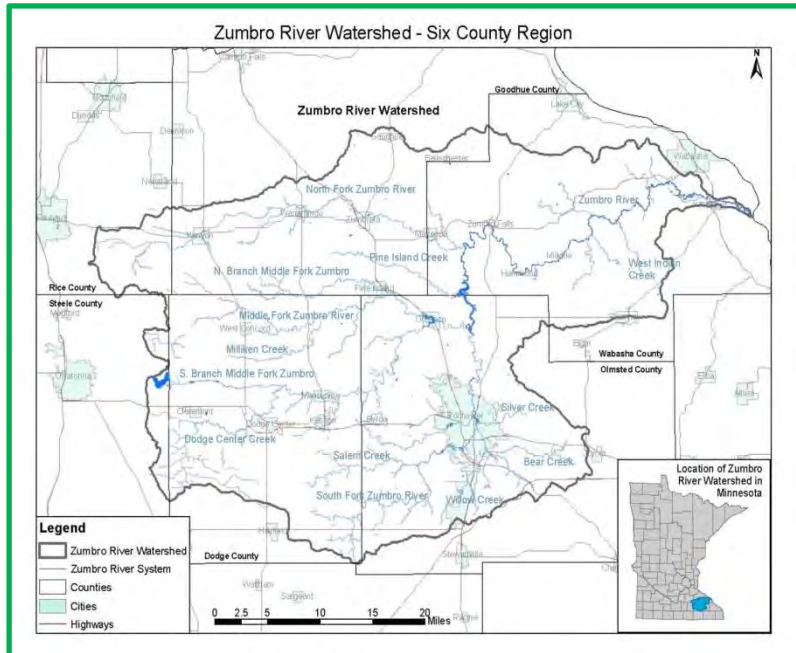


Chapter 3 - Rochester's Natural Water Features

With the exception of about 660 acres of the southern portion of the airport property, Rochester lies within the South Fork Zumbro River watershed. That means that everything that is left on the land surface in Rochester has the potential to be washed into the South Fork of the Zumbro River after each rainstorm or snowmelt.

A watershed is defined as all the land area that drains to a waterway. The boundaries of a watershed are based on topography. The highest elevations surrounding a water body become the boundaries or watershed divides. It is easy to

imagine how the Continental Divide in the Rocky Mountains can separate flow from the Pacific to the Atlantic Oceans, but even flatter areas like Rochester have divides. They are represented by the black watershed boundaries shown on the map above. The Zumbro Watershed drains about 297,000 acres



Source: Zumbro Watershed Partnership

Watershed Features



Source: www.rcc.nm.org/glossary/gl-watershed.html

and is made up of three smaller subwatersheds, one for each tributary: the South Fork, the Middle Fork, and the North Fork. A common misconception is that water flows from north to south, or from the top of a map to the bottom. That's not true. Water always runs downhill from divides; it does not follow a certain direction on a map. Look at the Zumbro River: it starts flowing from west to east, but then turns north before heading east again before it empties into the Mississippi River. These direction changes provide clues about how the glaciers formed our topography and the elevation changes in our watershed.



