Demonstrating Interconnection Between a Wastewater Application Facility and a First Magnitude Spring in a Karstic Watershed: Tracer Study of the Tallahassee, Florida Treated Effluent Spray Field 2006-2007

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Overview

The City of Tallahassee's SE Spray Field (SESF) receives secondarily treated wastewater and disperses it onto the land surface via center-pivot irrigators at an average rate of approximately 17 million gallons per day (City of Tallahassee, 2007). The system is intended to provide nutrient removal through plant uptake from the infiltrating water. It became operational in 1981, encompassing 1000 acres and was expanded in 1982 to 1500 acres, 1986 to 1896 acres, and 1999 to 2,159 acres (Chelette et al, 2002). Nitrate levels in groundwater monitoring wells installed in the upper Floridan Aquifer beneath the SESF increased precipitously after the SESF became operational rising from ~0.5 mg/L in 1980 to as much as 10 mg/L in the 1990's and stabilizing at ~6 mg/L by 2000 (Chelette et al, 2002).

During the same period, nitrate levels measured at Wakulla Spring rose from ~0.2-0.3 mg/L between 1971 and 1976, to >1.0 mg/L in the late 1980's, to ~0.7-0.8 mg/L between 1998 and 2000 (Chelette et al, 2002). The increased nitrate levels are thought to be the primary cause of algae growth and enhanced hydrilla growth that have resulted in significant harm to the ecosystems supported by Wakulla Spring and the Wakulla River (Hand, 2005).

Given the apparent correlation between nitrate increases in Wakulla Spring and in Floridan Aquifer groundwater beneath the SESF, considerable attention became focused on the SESF as the primary source of nitrate contamination to the spring by 2000. Further attention was directed toward the SESF when Chelette and others (2002) reported nutrient budget calculations for the St Marks and Wakulla River Watersheds that attributed 40% of the nitrate loading in the Wakulla Springs contributory area to the SESF.

In response to growing concerns about the fate of nitrates released to the Floridan aquifer from the SESF, the City of Tallahassee approved a three-year study with the US Geological Survey to, in part, develop of model of nitrate transport through the upper Floridan Aquifer. In concert with that effort, the Florida Department of Environmental Protection and the Florida Geological Survey commissioned Hazlett-Kincaid, Inc. to perform a groundwater tracing study to identify potential groundwater flow paths and velocities between the SESF and down-gradient springs.

Tracer injections were performed in three wells across the northern side of the SESF and one sinking stream located on the southeastern side of the property (**Figure 1**). Water samples were subsequently collected from ten wells and eleven natural discharge points for between two and fourteen months and analyzed in a laboratory for the presence and relative amount of the injected tracers. Sampling for the fluorescent dyes was also conducted at two of the wells, Wakulla B-Tunnel, and the St. Marks River upstream of its disappearance with insitu filter fluorometers (IFF).

One or more of the fluorescent dyes was detected at five of the wells and five of the springs (**Figures 2 & 3**). The springs at which the fluorescent dyes were detected include: Wakulla Spring, Sally Ward Spring, Indian Spring, and one or more of the small springs contributing to flow in McBride's Slough. The fastest travel times to those springs established by fluorescent tracer breakthrough curves ranged from approximately 28-66 days after the injections with subsequent smaller pulses of tracer-laden water arriving at Wakulla and McBride's Slough as late as approximately one year after the injections. Very minor quantities of fluorescent compounds that fluoresce in the same range as the injected tracers were detected at Monroe Spring and the St. Marks River Rise but not enough to be confident that our tracers were recovered at those locations. None of the fluorescent tracers were detected at in the St. Marks River at Natural Bridge, Rhodes Spring, or Newport Spring.

References

Chelette, A., Pratt, T. R., and Katz, B. G., 2002. Nitrate loading as an indicator of nonpoint source pollution in the lower S. Marks-Wakulla Rivers watershed: Water Resources Special Report 02-1, Northwest Florida Water Management District, Havana, Florida, 138 p.

City of Tallahassee, 2007. The Southeast Farm Wastewater Reuse Facility, accessed from http://www.talgov.com/you/water/sefarm.cfm

Hand, J. 2005. Nitrate & Hydrilla at Wakulla Spring, Untitled presentation, Solving Water Pollution Problems in the Wakulla Springshed of North Florida; Hydrogeology Consortium Workshop http://www.geohydros.com/FGS/ HC_Workshops/2005_WS_Workshop/

	
AR87 injection in Turf Pond Sink	*AY73 siphon injection at well SE06*

Figure 1. Photos of the dye injections that occurred at a swallet and monitoring wells located within the City of Tallahassee's waste water spray field.

