IOWA'S WATER

Ambient Monitoring Program

Watersheds – Reflections on Water Quality

The quality and quantity of water in streams, rivers or lakes are dependent on its watershed. Watersheds are present everywhere in the world, come in all shapes and sizes, and ignore political boundaries such as state or county lines. So what is a watershed?

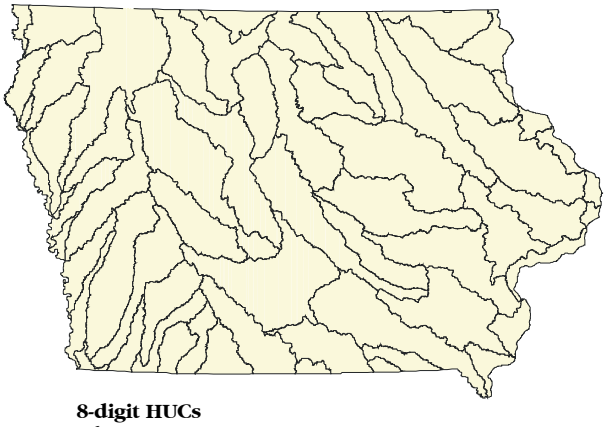
A watershed is an area or region of land that drains into a lake, stream or river (Figure 1). Ridges of higher land on the ground separate watersheds from each other. Small watersheds merge to form larger ones, which, in turn, merge and form still larger watersheds.

Figure 1. *Diagram of a watershed. Dashed white line indicates the boundary of this watershed.*

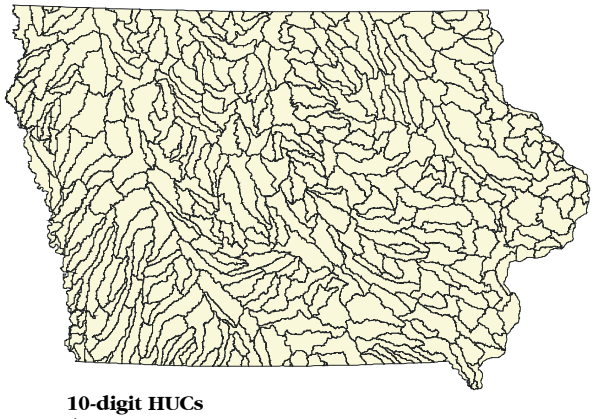
Watersheds can be shown at different map scales. A preferred method of mapping and identifying a watershed is by the use of Hydrologic Unit Codes (HUCs), as defined by the United States Geological Survey (USGS). Within the HUC system, Iowa is divided and further sub-divided into successively smaller watersheds or basins (Figure 2). As the watersheds get smaller, the HUC number gets larger (Figure 3). HUC numbers are unique to prevent confusion when referencing a watershed. For example, 12 watersheds in Iowa are called "Walnut Creek," but each has a unique HUC number to distinguish it from the others.

Influences on Water Quality

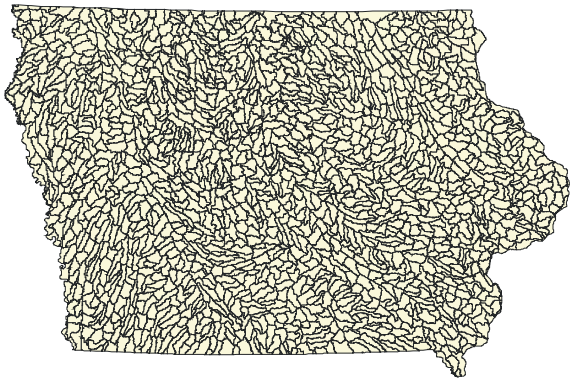
Many factors affect the quality of water in watersheds. Weather conditions, such as the amount, intensity and distribution of rainfall, all influence the quality of water in watersheds. Concentrations of nutrients (e.g. phosphorus), bacteria, pesticides and sediment loads can be much greater during heavy rainfall events. For example, one of the higher phosphorus levels recorded in Iowa was 20 mg/L at the English River in Washington County in May 2001 and was related to a heavy rainfall.



8-digit HUCs
56 basins
390.6 - 1,953 mi²



10-digit HUCs
408 basins
62.5 - 390.6 mi²



12-digit HUCs
1,662 basins
15.6 - 62.5 mi²

Figure 2. *Iowa divided into watersheds of varying sizes and shapes.*

The physical characteristics of a watershed, including geology, soil types, vegetation, topography and slope, also influence watershed water quality. Minerals contained in some rocks can dissolve in water and as a result, change the water's chemistry. Vegetation has been shown to remove certain chemicals from water. Pesticides and nutrients can adhere or stick to the surface of soils. Consequently the erosion of soils – which is dependent on soil type, topography and slope – can increase sediment load, turbidity, and concentrations of nutrients and pesticides in water. Data from Iowa's Ambient Water Monitoring Program indicate that landform regions in northwest and north-central Iowa have much higher levels of total dissolved solids and nitrate than any other region in the state.

