# CONTINUOUSLY OPTIMIZING A GROUNDWATER REMEDIATION SYSTEM IN COMPLEX FRACTURED MEDIA

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To contain environmental impacts of a former chemical plant of 150 ha located in Manfredonia (FG), a complex groundwater remediation system with 61 extraction wells and 68 infiltration/injection wells has been installed. Groundwater flow at the site primarly occurs within a complex karstic and fractured media.
A continuous groundwater monitoring has been performed since years, including monitoring of groundwater and seawater levels, daily measurements of pumping rates, groundwater sampling as well as periodically runs of a 3D finite elements numerical model.
Due to the Public Authorities' request to better detail the aquifer anisotropy a continuous analysis and evaluation of the previous data have been carried out. Thus, after several years of performance and monitoring, the complexity of the site has been investigated through an integrated analysis of new hydrogeological surveys, including numerical modelling and photo-geological mapping through the study of aerial photographs.
The site-scale conceptual model has been optimized conducting and evaluating 11 long term pumping tests and a detailed photo-geological study to better define the fracture pattern and aquifer anisotropy. In addition, the influences of tidal effects and of the Pump&Treat&Injection system have been taken into account.
The new outcomes allowed to update and recalibrate the existing groundwater flow numerical model. The numerical code used is FEFLOW, based on the Finite-Element technique. The flexibility of triangular finite elements gives the model the capacity to simulate the complex groundwater features of the aquifer media.
Due to additional hydrogeological investigations, a general confirmation of the known range of hydraulic conductivity values of the aquifer has been achieved and most of the data gaps were filled. The updated model was calibrated and then validated in a transient regime. In addition, using the numerical model, the remediation system has been evaluated with the aim of an extraction/injection wells system forthcoming optimization.