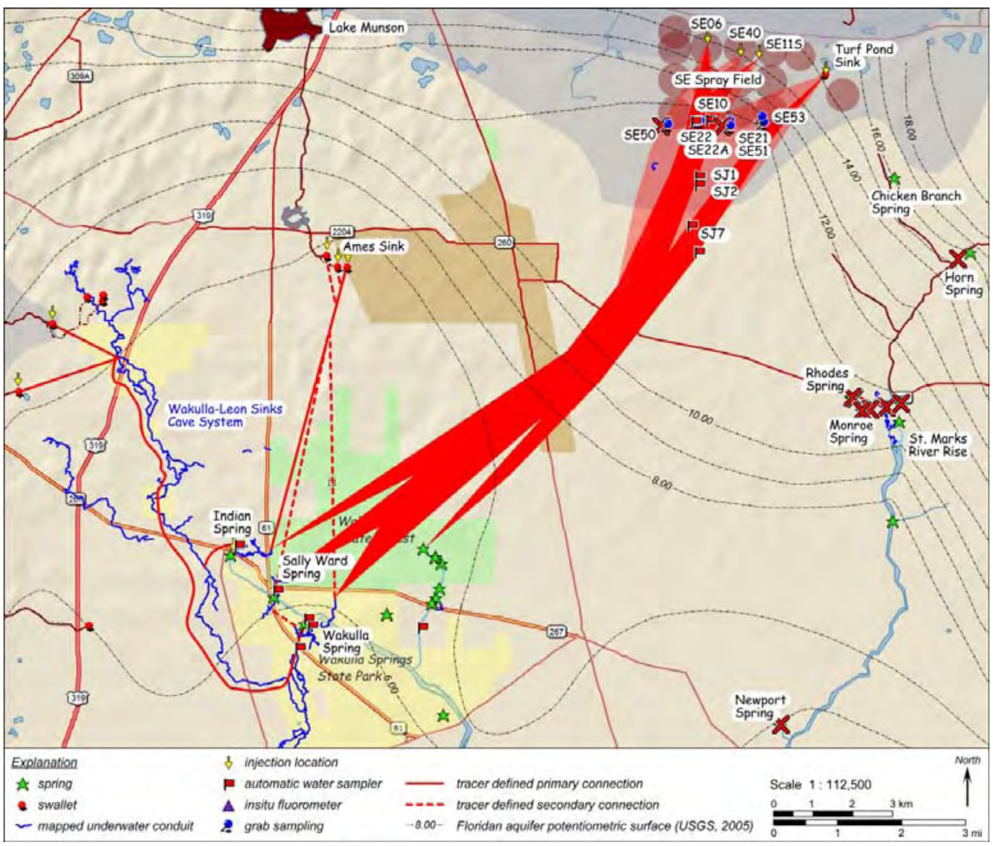

Figure 2. Traced groundwater flow paths from the City of Tallahassee's waste water spray field to Wakulla, Indian, Sally Ward, and McBrides springs, north Florida.

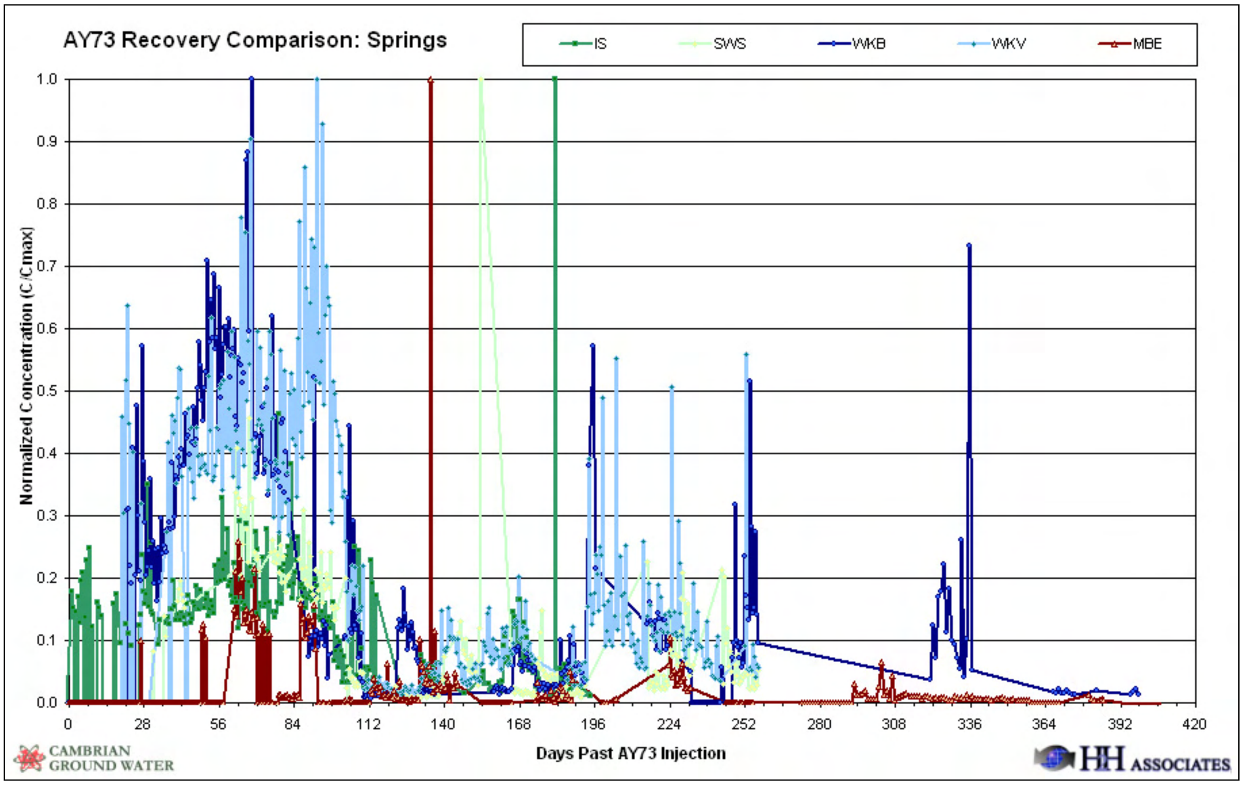

Figure 3. Uranine Dye (AY73) recovery curves for Indian Spring (IS), Sally Ward Spring (SWS), Wakulla B-Tunnel (WKB), Wakulla Vent (WKV), and McBride's Slough (MBE) resulting from dye injections performed at the City of Tallahassee's waste water spray field.