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REMEDIATION AND FINAL RESOLUTION OF ENVIRONMENTAL IMPACTS ASSOCIATED WITH THE RETSOF SALT MINE COLLAPSE, LIVINGSTON COUNTY, NEW YORK

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Abstract

The Retsof Salt Mine in Livingston County, New York had completely filled with saturated brine by 1996. This occurred as the result of a mine collapse on March 12, 1994 followed by flooding with ground water. Ground water monitoring nearly a decade after the collapse revealed salinity was increasing in the fractured rock above the mine in the collapse area, and this salinity was connected to the upward rise of brine from the flooded mine. The mine owner had entered into a legally binding commitment to address impacts if this brine was squeezed out of the mine into overlying fresh water aquifers. A remedial plan was developed in 2004 to prevent the mine related brine from entering the overlying aquifer system at the base of the glacial valley. The remedial plan consisted of pumping brine from the fractured bedrock in the collapse zone at a rate equal to the brine squeeze rate calculated from mine closure. The remedial plan was designed based on data collected from well drilling, geophysical logging, ground water sampling and analysis, geochemical modeling, and subsidence monitoring. Caliper and gamma-ray geophysical logging were employed to confirm the location of significant stratigraphic contacts and to refine the monitoring program. Caliper and acoustic televiewer logging were used to locate and evaluate the extent of fracture zones in the bedrock to determine the optimal placement of the pumps in the brine remediation wells. The remedial pumping program was initiated in May of 2006, after a period of pre-pumping monitoring, and was continued until December of 2013. Monitoring continued after cessation of pumping until November of 2014. The monitoring shows that the pumping program was successful in controlling the brine migration. The subsidence and geochemical modeling results show that no differential subsidence was induced dissolution of anhydrate and halite as the result of pumping. The subsidence data also show that the brine squeeze rate is approximately 15.7 gpm (59.4 l/m), which is much lower than initially projected, and that it would take 2,240 years for full mine closure at this rate. Approximately 47 percent of the mine area is at a closure rate of zero; consequently, it is likely that the overall mine closure rate will approach zero in the distant future. The brine mitigation and monitoring of ground water and subsidence were allowed to cease through a settlement between the stakeholders in 2014. The settlement discussion included consideration of costs and benefits of continuing the remedial activity for centuries.

Keywords: bedded salt deposits, brine chemistry, brine disposal, computer modeling, dissolution, geology, geochemistry, modeling, monitoring, New York, salt processing, salt properties, sinkholes, subsidence, underground mine/mining