DE GREY MINING LTD

MEMO

TO: Sarah Thomas, Manager Environment
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SUBJECT: Particle Tracking – Groundwater Flow from the Reinjection Borefield South

The potential for impacts from the proposed aquifer reinjection into the Reinjection Borefield South (RBS) was examined using the operational groundwater model (Geowater 2023). The model was run for 200 years post-closure, at which time groundwater drawdown stabilises. Therefore, the 200 years post-closure represent a steady state condition for groundwater drawdown.

MODPATH, a particle tracking post-processing software developed by the U.S. Geological Survey, was used to compute the three-dimensional flow path of particles placed surrounding the reinjection bores at a radius of 10 m. The block-centred file from MODFLOW was used to calculate the location of the particles in three dimensions.

MODPATH uses a semi-analytical particle tracking scheme and assumes that each directional velocity component varies linearly within a grid cell's coordinate direction. This assumption allows an analytical expression to be determined describing the flow path within a grid cell. Given the initial position of a particle anywhere in a cell, the coordinates of any other point along its path line within the cell, and the time of travel between them, can be computed directly.

The average linear velocity component across each face in a cell is calculated by dividing the flow rate volume across the face by the cross-sectional area of the face and the porosity of the material in the cell. In the absence of direct measurements of the porosity of the various hydro stratigraphic units and their variabilities within each unit, De Grey used specific yields as conservative estimates.

Figure 1 shows the simulated path lines of the particles from the reinjection bores, providing a clear visual representation of their movement over time. Results show that the flow line from the bores is restricted to the palaeochannel aquifer.

From Figure 1 it can be concluded that reinjected water moves back to the open pits in the early stages of operations, depending on the distance of the reinjection bore from the pit. Ultimately, reinjected groundwater will either be used in the processing plant during the operational phase of the Proposed Action or by the pits which act as continual groundwater sinks during the closure phase of the Proposed Action.

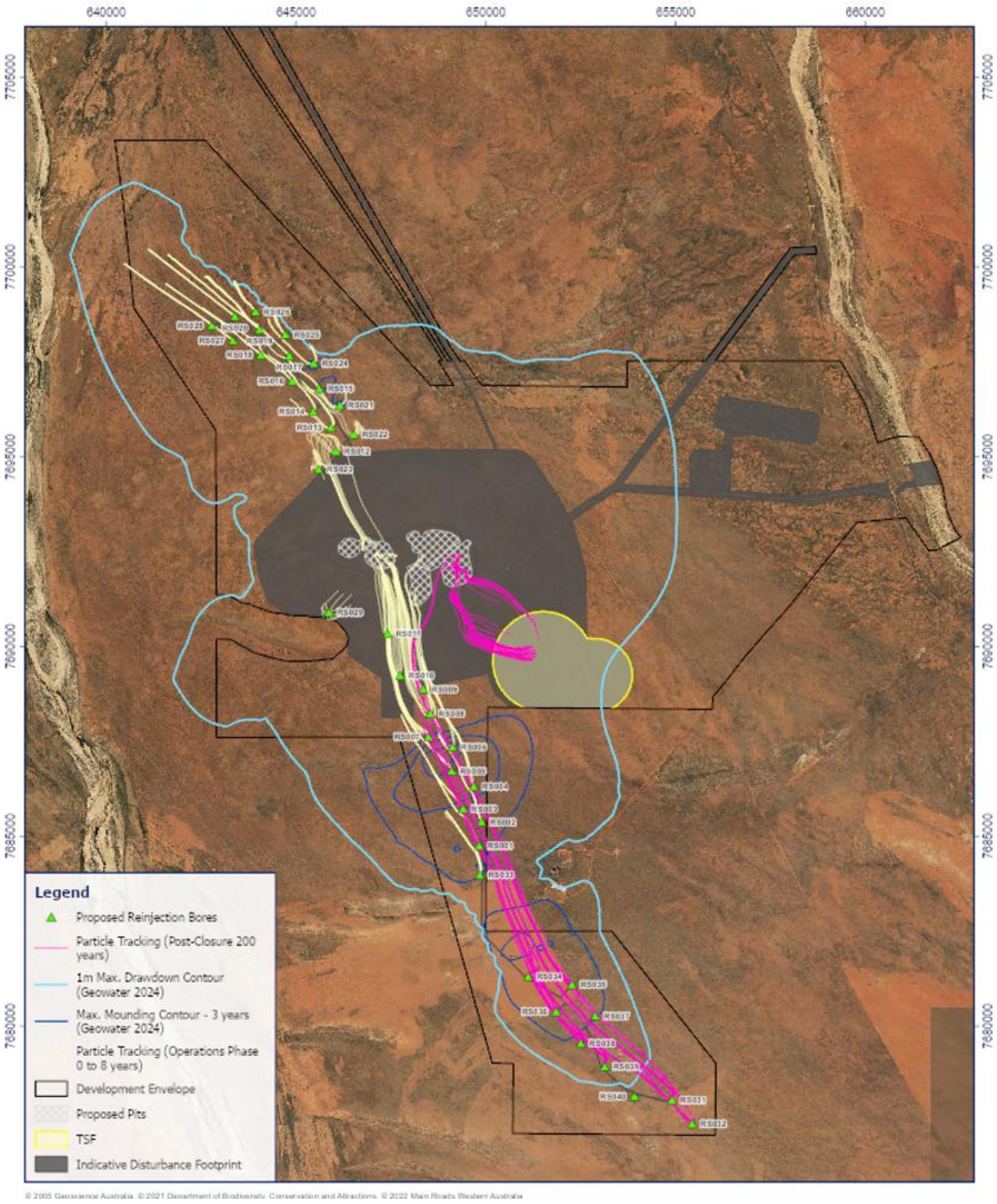

Figure 1: Particle Tracking Results