OPTIMISATION OF DEWATERING SCHEDULE FOR IRON ORE MINING, WESTERN AUSTRALIA

Client: Iron ore mining company, Australia

Task: Optimise operation of the existing dewatering borefield for the pit development schedule

Solution: AMWELLS model was developed and calibrated to water level measurements in observation boreholes. The model was then used for management and optimisation of dewatering operations

The iron ore deposit is located in the Hamersley Basin Iron province of the Pilbara Craton in the Northwest of Western Australia. The main bedrock aquifers are comprised by the weathered Wittenoom Formation and the detrital sediments of the Marra Mamba Iron Formation.

The pit operations requires mining in dry conditions, i.e. that water levels remain at least 5 m below the pit benches at any period of the pit schedule.

Although a numerical model was developed and calibrated, its updates for regular optimisation of pumping schedule required substantial time and computational efforts. Also, because the numerical model was developed at the regional scale, it was difficult to achieve an acceptable match between measured and simulated groundwater levels at the pit bench scale.

To overcome the above challenges, an analytical (AMWELLS) model was developed for operational purposes and calibrated to the observed hydrographs Fig.1

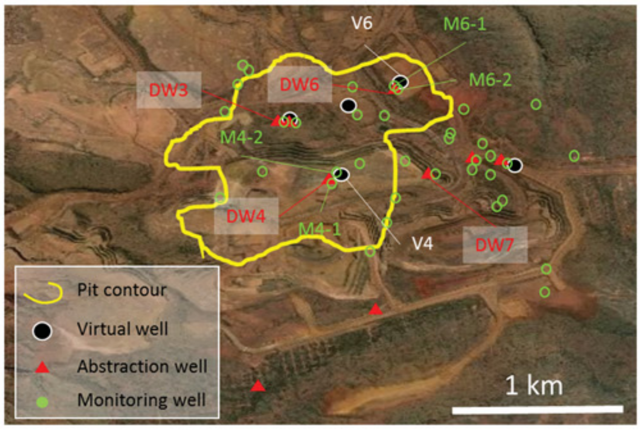

Fig. 2. Location of pumping wells, monitoring wells and virtual wells for one of the operating pits.

The AMWELLS model set up is presented on Fig.2 that shows one of the 25 modelled open pits. Existing monitoring and dewatering boreholes that are labelled on Fig.2, were input in an AMWELLS model and their hydrographs on Fig.1 were used for calibration.