Mississippi River Basin

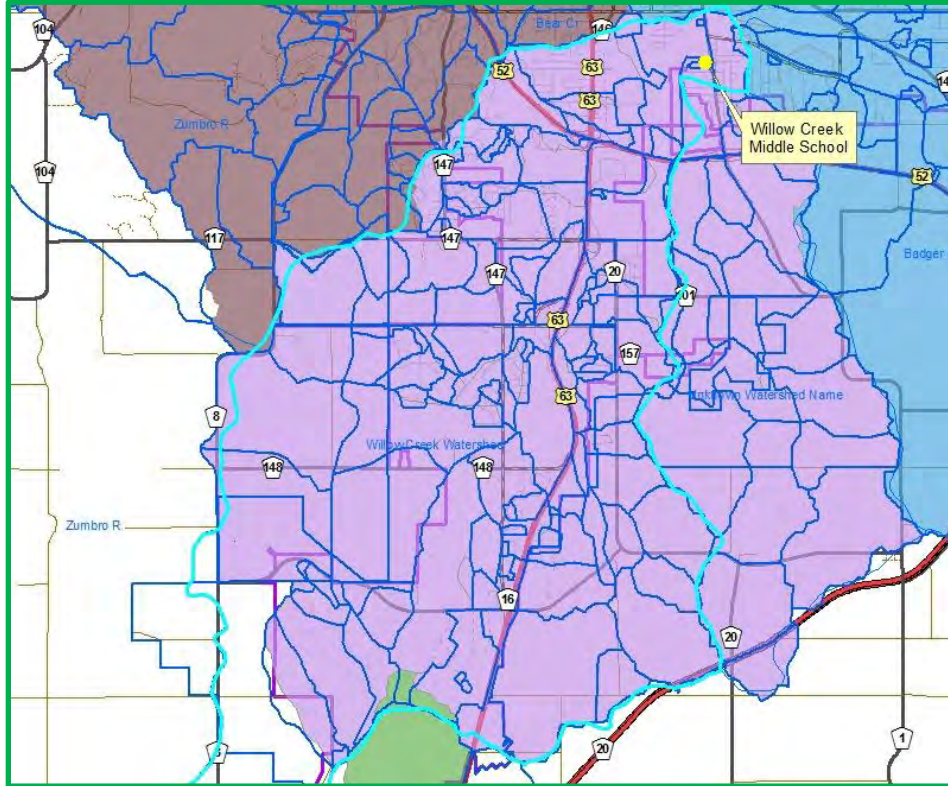


Source: <http://www.epa.gov/gmpo/lmrsbc/>

The Mississippi River flows south to the Gulf of Mexico. Imagine a water drop that fell in Rochester travelling all the way to New Orleans! Along the way, many tributary rivers join the Mississippi and each of those major rivers (like the Missouri, the Ohio and the Arkansas) has its own watershed boundaries, too. The Zumbro Watershed is part of the larger Upper Mississippi Watershed, which is part of the entire Mississippi River Watershed that covers such a large part of the U.S.

As you can see, watersheds can be defined as large or small areas. To understand how watersheds are nested within each other, let's look the Willow Creek Middle School and show how its watersheds fit together. (The maps below are from Rochester Public Work's Geographic Information System - GIS, which is a database that stores its storm water management information.) When rain falls onto the south half of Willow Creek Middle School, it flows to a small, on-site, private storm water management Pond (#229 in the picture below). The drainage area flowing to that pond is outlined by the royal blue watershed boundary. (Water falling on the north half of the school will flow directly to Willow Creek, without treatment.) There are dozens of the small (royal blue) watersheds within the watershed

