

## **What is the Appropriate Site for RBF?**

Thomas Grischek, Prof., University of Applied Sciences Dresden,  
Dresden, Germany

Coauthors: Schubert, J., Jasperse, J., Stowe, S., Collins, R.

### **ABSTRACT**

At many sites in Europe, RBF schemes have been efficiently operated for several decades. Most of these are well investigated and monitored for optimisation of processes in the river bed and in the aquifer. Some inefficient schemes have been closed due to clogging or water quality concerns resulting from wrong siting or inadequate operation. Whereas in Europe in a period of decreasing water demand new RBF site developments are rare, there is a renaissance of RBF technology in the US and other countries. Up to now no guideline exist to support engineers in identifying an appropriate site for RBF.

A complex assessment of hydrological, hydrogeological, hydrochemical aspects together with state specific regulations, land use, cost and other issues is necessary for optimal RBF siting. The main objective of using RBF determines the siting approach to a large extent. If RBF is seen as an alternative to direct water abstraction from the river to gain pathogen removal (and e. g. removal credits) or the proportion of pumped bank filtrate should be as high as possible to prevent abstraction of contaminated groundwater, short distances between the river and the abstraction wells, well location on an island or at the inner bends of a meandering river are preferred. If the equilibration of water temperature and water constituent concentrations or the removal of organic compounds is the major objective, long flow paths and travel times are of advantage.

Some general requirements have to be fulfilled to establish a sustainable RBF scheme in all cases. The river should have stable river banks and a natural sand river bed cutting into an alluvial sand and gravel aquifer. The aquifer has to be in direct hydraulic connection with the river. The thickness of the aquifer should be more than 10 m, the hydraulic conductivity of the aquifer should be in the range of  $10^{-2}$  to  $10^{-4}$  m/s.

For prevention of river bed clogging, key factors for site selection are the slope of the river and the composition of the river bed. The average flow velocity of the river should be more than 1 m/s and the average shear stress should be higher than 5 N/m<sup>2</sup>. The river water discharge should frequently rise to cause bed erosion to remove a potential clogging layer. Other important factors to prevent clogging are the infiltration rate determined by the pumping rate and well location along the bank as well as river water turbidity and particulate organic matter. From long term experiences average infiltration rates of less than 0.2 m<sup>3</sup>/ (m<sup>2</sup> \* day) over the river bed ensured stable infiltration conditions. Sufficient dissolved oxygen in the river water is necessary to prevent anoxic conditions in the aquifer which may cause iron, manganese or arsenic dissolution and thus further treatment demands. If no data for biodegradable dissolved organic carbon (BDOC) are available, as a first estimate the river

water TOC and DOC values should be less than 8 mg/L and 6 mg/L, respectively.

Scientific design approaches together with evaluation of case studies are combined to identify further parameters and to propose feasible values for site selection through a RBF design manual workshop, 8-11 October 2006. The work is coordinated by the Water Treatment Technology Assistance Center at the University of New Hampshire and supported by the US EPA.