Assessment of Groundwater Pollutants and Contaminants in the Shallow Aquifer of the Flathead Valley, Kalispell, Montana

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The shallow alluvial aquifer in the Flathead Valley is bound by the fluvial geomorphology of the Flathead River to the east and the Whitefish River to the west. Subsurface water flows generally in a north to south direction at an average rate of 10 cm/s. The Flathead River recharges the aquifer at the head of the valley and the aquifer discharges water into the river in progressively greater volumes as it moves down the valley. The connectivity between the surface and subsurface waters is so great that invertebrates from the river are able to travel underground through the interstitial spaces up to 2 km away from the Flathead River. The high movement of water through the aquifer, its hydraulic connectivity with rivers and streams within the basin and the shallow nature of the aquifer make it vulnerable to several potential sources of surface (e.g., urban and agricultural runoff) and subsurface (e.g., septic system effluents and underground storage tanks) pollution and contamination. The groundwater in the shallow alluvial aquifer has social and ecological importance, as it provides drinking water for many valley residents and many pollutants and contaminants are detrimental to humans and unique riverine and groundwater organisms. The health of our rivers and streams is contingent upon the discharge of clean water from the aquifer.

In the fall of 2009 through the spring of 2011, we conducted a broad-spectrum analysis of the presence and concentration of a variety of groundwater pollutants and contaminants in 21 residential drinking water and 9 groundwater monitoring wells throughout the shallow alluvial aquifer of the Kalispell Valley. We also sampled 7 storm water outfall sites during a spring 2011 rain storm. The primary objective of this study was to provide baseline data for future monitoring efforts and research on how various pollutants and contaminants move through and affect surface and ground water ecosystems. The analytes selected for study, ranged from nutrients (i.e., nitrogen and phosphorus), chloride (Cl) and sulfate (SO_4), to semi-volatile and volatile organic compounds (sVOC and VOC), metals, polychlorinated biphenyls (PCB), endocrine disrupters/pharmaceutical and personnel care products (EDC/PPCP) and coliform bacteria (see 2010 and 2011 reports by Tappenbeck and Ellis for full list of analytes).

We detected sVOC in 15 out of 31 wells (i.e., shallow ground water) and 6 out of 7 storm water outfall sites (i.e., storm water runoff). Twenty-three different sVOC were found in wells and 9 different sVOC compounds in storm water. Most sVOC that were detected are considered carcinogenic by the Montana Department of Environmental Quality (MDEQ). VOC compounds were less common and were only detected in 3 wells and at 1 storm water outflow site and are considered either toxic or carcinogenic by MDEQ. No PCB were detected in shallow ground water or storm water.

A total of 9 different EDC/PPCP were detected in 17 out of 31 wells sampled and included bisphenol A, carbamazepine, oxybenzone, sulfamethoxazole, acetaminophen, progesterone, sulfamethazine, caffeine, warfarin, and DEET. Total coliform bacteria were detected in 9 out of 31 wells and all storm water outflow sites. *Escherichia coli* was not detected in any well but was detected in all storm water sampling sites. This report is the first of its kind to investigate sVOC, VOC and PPCP in the shallow aquifer in the Kalispell Valley and provides insight into the extent of organic and inorganic pollutants/contaminants present in shallow groundwater and residential drinking water wells.

Flathead Lake Biological Station Research Scientist Tyler Tappenbeck collecting an EDC/PPCP sample from a shallow residential drinking water well in Kalispell, MT.