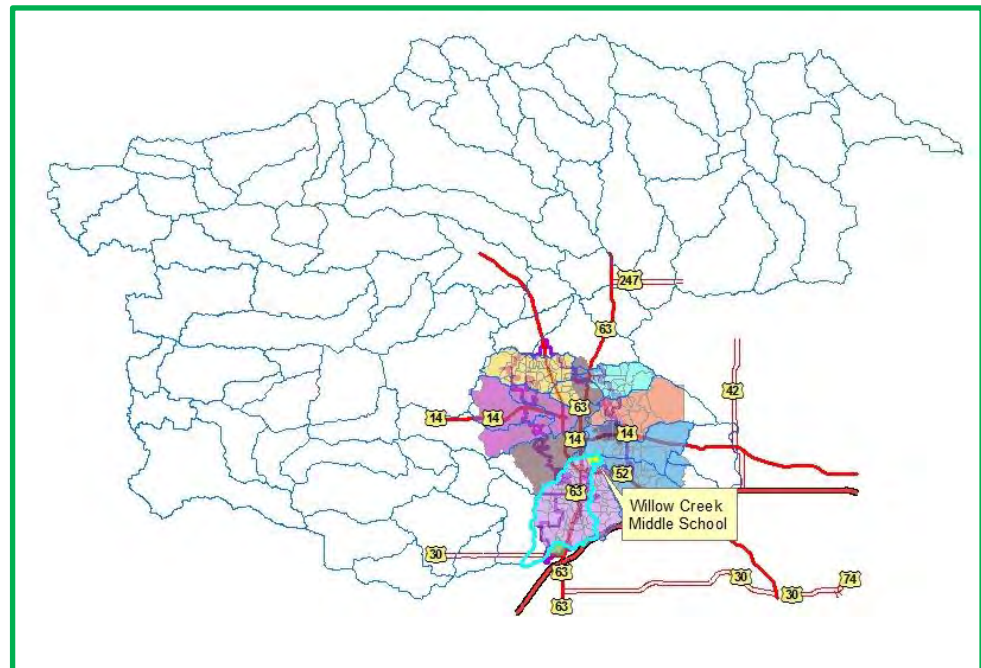




boundary for West Willow Creek (aqua blue boundaries).

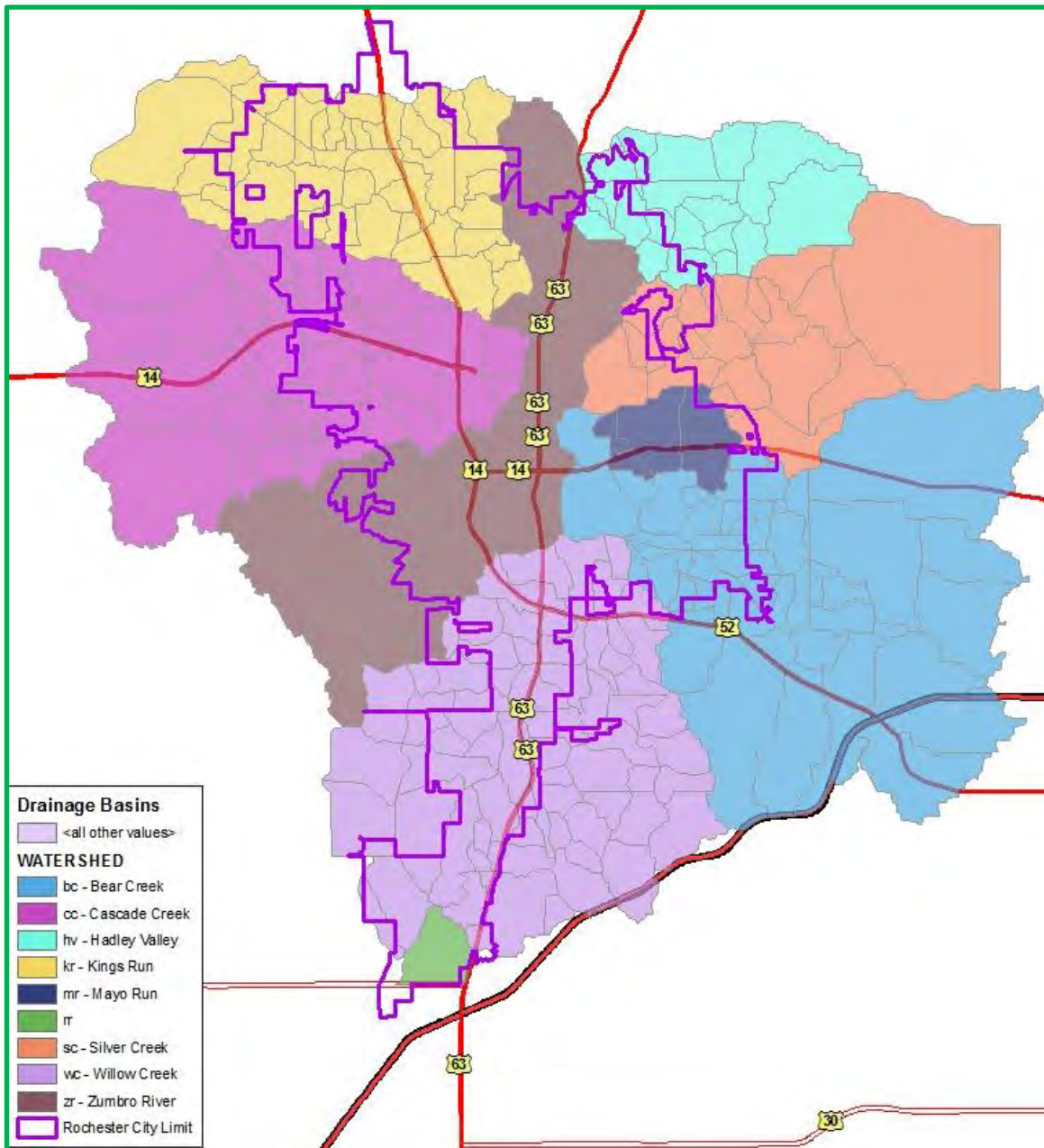
The West Willow Creek Watershed (aqua boundaries) together with the East Willow Creek Watershed forms the purple Willow Creek Watershed.

