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A Baseline Study of Groundwater Resources and Connectivities in Anticipation of Hydraulic Fracturing in the Karoo

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The anticipated exploration and exploitation of shale gas in the Karoo through hydraulic fracturing has raised considerable debate regarding the benefits and risks associated with this process for both the Karoo, and the country as a whole. Major concerns include the potential impact of hydraulic fracturing on ecological, environmental and especially water resources which are seriously stretched at surface, and it has been predicted with anticipated climate change it will become increasingly arid. Thus, the Karoo region generally is a water-stressed area that will become to rely ever more on groundwater resources that are apparently also limited. As such, effective and reliable management, based on greater scientific knowledge of groundwater, is crucial for sustainable agriculture and further development in this region.

An early aim of this research is to hydrochemically characterise both the shallow groundwater (<500m) and deeper saline groundwater in the vicinity of the shale gas bearing formations, based on major and trace elements, as well as gas isotope analyses. Sampling will include water sampling and gas measurements from shallow boreholes (<300m), deep boreholes (>500m) including oil exploration holes drilled in the 60's and 70's up to 4km deep (by the national petroleum agency of South Africa, formerly SOEKOR) and thermal springs (source of water >500m).

To-date, a desktop study includes the collation of information determining the areas with the highest potential for shale gas exploration throughout the Eastern Cape Karoo, from which the research area has been determined. This includes the identification of the respective oil companies' exploration precincts. A Hydrocensus has been completed across this area, which includes slug testing and electrical conductivity profiling of open, unequipped boreholes. Borehole selection have been finalised from the acquired information. Sampling of boreholes, previously covered during the Hydrocensus, has commenced. All selected boreholes will be sampled and analysed a minimum of three times per year, which will occur after summer (April/May) and winter (October/November) with an additional sampling phase in the middle, after which the hydrochemistry will be analysed.

The possible hydraulic connectivity between the shallow and deep aquifers will be tested, particularly in those areas where dolerite intrusions as well as fault systems may enhance preferential flow of water, using the chemical forensics complemented with passive seismic profiling/imaging and deep penetrating Magneto-Telluric (MT) imaging. A final goal of the project then is to provide a three dimensional hydrogeological model of the eastern Karoo region.

The data collected will form a record against which the impact of hydraulic fracturing can be accurately determined. The research is a critical first step towards the successful governance of groundwater in light of the proposed shale gas development. In its absence, effective regulation of the sector will not be possible.

