer, to 20m and a boulder clay to 32m, where the top of the SSG is encountered. The SSG is the predominant bedrock geology in the this area (Figure 5).

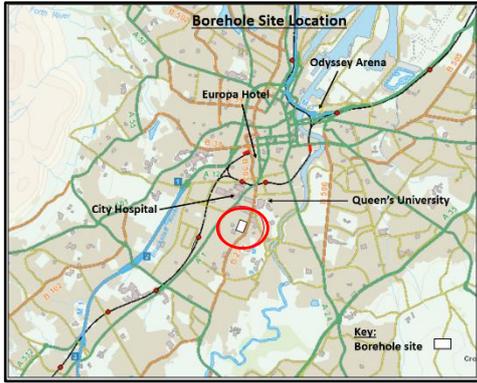


Figure 6 – Borehole test site location

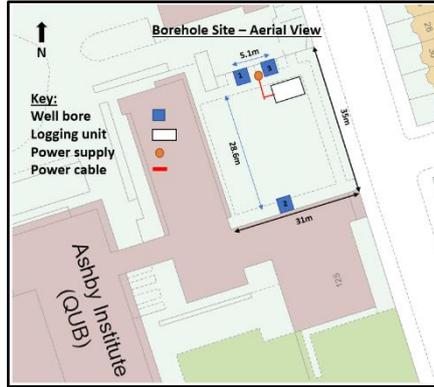


Figure 4 – Borehole test site location

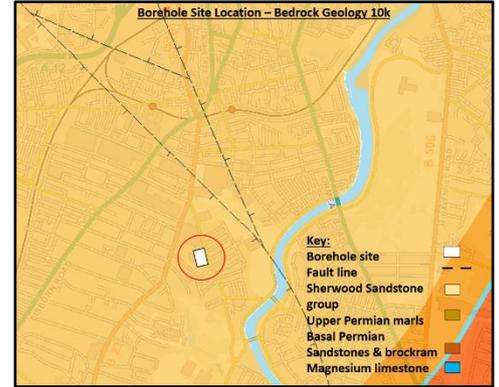


Figure 5 – Borehole test bedrock geology

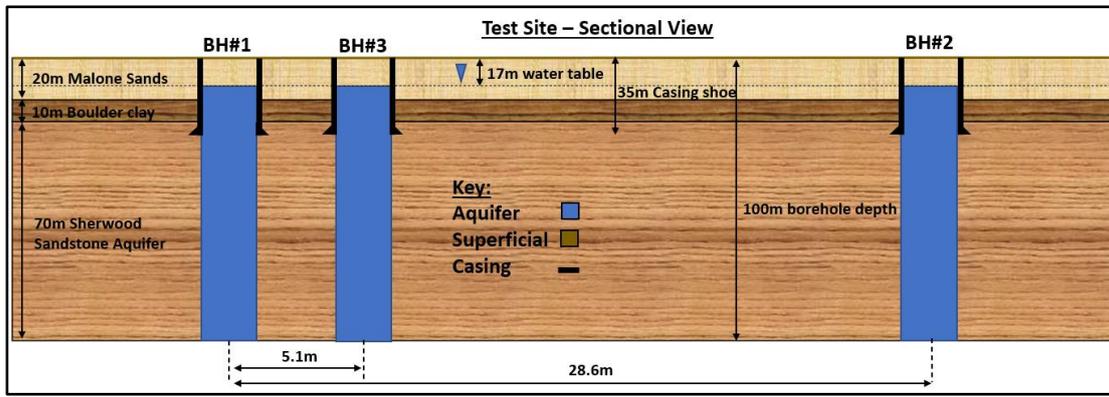


Figure 7 – Boreholes cross section

The three boreholes are identical from a well design perspective (Figure 7); 6” hole drilled to 100m TD, steel casing across the superficial geology to top of SSG ~35m, then open hole to TD. The water table is at ~17m.

The current PhD research project being undertaken at the borehole test site is titled, “The Impact of thermal plumes on the Sherwood Sandstone Aquifer properties”. The project plans to inject warm groundwater at varying set temperatures into the SSG aquifer, then monitor it for a storage period of time using distributed temperature sensing fiber optics equipment and other borehole sensors and then abstract the groundwater to obtain a thermal performance for the SSG and observe any impacts to the SSG properties, e.g. permeability and porosity.

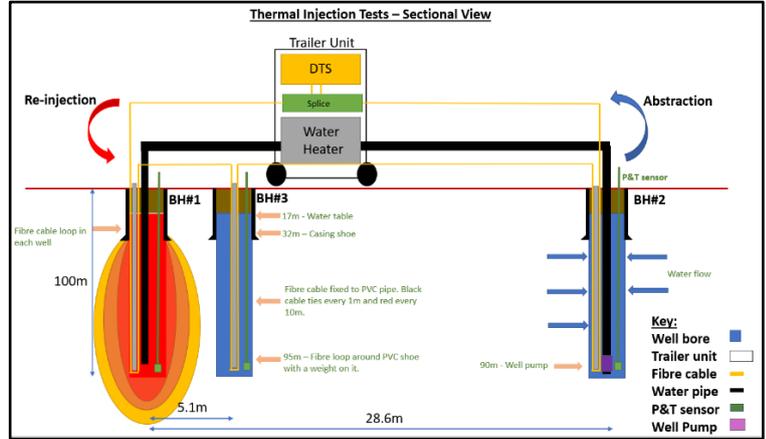


Figure 9 – Thermal injection tests set-up

Building Back Better – A Future for Geothermal Energy in Northern Ireland

This online conference is the first in a series considering the future for Geothermal Energy in Northern Ireland. As we look toward our recovery from a global pandemic, we can take a fresh and renewed approach to build a fairer, greener and more resilient economy. Geothermal Energy can play a fundamental role in this as we build back better.

Date: Friday 11th December 2020.
Time: 9:00am to 1:30pm.
Hosts: Centre for Sustainability, Equality and Climate Action (SECA) at Queen's University, Belfast and the Geological Survey of Northern Ireland (GSNI).
Location: Zoom Video Conference.
Register here: <https://www.eventbrite.co.uk/e/building-back-better-a-future-for-geothermal-energy-in-northern-ireland-tickets-127452984307>

Figure 8 – Geothermal Energy NI conference flier

There is significant interest in Geothermal Energy research in Northern Ireland. For example, 320 people registered for a recent conference and the resulting webinar series is proving equally successful. Integrating the QUB Geoenery Observatory into the network of existing ones will allow Northern Ireland to contribute significant scientific data to the current energy transition we face across the Globe. The information can be directly used by the Executive in NI when planning for future Energy Strategies utilising renewable energy.