The purple Willow Creek Watershed is one of several watersheds in Rochester that are part of the Zumbro River Watershed – that is part of the Upper Mississippi River Watershed – that is part of the Mississippi Watershed. All water is connected!





Which watershed (or drainage basin) do you live in?



The EPA has a website that stores data about watersheds. To find out more information about the Zumbro Watershed, check out their link http://cfpub.epa.gov/surf/huc.cfm?huc_code=07040004



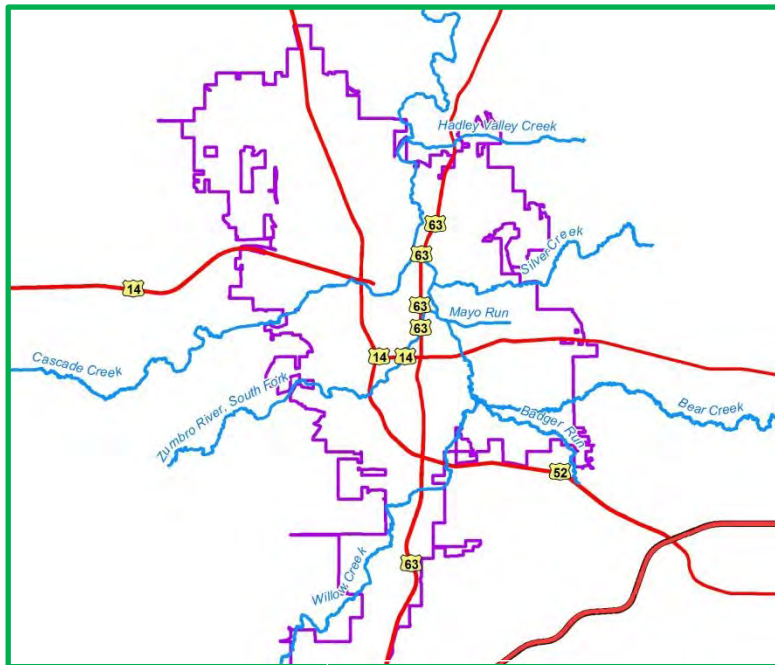
Zumbro River & Tributaries

Rochester was built in a river valley formed by the South Fork of the Zumbro River and its tributaries. Several creeks join the Zumbro River within the City limits, starting from the south and working clockwise: Willow Creek, Cascade Creek, Kings Run Creek, Hadley Creek, Silver Creek, Mayo Run, and Bear Creek. Not all rivers and streams carry water all the time. Those that always have water are called perennial streams, while those that don't are intermittent streams. Badger Run is a small tributary to Bear Creek and Quarry Hill Creek is a tributary to Silver Creek. They are examples of intermittent streams. Just because a stream is small does not mean it will be intermittent. Mayo Run has a constant water supply from hillside discharges and wetlands.



Intermittent means starting and stopping at times, so an intermittent stream is wet and dry at different times

Rochester Rivers



Source: Rochester Public Works

For current data about the flow of the Zumbro River through Rochester, go online at http://waterdata.usgs.gov/nwis/uv/?site_no=05372995&PARAMeter_cd=00065,00060,00062,72020 .



Wetlands

Early settlers to the region quickly learned that the native prairie lands had excellent soil for farming. They also discovered what historical documents refer to as “unimproved lands”. The reference referred to steep hillside slopes and to wetlands that could not be plowed. In the Rochester area, wetlands are found both along the rivers and on hillside edges. Developers also thought the wetlands had little value, so they were commonly filled in so they could be built upon.