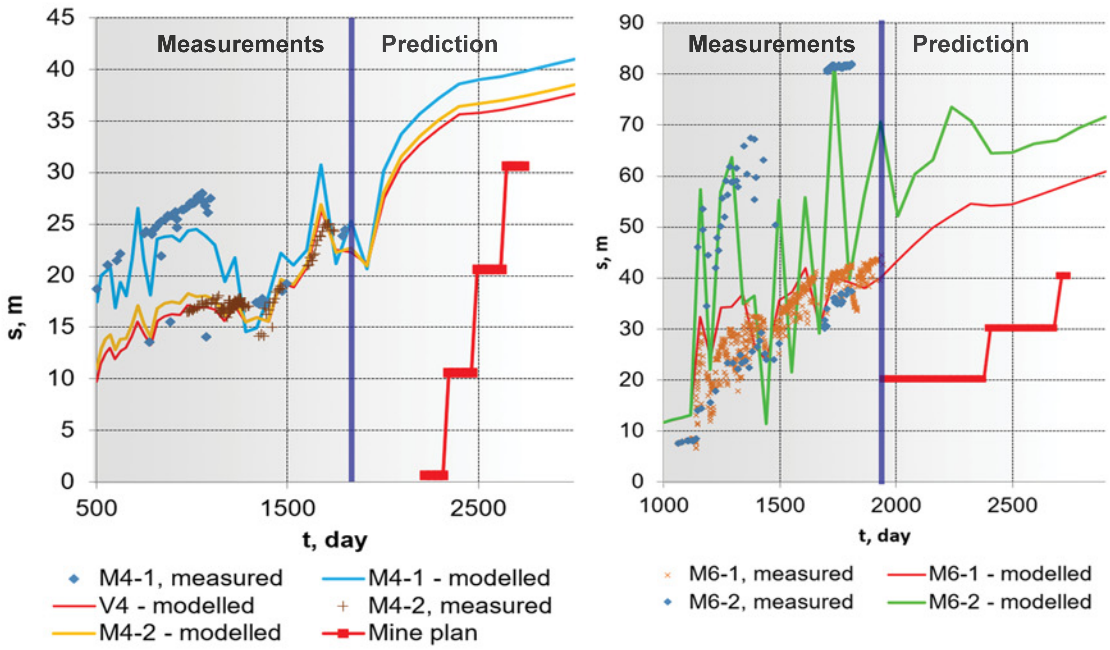

Fig. 1. Measured and modelled water levels for monitoring and virtual boreholes at M4 and M6 monitoring locations.

Recorded dewatering rates for each production borehole (**Fig.3**) were assigned to dewatering boreholes. The aquifer was modelled using the Moench analytical solution, as unconfined, with partially penetrating dewatering and monitoring wells. Effective hydraulic conductivity and specific yield were determined by trial and error until a good match of calculated and monitored hydrographs was achieved (**Fig.1**). The calibrated hydraulic properties were consistent with the average hydraulic conductivity and specific yield in the calibrated regional numerical model.

For the prediction period, additional monitoring locations at the pit bottom and benches were introduced (Virtual wells on **Fig.2**). The prediction was conducted for the existing and virtual monitoring locations as illustrated on **Fig.1**.

Fig.1 also shows ground elevation changes at each monitoring location, based on the 6-month pit development schedule. The pumping rates in the AMWELLS pumping wells for the prediction period were modified, as presented on **Fig.3**, such that water at Virtual well locations always remained at least 5 m below pit bench levels.

The AMWELLS model predictions informed on how pumping rates and number of wells need to be changed to meet dewatering targets allowing to optimize the cost of dewatering during pit development.

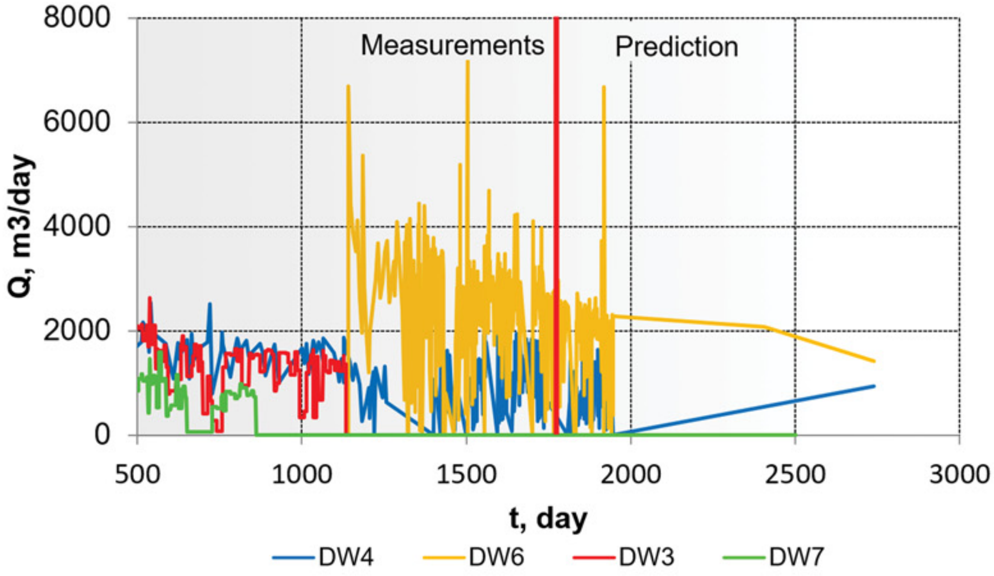

Fig. 3. Variation of pumping rate with time in dewatering wells