Case Study: Louvered Screen Produces High Efficiency Boreholes for Mine Dewatering – Sub-Saharan Africa

Introduction

Ground water is the bane of mine operators because among its many effects, if left uncontrolled, it can seriously compromise the stability of the mine slopes, retard the progress of ongoing operations, and limit the depth to which a mine can be worked. While artificial control of ground water is no easy task, it can be effectively accomplished by continuous ground water pumping that lowers and stabilizes the ground water at a prescribed level (i.e., depth) so that the mine can be worked progressively deeper in dry conditions. Such operations, referred to as dewatering, begin by designing, installing and operating a strategically laid out network of dewatering boreholes that have the combined production capacity to pump ground water at a predetermined rate to control its inflow and level at the mine site.

Each dewatering borehole within a dewatering system is designed to accommodate a dedicated pump whose capacity may be several thousand cubic meters of water per day. A typical network of dewatering boreholes (i.e. wellfield) is designed to operate continuously 24 hours-per day without interruption. Its demands for power or fuel are often high, particularly when the efficiencies of the boreholes are low. So, depending on the number of boreholes and their combined power or fuel demand, the annual cost of power and/or fuel to operate a dewatering system can be a substantial and significant operational cost that directly impacts the profitability of the mine.

Cost-conscious mine operators, not unlike municipalities and water utilities, work hard to control power and fuel costs because by so doing they can enhance their profitability if they pump water at the lowest possible unit cost. Cost control begins by ensuring that their dewatering systems consist of highly efficient dewatering boreholes. Operators know that constructing dewatering boreholes with efficient well screens will reduce head loss which will, in turn, allows them to pump water at a lesser cost per unit volume.

This memorandum describes the findings at one mining site where pumping tests were performed on several dewatering boreholes constructed with louvered well screens manufactured by Roscoe Moss Company. The importance of these tests is that they clearly show the high efficiency of louvered well screens that is available for mine dewatering. At the request of the operator, the identity of this mine is confidential. For the purposes of this technical memorandum, it is sufficient to describe it as an open-pit mine in Sub-Saharan Africa that is typical of many others in operation in the region.

Other On-Site Dewatering Boreholes

Over the years, the operator installed many dewatering boreholes and like so many others that dewater mines in the region, they were completed with low-cost materials that offered very low efficiency. In fact, efficiency received little or no consideration. Existing dewatering boreholes were completed with low-carbon steel blank casing (165 mm in diameter) down to the water-bearing zone and slot perforated (i.e., plasma-cut) casing within the dewatering zone. Based on pumping test results, the efficiency of the existing dewatering boreholes was about 38 percent.

Louvered Screen Dewatering Boreholes

Owing to an interest to optimize the efficiency of new dewatering wells, the mine operator installed several new dewatering wells using Ful-Flo louvered screen from Roscoe Moss Company. The Ful Flo louvered screens were manufactured from high-strength low-alloy steel and were 165 mm in diameter. After being installed and properly developed, each borehole was pump tested to assess its production capacity, drawdown and efficiency. The pumping test results were used to calculate aquifer parameters and borehole efficiency.

The test results showed the efficiencies of the Ful Flo louvered screen boreholes were dramatically higher compared to the slotted casing boreholes. Ful Flo louvered screens exhibited efficiencies of 73 percent.

Potential Impact on Operational Cost

Each dewatering borehole constructed of Ful Flo louvered screen at this mine site will operate at a lower cost to the owner throughout its design life because it will exhibit less drawdown. And less drawdown means that each pump will require less power to lift water to its discharge level. By making this one simple, straightforward design decision, the mine operator effectively reduced the annual operating cost for the dewatering system.

Summary

Boreholes typically operate for tens of years and require a constant supply of power or fuel for their operation. Over a period of years, power and/or fuel costs can be staggering. Therefore, efficiency should be a prime consideration whenever a new borehole is designed and constructed. Using highly efficient screens, such as Ful Flo louvered screen, will translate directly into lower operational costs. And lower operational costs will lead to lower unit costs for water. For the operators of mine dewatering systems, pumping water at the lowest cost per volumetric unit contributes to higher profits.

Based on the experience described above, the mine operator will continue to install new dewatering boreholes in the future and intends to specify Ful Flo louvered screen as the material of choice.

References

Roscoe Moss Company, 2005, *Building Efficient Production Wells: The Long-Term Perspective on Operating Costs and Well Design*, Technical Memorandum 005-1.

Roscoe Moss Company, 1990, *Handbook of Ground Water Development*, John Wiley and Sons, New York, NY.

About the Author

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