Riverbank Filtration Technology

By Gary L. Smith

A natural alternative for pretreating surface drinking water

RBF technology produced a 12-mgd supply, by way of a 165-ft-long gravel well, beneath the Merrimack River in New Hampshire.

Riverbank filtration (RBF) is a cost-effective, natural pretreatment technology that uses Mother Nature's geology—instead of chemicals—to pretreat surface water and groundwater supplies.

As energy costs for conventional treatment technologies escalate and translate into increases in user rates, alternative pretreatment technologies are being used more widely. RBF technology is at the forefront as a method for not only pretreating existing raw surface water supplies but also for developing new and sustainable water supplies.

RBF uses the bed of a reservoir, lake or river and an adjacent sand and gravel aquifer as a natural filter. The technology can be applied directly to existing surface water reservoirs, streams, lakes and rivers, and now it is often a guiding factor in the hydrogeologic investigation of new source supplies.

Technology Benefits

Advantages of RBF include natural pretreatment through bank filtration, reduced chemical usage for pretreatment and resistance to contaminant threats. It has minimal color, odor, turbidity and algae, features a low profile and is aesthetically pleasing. The technology decreases construction and operation costs, offering the lowest costs among supply options, and it provides maintenance cost savings (e.g., no leaf debris, which is common to surface water intakes).

Use of RBF results in a reduced need for disinfection, less sludge generation, achievement of treatment removal credits used to meet the Long-Term Enhanced Surface Water Treatment Rule, easy maintenance and consistent water quality and temperatures. It also is not susceptible to invasive plant infestation and has no impact on fisheries.

Applications

Using alternative well technology (e.g., horizontal or angle wells) opens up numerous RBF applications depending on the site characteristics and soil conditions. These include:

- Freshwater intakes beneath river and lake beds;
- Saltwater intakes beneath an ocean floor;
- Offsetting well head from wetlands, buildings and floodplains;
- High-capacity single-well pumping;
- Utilizing aquifers beneath rivers and lakes to provide prefiltration and enhance raw water quality; and
- Tapping aquifers from a distance where land constraints prevent drill rig access.

Case Study

RBF was used as a pretreatment technology for Manchester Water Works (MWW) in New Hampshire.

MWW worked with its consultant, Wright-Pierce, to evaluate the application of RBF technology for its proposed 15-million-gal-per-day (mgd) supplemental drinking water supply at Merrimack River. Hydrogeologic investigation indicated that the technology was a potentially viable pretreatment technology and an alternative to a direct surface water intake.

The RBF investigation involved aquifer exploration utilizing seismic reflection profiling, subsurface angle intake modeling, pumping tests, detailed water quality analysis and bank filtration modeling. Onshore and offshore geophysical and test well exploration studies identified a potential high-yield sand and gravel aquifer beneath the Merrimack River.

In this study, a 21-degree angled well design was used to explore the possibility of developing a 12-mgd future RBF supply. The low-angle gravel well, 165 ft in length, was drilled beneath the river and pump tested for six days at 620 gal per minute. A detailed groundwater flow model with a rhodamine dye time-of-travel analysis was conducted, and a detailed water quality laboratory analysis was conducted.

RBF was shown to be an excellent barrier against microorganisms. A log credit removal of at least 2 for bacteria, viruses and aerobic spore-forming bacteria could be assigned. It removed organic precursors by an average of 63%.

Induced infiltration from the river was estimated to range from 53% to 64%. The design of a unique offshore well construction and pumping system allowed the utility to take advantage of the raw water source, positioning it to meet projected supply needs. By utilizing the technology, MWW may eliminate the need for filtration as well as reduce chemical, operational and treatment facility construction costs. WWD

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