PELA GeoEnvironmental

Project Summary
Sinkhole Remediation

Remediating Sinkholes Beneath the Liner of a Potable Water Lagoon, Alcoa, Tennessee

As part of its water treatment process the City of Alcoa, Tennessee, operated a potable water impoundment on a hill above the Little River. During construction in 1991, and again in recent years, the 55 million-gallon-impoundment was compromised by sinkholes. The collapse of sinkholes correlated with discharge from a number of small springs downslope from the impoundment. The flow of five out of seven springs ceased when the impoundment was emptied. Following construction-induced sinkholes, an impermeable liner was installed, and the more recent sinkholes were plugged with low-slump grout, but new sinkholes continued to collapse.

The impound-ment is located on the nose of a plunging anticline, with its core composed of Pumpkin Valley Shale and its outside strata of Rutledge Limestone. The sinkholes form in the overburden above the limestone, not the shale. A complete karst inventory, including infra-red thermography to detect submerged springs in the river, was conducted in the vicinity. A quantitative dye trace was then conducted by injecting Rhodamine WT into an open sinkhole in the impoundment. Water samples were collected at seven small springs and several locations along the Little River and analyzed in the field using a Turner Designs Model 10-AU Fluorometer to establish breakthrough curves.

The data collected indicate that frequent small karstic drainage paths have developed in the steeply sloping limestone. These small flow paths merge into a network that discharges 1-2 meters above the present river level: dye went to all springs almost simultaneously. A remedial strategy to grout the karstic flow network using a quick-setting high-fluid grout was suggested. The approach is to allow the grout to flow into the discharge network and plug all paths without having adverse effects on the river and groundwater flow from other areas.

2003 Sinkhole on the berm of the impoundment