EPILOGUE

" . . . blues would become the underground aquifer that would feed all the streams of American music, including jazz."

– Ken Burns, Iowa Public Television documentary film on *"Jazz"* (2001)

Silver Lake, Dickinson County. Photo by Clay Smith.

Groundwater surfaces to feed our lives in many ways, including its apt use in the metaphor above. To be fully appreciated, groundwater must be viewed as a vital natural resource, as a dynamic geologic process, and as a fundamental element of the natural environment. Groundwater influences the quality of our lakes and streams, the supply of our aquifers, the depth and purity of our well water, the appearance of our landscape, the sites of our cities and towns, and the ability of wetland habitats to sustain native forms of life. It has value both when extracted from the ground and when left in place.

The need for water resources drawn from wells has long been the essential motivation for groundwater studies in Iowa. The fact that nearly 80 percent of Iowans depend on groundwater for their drinking water supplies emphasizes this point. Many Iowa communities initially put down their roots along river valleys because of easy access to abundant shallow groundwater. Today, our ability to produce reliable forecasts of the availability, quantity, and quality of this resource for new wells requires increasingly accurate and detailed views of the geological conditions beneath Iowa's land. Similarly, as demand increases for larger capacity wells, information is needed to minimize the impact of such pumping on existing wells and to resolve conflicts among water users. If groundwater is to continue its essential role in Iowa's water resources picture, then it also needs protection from threats of contamination originating in both the past and present, from both point and non-point sources. The ability to forecast extends to identifying vulnerable groundwater aquifers and the geologic conditions that put them at risk from human activity.

With today's improved awareness and recognition of problems, and with more effective regulations in place, we are moving into an era that emphasizes contaminant prevention, in addition to after-the-fact cleanup and remediation. We must continue to investigate the diversity of geologic settings across Iowa and the complexities of

groundwater travel through three-dimensional configurations of soil and rock in order to meet the demand for more detailed information about potential contaminant risk to groundwater resources.

In addition, groundwater is a slow but effective geologic agent currently shaping Iowa's landscape. The natural erosion of hillsides and stream banks is closely tied to subtle but persistent fluctuations of groundwater flow through time. The shifting intersection of water table with land slope contributes to slumps, collapse, and larger landslides. In fact, our own awareness of groundwater tends to fluctuate with the water table. Only when it rises well above its normal range, and floodwaters spread into our lives, do we take active notice of its presence. During the Flood of 1993 for example, many people found the water table rising into their basements to be as serious a problem as overland flooding was to others. Groundwater can be notorious during another extreme condition – when it's absent. During periods of drought, the water table falls and water disappears from creeks, river beds, and the reach of shallow wells. Still other expressions of groundwater as a geologic agent are the presence of solutional cave and karst features below ground, and springs and sinkholes at the land surface.

The movement of groundwater is a major contributor to natural hazards in Iowa. Such events occur when normal geologic processes are speeded up. For example, in the shallow limestone terrain of northeastern Iowa, underground flow systems persisting through time can result in the sudden collapse of land into a sinkhole. In western Iowa, groundwater saturation of the steep loess bluffs near the Missouri River creates slope instability that leads to landslides and other serious engineering problems.

Finally, groundwater is an important element of Iowa's natural environment. It is part of the dynamic hydrologic cycle, one of Earth's most fundamental and vital natural systems. Understanding the role of groundwater in this cycle is essential to interdisciplinary, regional, watershed-based, and site-specific assessments of biological habitats as well as environmental issues. Water-based habitats such as rivers, lakes, sloughs, springs, hillside seeps, and fens in Iowa are dependent in varying degrees on groundwater flow and replenishment. Distinct plant and animal communities reside in these ecological niches, and their long-term protection is dependent on maintenance of both the physical flow and chemical quality of the groundwater feeding them. The role of groundwater needs to be recognized and integrated into efforts to maintain and restore these habitats.

Watersheds are a keystone of natural resource management today. To improve the quality of a single body of water requires a combined, long-term effort over its entire watershed, a large, sometimes diverse drainage area where numerous individual decisions affect how land is used. Keep in mind that watersheds are more than three-dimensional features of the land surface. They extend below the ground and include the movement of groundwater through time. These added groundwater and time dimensions of watersheds in Iowa are essential to understanding the movement of contaminants below ground and their eventual delivery back to our surface streams and lakes.

Understanding the fundamentals of groundwater in its geologic realm provides valuable information and insight for the use, protection, and sustainable development of Iowa's land and waters.