Groundwater Assessment of the Glendalough Alluvial Aquifers

The shallow alluvial aquifers at Glendalough Station host a groundwater resource that offers genuine opportunities for future irrigated agriculture development around Hughenden, Qld. However, very little is currently known about these aquifers and there is limited data available to understand the scale of potential development. Innovative Groundwater Solutions Pty Ltd. was commissioned by the Australian Governments' North Queensland Water Infrastructure Authority to provide a defensible and independent evaluation of the sustainable extraction limit of water from this resource.

The assessment found the sustainable extraction limit (SEL) for the alluvial aquifer is likely in the range of 1,400 to 17,800 ML/year, with a high confidence (80% probability) limit of 2,300 ML/year, a moderate confidence (50% probability) limit of 3,100 ML/year, and a low confidence (20% probability) limit of 13,300 ML/year. This large range depends on the relative abundance of deep, high-permeability sands and gravels, which to date have only been found in certain parts of the property. Drilling results for many other areas of the property indicate the alluvium is characterised by low-yielding clays and silts that do not provide bore yields sufficient for irrigation supply.

The determination of extraction limits utilised a groundwater modelling approach that began with 7,000 different depictions of the alluvial sediments and their hydraulic properties. Estimates of aquifer hydraulic conductivity (K) used in the models reflect the full range of plausible values from the literature, however the models that produced extraction volumes similar to the high and moderate confidence SEL had the most reliable values of K. These were broadly consistent with results of previous aquifer pumping tests at the site, as well as anecdotal evidence of both limited drawdown during pumping and rapid recovery in existing production bores.

All of the acceptable models were calibrated using estimates of long-term average annual vertical recharge, which was found to be very low based on multiple lines of evidence that include a vertosol soil type, limited water table response to surface inundation from flooding, and previous estimates using hydrochemistry and isotopes. Most models produced their best calibration to observed groundwater levels when average recharge was in the range -10 to -1 mm/year; the negative value probably reflecting a net discharge flux in the form of evaporation and direct groundwater uptake by deep-rooted vegetation from shallow water tables.

The assessment highlighted the importance of groundwater connectivity between the alluvial aquifer at Glendalough and the Sturgeon Basalt to the north, as well as connectivity with the upstream and downstream alluvium. Maintaining lateral groundwater inflow from these boundaries is critical for sustainable development of the resource, particularly for ensuring water level recovery during each non-pumping wet season.

The opportunity for managed aquifer recharge (MAR) to enhance the total extraction volume by injecting surface water from the Flinders River into the alluvial aquifer appears limited. This is primarily because drillers logs and downhole geophysical surveys indicate the main sand deposits are located below the current water table, so there is limited aquifer storage potential above the water table. This assessment has shown that MAR could increase the high confidence MSEL by between 400 – 500 ML/year, the moderate confidence MSEL by between 600 – 700 ML/year and the low confidence MSEL by between 600 – 800 ML/year.

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