

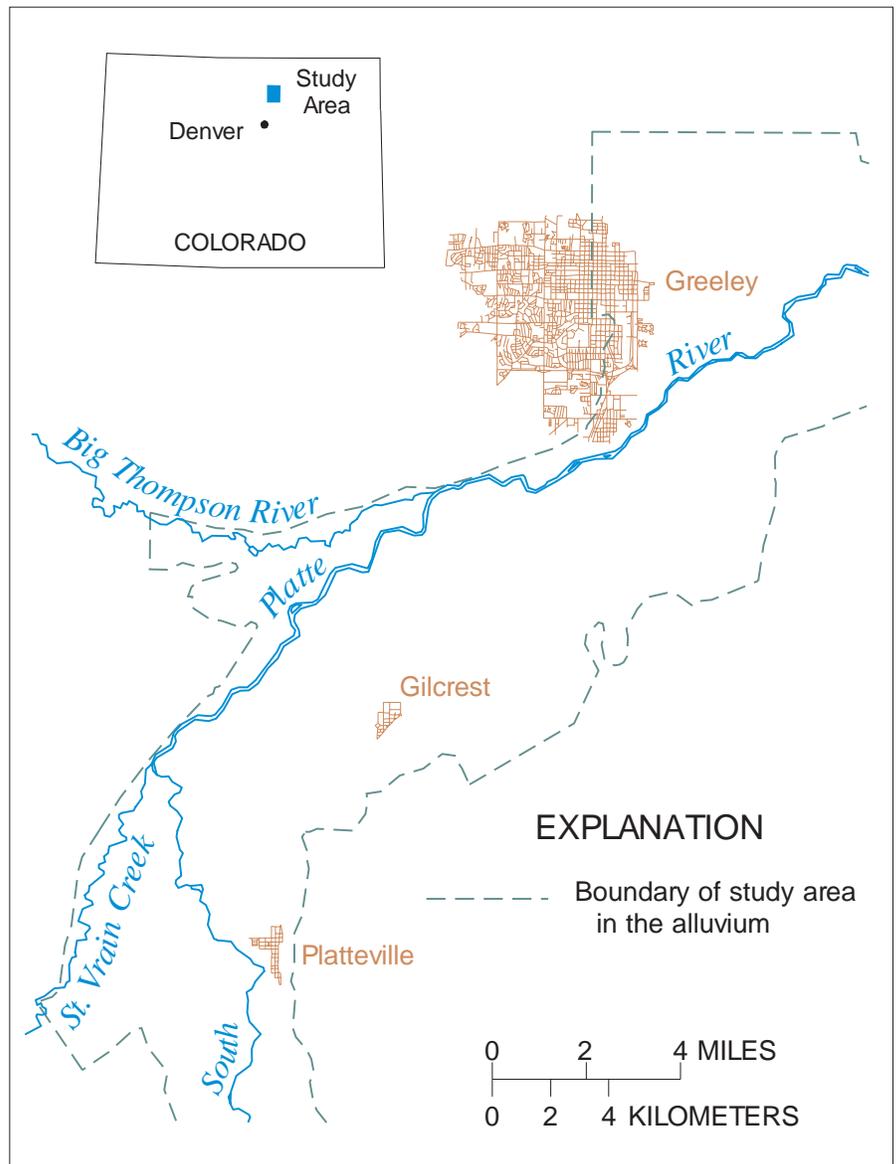
Some Bacteria Are Beneficial!

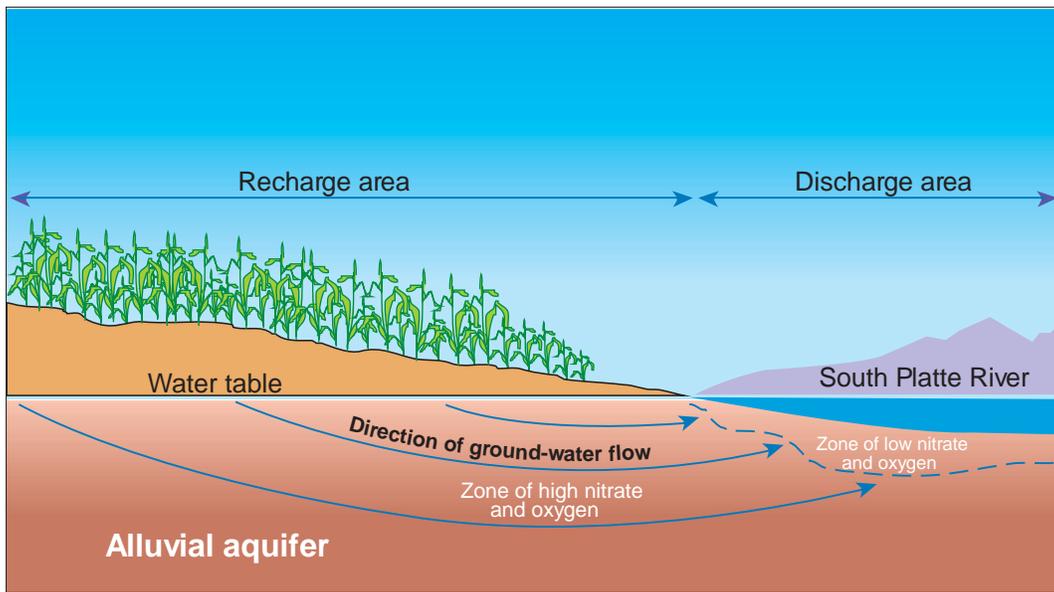
Most people would agree that bacteria usually spell trouble where the quality of drinking water is concerned. However, recent studies conducted by the U.S. Geological Survey (USGS) under the National Water-Quality Assessment (NAWQA) program have shown that some bacteria can improve the quality of water.

