Summary and Conclusions

The goal of this project was to summarize and evaluate groundwater quality from basin management units 1, 2, and 5 (watersheds of the Kentucky River, Salt River, Licking River, Big Sandy River, Little Sandy River, and Tygarts Creek, and adjacent tributaries of the Ohio River). Results of groundwater analyses were obtained from the Kentucky Groundwater Data Repository, which is the largest and most inclusive collection of information on groundwater in Kentucky. The water-quality data were compared to criteria provided by the Kentucky Division of Water; these criteria included maximum contaminant levels, secondary maximum contaminant levels, health advisory limits set by the Environmental Protection Agency, and other criteria established by the Division of Water if there was no MCL, SMCL, or HAL.

Table 34 summarizes the findings. Although there are no widespread areas where groundwater is unusable because of nonpoint-source contamination, many wells and springs have groundwater that exceeds recommended levels for water properties, inorganic anions, metals, nutrients, pesticides, and volatile organic chemicals. In many cases, the sources appear to be natural; in other cases, there is evidence of contamination by nonpoint-source chemicals.

General water properties (pH, total dissolved solids, total suspended solids, electrical conductance, and hardness), inorganic ions (chloride, sulfate, fluoride), and metals (arsenic, barium, mercury, iron, and manganese) are largely controlled by bedrock lithology. Some exceptionally high values of conductance, hardness, chloride, and sulfate may be the effects of deep brines associated with coal fields, oil and gas production, or leaking on-site waste-disposal systems,

Table 34. Summary of evidence for nonpoint-source impacts on groundwater quality in basin management units 1, 2, and 5.

	Parameter	No Strong Evidence for Widespread Nonpoint-Source Impact	Evidence for Minimal Nonpoint-Source Impact	Evidence for Definite Nonpoint-Source Impact
Water Properties	Conductance	X		
	Hardness	X		
	pH	X		
	Total dissolved solids	X		
	Total suspended solids	X		
Inorganic Ions	Chloride	X		
	Sulfate	X		
	Fluoride	X		
Metals	Arsenic	X		
	Barium	X		
	Iron	X		
	Manganese	X		
	Mercury	X		
Nutrients	Ammonia-nitrogen		X	
	Nitrate-nitrogen			X
	Nitrite-nitrogen		X	
	Orthophosphate-phosphorus	X		
	Total phosphorus	X		
Water Properties	2,4-D		X	
	Alachlor		X	
	Atrazine		X	
	Cyanazine		X	
	Metolachlor		X	
	Simazine		X	
Volatile Organic Compounds	Benzene		X	
	Ethylbenzene		X	
	Toluene		X	
	Xylenes		X	
	MTBE		X	

and some exceptionally low pH values may show the input of mine drainage. Fluoride, arsenic, and barium exceed recommended health-based standards in some instances, but these cases appear to be the product of natural sources rather than nonpoint-source contributions.

Nutrient concentrations show the effects of both natural and nonpoint-source inputs. Nitrate-nitrogen concentrations that far exceed natural contributions are common, particularly in regions where the land is used for agriculture. Phosphorus concentrations are generally higher in the Inner and Outer Bluegrass Regions, where limestone bedrock is known to be rich in phosphate.

Pesticides are synthetic organic chemicals that do not occur naturally. The presence of any pesticide in groundwater indicates a nonpoint-source contribution from agricultural or urban applications. The relative scarcity of detectable pesticide concentrations found in this study may be misleading, for two reasons. First, shallow wells in rural areas, those most susceptible to pesticide contamination, were not specific targets for sampling in the ambient groundwater-quality investigations that provide many of the data for this summary. Second, pesticide levels in groundwater are known to be highest following applications and after rainfalls. Sampling one time or on a quarterly schedule may miss the presence of pesticides if the sampling does not closely follow field and lawn applications or significant rainfalls. High pesticide concentrations in water from a well or spring are a health hazard when the water is used regularly for domestic purposes, even though the available analyses did not show high pesticide concentrations at the time of sample collection. For these reasons, pesticides may be a greater health threat at some times of the year than these data suggest.

Like pesticides, refined volatile organic chemicals do not occur naturally in groundwater and can have significant health effects at very low concentrations. The occurrence of volatile organic chemicals in groundwater is not natural and can only be the result of human activities. This study excluded analyses of groundwater from wells or springs that were known to be affected by leaking underground storage tanks and other sources of volatile organic chemicals. The detection of volatile organic chemicals in springs and shallow wells that were previously thought to be free of such compounds suggests that volatile organic chemicals are entering regional groundwater systems.

Springs and shallow wells are more likely to have high levels of metals, nutrients, pesticides, and volatile organic chemicals than intermediate or deep wells. The potential contamination of the shallow groundwater system (springs and shallow wells) is cause for concern, as is potential contamination of the intermediate and deeper groundwater system.

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