Water quality is affected by land uses and human activities as well. Waste treatment and industrial plants can contribute nutrients, heavy metals and bacteria to streams. Runoff from agricultural lands can add sediment, nutrients, bacteria and pesticides to streams. Runoff from construction sites, lawns, parking lots and streets can add bacteria, heavy metals, nutrients and pesticides to streams.

Monitoring a Watershed

People monitor the water quality in watersheds for a variety of reasons. Some are interested in knowing the water quality of a local

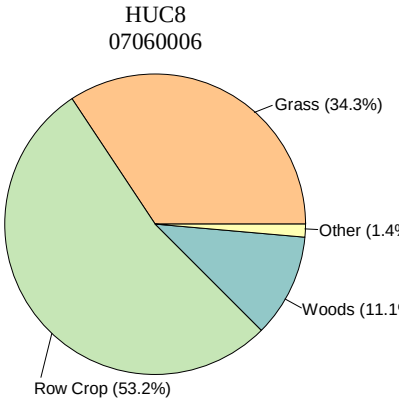


Figure 4. *Comparison of landus nested within a HUC8 watershed*

creek, stream or river to determine aquatic health. Others monitor to make sure industries are not polluting the water. Iowa's Ambient Water Monitoring Program is designed to describe and measure water quality geographically throughout Iowa and identify natural differences among watersheds and landform regions.

The goals of a monitoring program influence the size of a watershed to monitor. Land use, geology and vegetation are usually more variable in large watersheds compared to smaller watersheds (Figure 4). If the purpose is to document general nutrient concentrations in a stream, working within a large watershed is acceptable. If the goal is to show changes in water quality resulting from changes in land-use practices, working within a smaller watershed is preferred.

The first priority of the ambient program is to describe water quality geographically throughout Iowa. As a result, the program has focused on the larger 8-digit HUC watersheds, with sites distributed throughout the state on every major river. Future goals of the program include monitoring the smaller 12-digit HUC watersheds to gain insights on how changes on the landscape affect overall water quality.

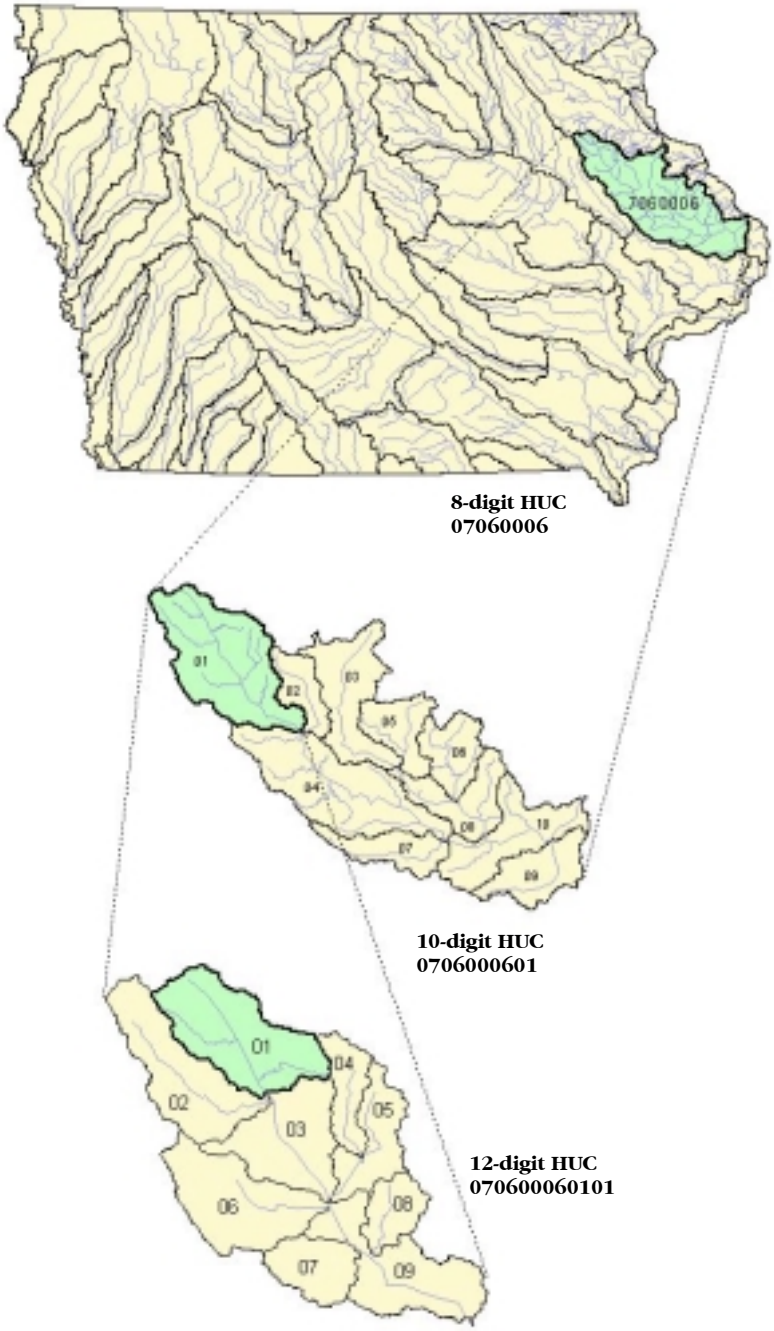
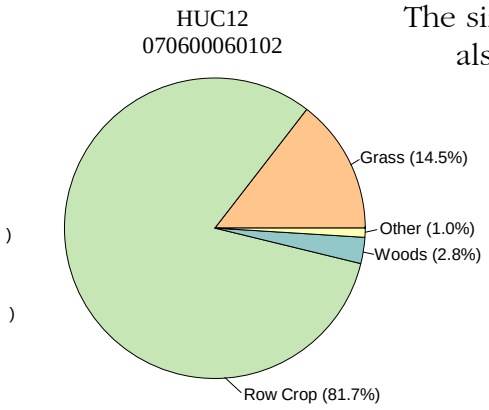