In 1995, the USGS completed a study of nitrate contamination in ground water of the South Platte River alluvial aquifer near Greeley, Colorado, and determined that bacteria native to the aquifer actively degraded nitrate in the ground water. Nitrate contamination in ground water is of concern for two reasons. First, excessive nitrate concentrations in drinking water can cause methemoglobinemia, or "blue baby syndrome," in small children. As a result, the U.S. Environmental Protection Agency has established a maximum contaminant level (MCL) for nitrate in drinking water of 10 milligrams per liter as nitrogen. Second, nitrate-laden ground water that discharges into rivers and lakes can cause algae blooms that can degrade the quality of the water in rivers and lakes.

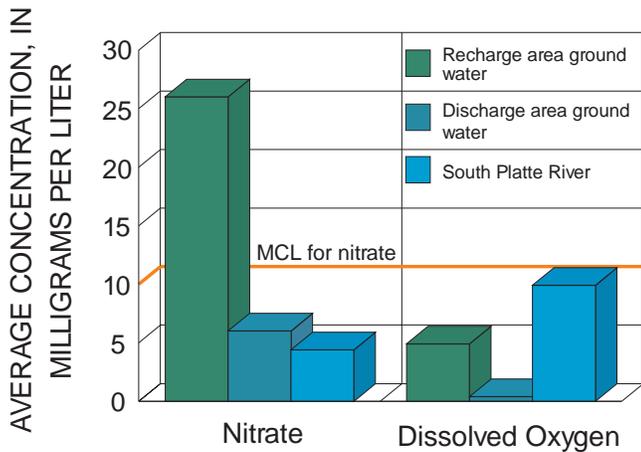
The South Platte River alluvial aquifer near Greeley is recharged by precipitation and irrigation water applied to the agricultural fields overlying the aquifer. Water in the aquifer moves slowly beneath the fields toward the South Platte River where the water eventually discharges.

By measuring the concentrations of freon in the ground water, the USGS determined that it takes about 10 to 25 years for ground water to move from recharge areas to the South Platte River.





The average concentration of nitrate in ground water from the recharge area is about 2.6 times greater than the MCL for nitrate in drinking water.



Bacteria native to the aquifer decrease the amount of nitrate in the ground water before it discharges to the South Platte River.

The USGS study determined that certain bacteria in the South Platte River alluvial aquifer greatly decreased nitrate concentrations in ground water before it discharged to the South Platte River.

These bacteria, called denitrifying bacteria, occur naturally in most shallow aquifers; however, they are not active unless nitrate is available, and there is little or no dissolved oxygen in the water. The USGS determined that concentrations of nitrate in recharge areas were large (average concentration was 26 milligrams per liter, or about 2.6 times greater than the drinking-water MCL for nitrate). Because dissolved oxygen also was present in the recharge areas, the denitrifying bacteria were not active and did not decrease the nitrate in the ground water; therefore, nitrate persisted in the recharge areas of the aquifer. In contrast, little or no dissolved oxygen was present in ground water in the discharge area, which allowed denitrifying bacteria to decrease the amount of nitrate in the ground water before the water discharged to the South Platte River. Dissolved oxygen was not present in ground water in the discharge area because there was enough organic carbon available in that part of the aquifer to react with and remove the dissolved oxygen from the water.

The ability of denitrifying bacteria to remove nitrate from the ground water before it discharges to the South Platte River might keep nitrate concentrations in the river below levels that could otherwise exceed the MCL for nitrate. Because of high nitrate concentrations in ground water in the recharge areas and the long residence time of water in the aquifer, this bacterial process will probably continue for decades to come.

Information on technical reports and hydrologic data related to NAWQA can be obtained from:

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