CALCULATION OF PIT INFLOWS FOR DIFFERENT STAGES OF LIFE OF MINE

Client: KAZ Minerals (Copper deposit in Kazakhstan)

Objective: Calculate inflows into an open pit at different stages of mine schedule

Method: "Pit inflow" dialog box in ANSDIMAT Hydrogeologist Workbench

Estimates of groundwater inflows to the three open pits were required to assist in water management planning during LoM. The site geology can be described as a succession of andesites, basalts and sandstones, where the groundwater flow is strongly controlled by fractures.

Hydraulic conductivity was characterized by an extensive drilling and hydraulic testing program to the depth of 300 m. The aquifer test interpretation results led to conceptualise the aquifer at the mine site as four zones of decreasing hydraulic conductivity with increasing depth (Table 1).

Table 1. Assumed hydraulic properties for the ANSDIMAT model

N of zone in profile	Depth interval, m	Geometric mean of *k* from		Assumed parameters	
		historical tests	aquifer tests in 2019	*k*	S_y
1	0-50	0.072	0.105	0.15	5
2	51-100	0.053	0.005	0.04	1
3	101-250	0.012	0.016	0.01	0.5
4	>250	0.0035		0.003	0.3

k is Hydraulic Conductivity (m/day), ***Sy*** is Specific Yield (%)

Other model details are summarized in Table 2.

Inflows were calculated for the duration of LoM considering the evolution of the pit shape through time. Each period was modelled taking into account the zones intersected by the pit, pit depth and its effective radius. ANSDIMAT is using "big well" approach, where a pit is conceptualised as a well with effective radius of a pit and drawdown equal to the pit bottom depth.

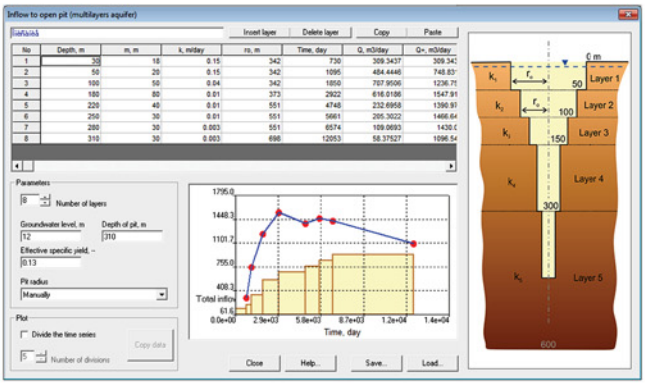

Fig. 1. The Pit Inflow dialog window. Calculations of inflow for Eastern Pit for 2018 (calibration period)

The dialog window that was used for calculations (multilayered aquifer, ANSDIMAT Hydrogeologist Workbench - Fig.1) allows accounting for permeability changes in profile and transient nature of mine inflows that are related to pit layouts.

The model hydraulic conductivity for the two upper layers was calibrated to the recorded pit inflows in 2017 and 2018.

The calculated total inflows for the three pits are presented on Fig.2. The figure shows very low predicted inflow rates during LoM, to the maximum of 1700 m^3/d.

Table 2. Details of the ANSDIMAT model setup

Year	*T*, days	Pit bottom elevation, mRL	*Vertical profile zone*	*A*, km^2	*R*, m	S_0, m	*S*, m
2017	365	390	1	0.25	280	12	18
2018	730	370	1	0.36	340	12	38
2019	1 095	340	2	0.37	342	12	68
2029	4 748	180	3	0.95	551	12	228
2049	12 053	90	4	1.53	698	12	318

T is Time from the start of dewatering, ***A*** is Pit area at its middle elevation bench, ***R*** is Effective pit radius, ***S0*** is Depth to the pre-mining water table, ***S*** is Drawdown at the end of the dewatering period

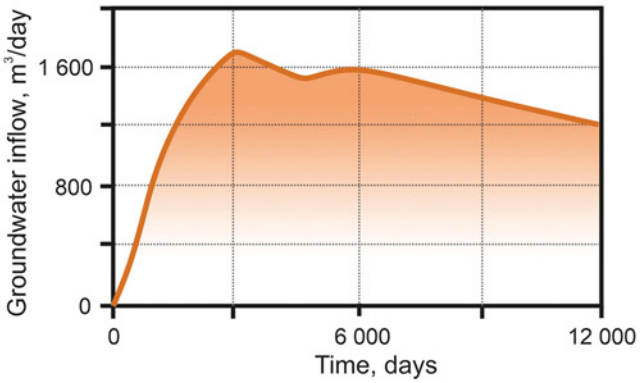

Fig. 2. Total groundwater inflow into the three pits during LoM

While hydraulic conductivity is low at deeper horizons, predicted groundwater inflows are relatively stable because most of water is coming from the shallow layers.