Drawdown of Groundwater Level in Open Pit Mine

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ABSTRACT

In the conditions of the Republic of Uzbekistan, groundwater is found at depths ranging from a few centimeters from the surface of the earth to several tens of meters (30-60 m or more). The depth of the level of these waters depends on many factors such as the region of location, the hypsometric level of the region, the presence of natural water arteries, the geological structure of the terrain, the properties of the soil and other factors. The study of this problem began in the first half of the last century and continues to this day. In the oil and gas industry, the recycling of corrosive and highly mineralized waters collected from the surface together with oil and gas poses a serious environmental problem. In practice, for recycling, isolated permeable layers are found in the geological section of deposits. It should be noted that such measurements are carried out on flooded or liquidated wells for geological or technical reasons. Salt water is pumped out using pumps or drained by gravity into the wells, from where the water goes into the absorbent layers. At the same time, huge savings in logistical and financial resources are obtained in a short period of time, without harming the environment. The analysis of the flood control of solid mineral resources deposits and building materials quarries, which are developed in an open way reveals that it applies the traditional methods of water evacuation that the construction of trench sewers. Application of filtering devices, drilling of drainage wells and others. Of these, the drainage of quarries by lowering the groundwater level through drainage wells has been the most effective. At the same time, drainage wells with a depth of 20-30 m are drilled in the areas prepared for exploitation. These wells were equipped with deep electric or mechanical pumps and groundwater was pumped through these pumps. In the initial phase, the application of such a measure turned out to be relatively effective, but as the work front widened, there were some significant drawbacks. These disadvantages include the following:

a) Significant dispersion of drainage wells in the quarry.
b) High communication costs (electricity, construction of gutters or installation of sewer pipes for wastewater).
c) Difficulty in maintenance of drainage wells by staff due to uncertainty in establishing pumping regime due to changes in groundwater level and others.

Considering the drawbacks identified on the above method, we proposed to deepen the drilled drainage wells to the underlying permeable layers, in order to transfer the upper groundwater into the underlying aquifers. The significance of this proposition is the difference between the hydrostatic pressures above and the underlying aquifers. It is known that if the piezometric surface of the underlying aquifers is lower than that of the overlying underground aquifers

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and there is a hydrodynamic connection between them, the water from the upper aquifers will be absorbed by the lower aquifers. During the process of deepening the drainage wells, geophysical and hydrodynamic methods were used to determine the permeable intervals, the possible absorption capacity of the underlying layers and the height of the hydrostatic water level. This made it possible to establish the existence of aquifers at shallow depths of the ore sole such that the maximum deepening of the drainage wells was 68 m and a minimum of 33 m. After the establishment of a hydraulic communication in an upper well of layers lower than the water table which have themselves become lower than the horizons and eliminates the need to resort to pumps. If in the cut of a well between the sole of the ore body and the absorbent layer had clay layers (intercalation), to avoid turdidition of water flowing down the water (which reduces the collection of wells) and rinsing of the clay going to the bottom of the water, in a drainage well descended the tubes of the PVX type and were isolated in the intervals. Subsequent monitoring of the groundwater level of the experimental site showed that on the bottom of the 17 drilled wells, in 15 of them the water column corresponded to the height of the roof of the ore body. Subsequent daily groundwater level measurements showed a decrease in the height of the water column in 15 wells, opposite the ore body capacity. As for the other two shafts, where the ground level has slightly decreased, they were laid in zones of lithological substitution of the ore body with other low-permeability rocks. After the implementation of the activities of reduction of groundwater levels and the drying phase experienced provides for the control of flooding extract production. The assessment of the water flow of the products was carried out by gravity, depending on the ability of water to flow under the influence of its own weight. It was found that at the end of the deepening and the beginning of the water diversion in the underlying horizons, no change in the water contour was observed. However, after 17 days, the amount of water flowing from the mineral decreased in the mined products, especially from the upper part of the deposit cut. At first, with a daily delay of 1 m^3 of rock on the open storage area, 80-90 liters of free water were released from it, then at the end of the second month from the beginning of this event, this amount of water decreased to 15-20 liters per day. These encouraging results will pave the way for the application of this activity in other deposits presenting similar problems, in particular those of bauxite in the Republic of Guinea. In addition, these activities can be used in agriculture to reduce the water table, which causes many problems.

Keywords: Groundwater level, Open pit mine, Republic of Uzbekistan