ABSTRACT OF THE QUEENSTOWN BROCHURE

The primary aim of the Queenstown General Hydrogeological Map was to produce a synoptic overview of the hydrogeological character of the area by processing groundwater-related data according to a standard legend. The main features shown on the map are borehole yield, aquifer type, groundwater quality, lithology and groundwater use.
The brochure was compiled to provide supplementary information on these features.

For the purposes of the 1:500,000 map series aquifers are divided into four types namely: intergranular, fractured, fractured and intergranular as well as karst.
In this way the voids in the rock through which water is transmitted are classified. These types refer to the nature of aquifer that may be found, rather than the boundaries of individual aquifers. The aquifer type mapped was not necessarily the shallowest, but the **principal** aquifer. I.e. **the shallowest aquifer with the highest borehole yields and the best quality water.**

The standard procedure adopted for this map series was to classify the aquifers as "**fractured and intergranular**" when the water level was in the weathered zone, and as "**fractured**" only when the water level was below the weathered zone. This approach was not possible for this map sheet because of insufficient information on depths of weathering and water level. Instead the National Saturated interstices Map (Vegter, 1995), and a map of weathering of basic igneous rocks (Weinert, 1974) were used to separate the aquifers into the "fractured" and "fractured and intergranular" categories.
The "**intergranular**" aquifer class is **not** depicted, since there **are no areas** within the Queenstown map sheet, where unconsolidated deposits yield significant amounts of water. The "**karst**" aquifer class is **also not depicted.**

On the General Hydrogeological Map a background ornament depicts lithologies which were derived from the 1:250 000 geological maps published by the Council for Geoscience for the area. The lithology is shown in a highly simplified form highlighting the variations likely to have a significant effect on groundwater occurrence.

Hydrogeology

For the bulk of this area, groundwater occurs in dual porosity aquifers, comprising large but infrequent principal transmissive fractures with relatively low storage capacity, and secondary but numerous microfissures with higher storativity but lower transmissivity. The microfissures are mainly concentrated in a near-surface upper zone usually less than 30 m thick, possessing a higher storage capacity than the rocks encountered at deeper levels. The upper and lower zones are hydraulically linked.

The following general trends were revealed on analysis of the groundwater related data from the map sheet:

- Yields associated with dolerite intrusions are higher than those associated with sedimentary rocks only,
- Yield characteristics of dykes and sheets are broadly similar,
- Yields associated with dolerite intrusions are highly variable at both the local and regional scale,
- Regions that have higher yields than average in the sedimentary rocks will also have correspondingly higher than average yields in the dolerite associated aquifers.

In order to illustrate and explain the variations in groundwater occurrence associated with dolerite some "type areas" were selected somewhat loosely, taking into account the distribution of available information as well as intrusive style and relative abundance of dykes, sheets and sills namely:

- Queenstown – predominantly dykes, "ringsheets" and sheets
- King William's Town – mainly sills
- Jamestown – mainly dykes
- Qumbu – "dykes and sills" and "dykes and sheets"

Dykes are generally longer and more abundant in the higher yielding Queenstown and Jamestown type areas than in the other two areas. This correlation could indicate that the abundance and length of dyke intrusions reflect the degree of associated structural disturbance / fracturing resulting in higher borehole yields. Assuming the study area is subject to regional compression from the south-east, dykes with a north-west trend will be in tension and associated fractures more open as a result. This could also partly explain the better results obtained in Queenstown and Jamestown type areas where this trend is more prominent.
However, with the current level of information it is only possible to speculate as to the reasons for the borehole yield variations associated with dolerite. Detailed research-orientated drilling investigations in the individual type areas are required to better explain such variations. Drilling traverses through typical dolerite intrusions toe determine their structure, detail on the distribution of associated fractures, including their orientation and yield, will have to be done. Until then, it would be wise not

to be too dogmatic, or to make sweeping generalizations, about the relation between groundwater occurrence and dolerite intrusions.

Springs are important groundwater sources in the high rainfall areas (mainly in the east of the area as well as in the mountainous areas) Snowfalls in the Drakensberg enhance recharge to the springs – the slow melting process allowing more time for percolation of the melt to groundwater as opposed to rapid runoff from rainfall

Over-exploitation is possible in any area where potential demand exceeds supply, it is a particularly high- risk scenario where the Abstraction Potential exceeds the Harvest Potential. The south-western part of the map (Bedford area) is such an example and is thus in more urgent need of groundwater management advice or intervention.

The fractured aquifers in the Queenstown map area are highly heterogeneous, making it very difficult to make accurate estimates of sustainable yield. The best way to determine what these aquifers can yield is to monitor groundwater abstractions and water-level behaviour so that the sustainable yields can be refined.

Armed with this information it is possible to manage the resource, adjusting pumping rates to sustainable levels and in addition, to see to it that all boreholes drilled in this area must be properly documented and records be entered onto the National Groundwater Data Base.