Figure 3. *Illustration showing how smaller HUC12 watersheds are nested within a HUC8 watershed.*

The size of a watershed also affects decisions on the appropriate sampling frequency. Rivers in



e percentages in a HUC12 watershed in the Maquoketa River basin.

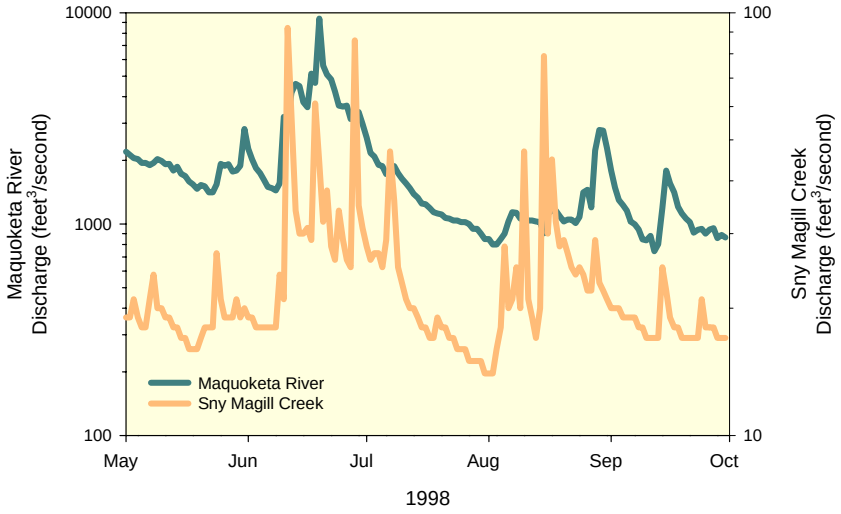


Figure 5. *Hydrographs showing stream response to weather. Located in northeast Iowa, Sny Magill Creek is a HUC12 watershed and the Maquoketa River is a HUC8 watershed. Note that discharges for both watersheds are plotted on different logarithmic scales. (Data from U.S. Geological Survey.)*

small watersheds react quickly to big storms, giving rise to flash floods (Figure 5). In these watersheds, a contaminant in the water can be present at low concentrations for most of the year, but will increase dramatically with the passage of a single storm. To truly understand how the watershed works, random, infrequent storm events need to be sampled.

Large watersheds do not react to a single, intense storm the same way small watersheds do. Rivers in large watersheds tend to rise – and then fall – slowly after prolonged rainfall. Therefore, sampling can be scheduled at more regular intervals without missing peak levels of contaminants. The ambient program visits the larger watersheds monthly to collect water quality samples, while smaller watersheds are sampled more intensively during rain events. Understanding the factors that affect watersheds, and therefore water quality in Iowa streams, is vital to improving how monitoring activities are conducted.

If interested in the sites monitored as part of the ambient program, visit the Web site at www.igsb.uiowa.edu/water. To learn more about watersheds, or to find out what monitoring groups are working in your local watershed, visit the U.S. Environmental Protection Agency's "Surf Your Watershed" Web site at www.epa.gov/surf/.

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Water Monitoring Program Web Site – www.igsb.uiowa.edu/water

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