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## News Release

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Editors: Photographs are available at <http://sd.water.usgs.gov/pressrelease/SpearfishGallery.html>

# USGS discovers rapid ground-water flow paths from Spearfish Canyon to Spearfish area wells and springs

Dye tests conducted by the U.S. Geological Survey (USGS) in Spearfish Creek show that ground-water travels relatively fast in the underlying Madison Aquifer, indicating a potential concern about the ease of unwanted chemicals to enter the water supply.

At the intersection of Spearfish Creek and the Madison Formation in Spearfish Canyon, flows as high as 21 cubic feet per second flow into the Madison Aquifer to become ground-water recharge. The path and velocity of this recharged water were traced by the USGS using using two different dyes. A green dye was injected in March 2003 and a red dye was injecting in May 2003.

Following the injections, samples were collected from wells in the Spearfish vicinity to determine when and if the dye arrived. Based on this information, ground-water velocities ranged from one-tenth to one-half mile per day, which according to USGS hydrologist, Larry Putnam, are quite fast for ground water. Additionally, dye was measurable in well water as much as 400 days following injection.

“The rapid ground-water movement is a potential contamination concern because there would be little time to mitigate a spill along Spearfish Creek before the water reaches wells. The length of time that dye was detectable also is a concern because it shows that if a contaminant enters the aquifer, it will remain for a long time,” said Putnam.

From the recharge areas just south of Spearfish where the Madison Limestone is exposed at or near the land surface, ground water in the Madison Aquifer generally flows north towards Spearfish. These recharge areas are where streams lose flow and precipitation can infiltrate into the aquifer. In addition to this local recharge, another source of ground water in the Spearfish area is the high-altitude Limestone Plateau southwest of Spearfish. From the Limestone Plateau, ground water flows to the northwest into Wyoming, then to the east across Lawrence County at some distance north of Spearfish. The Madison Aquifer and the overlying Minnelusa Aquifer are the source of water to many springs in the Black Hills.

As part of the study, additional water samples were analyzed for various isotopes and other ground-water tracers. These tracers can provide a fingerprint about the source of the water, much like DNA provides a genetic fingerprint for humans. The tracer samples were used to estimate the sources of water to several springs located north of Spearfish. Springs feeding Cox Lake and McNenny Pond,

located about 5 miles northwest of Spearfish, have a component of ground water that originates from the Limestone Plateau southwest of Spearfish. In contrast, the source of water to Old Hatchery spring and Higgins Gulch spring, both located about 2 to 3 miles north of Spearfish, appears to originate from infiltration of local precipitation where the Madison Limestone and Minnelusa Formation are exposed at land surface just south of Spearfish.

Details regarding the Spearfish study are available in USGS Scientific Investigations Report 2007-5001 at <http://pubs.usgs.gov/sir/2007/5001/>.

Additional information about the USGS water-resources studies in South Dakota can be obtained by visiting the USGS South Dakota Water Science Center home page at <http://sd.water.usgs.gov/>.

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