Today, we better understand the value of wetlands. Wetlands are natural filters and sponges. They serve as barriers that protect our rivers and lakes from polluted surface water. They are able to hold large amounts of water and slow running water during large rainfall events, thus prevent flooding. During droughts, wetlands can release water to maintain stream flow and may help recharge of underground water supplies. Wetlands provide wildlife habitat. Now there are federal, state and local laws that protect all these wetland values: Section 404 of the federal Clean Water Act, the Minnesota Wetland Conservation Act, and the City’s Wetland Conservation Ordinance Ch. 59A. Wetland regulations alone are complicated, but because they are also related to other types of water regulations and involve several governmental agencies. Water law is very complex.

Wetlands can be harmed by pollutants, such as excess sediment and nutrients. Changes in hydrology can also impair wetlands. Invasive species can also destroy native wetland habitat. In Minnesota, the majority of the state

has lost about half of its original wetland habitat. Some counties filled in up to ninety percent of their wetlands before Minnesota laws were enacted in 1991. Local governments did not start dealing with wetland

Wetland at Autumn Ridge Church



Source: Deb Las

regulations until 1993. Neither Rochester nor Olmsted County has calculated the loss of original wetland acres within their boundaries. In urban areas, wetlands can no longer be destroyed in any way unless there is an approved plan in place to replace the lost acres with twice as many wetland acres nearby.



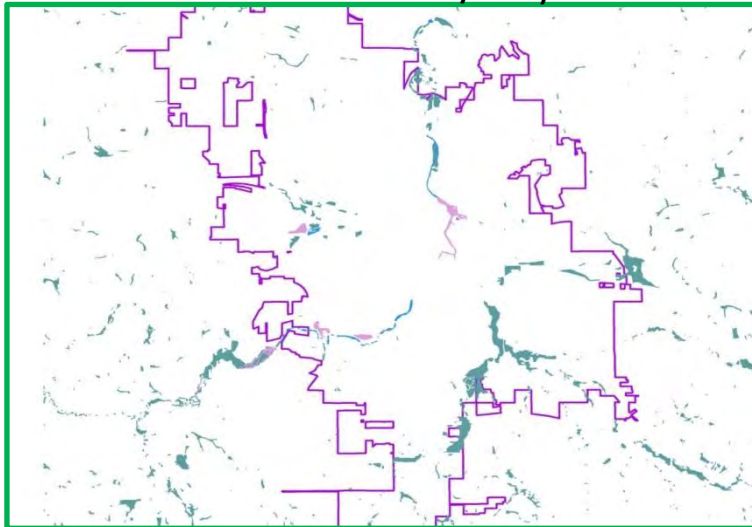
Wetlands are highly variable. They can range from an open water wetland to land that is dry part of the year. There are three things that all wetlands have in common: hydric (wet) soils, standing water or saturated soil for part of growing season (hydrology), and plants that like wet conditions (vegetation). If only one or two of those characteristics are present, the area is not classified as a wetland.

Several different classification systems are used to describe the different types of wetlands. Two commonly used systems are the Circular 39 system and the Cowardin system, both developed by the U.S. Fish and Wildlife Service. The Circular 39 system divides Minnesota wetlands into 8 types. The Cowardin classification system expands on this by creating sub-classifications that can be used to classify sub-portions of a wetland. To learn more about wetlands and see 7 of Minnesota's 8 wetland types, visit Cascade Meadow Wetlands & Environmental Science Center (2900 19th St NW).

Wetland Types Found in Minnesota

1. Seasonally Flooded Basins or Floodplains
2. Wet Meadows
3. Shallow Marshes
4. Deep Marshes
5. Open Water Wetlands
6. Shrub Swamps
7. Wooded Swamps
8. Bogs(only this type can't be seen in Rochester)

Rochester's NWI Wetlands as of 8/2000



Source: Rochester Public Works

The U.S. Fish and Wildlife Service has been producing wetland maps and geospatial wetland data for the United States since the mid-1970s. Their inventory is called the National Wetland Inventory (NWI) and it classifies wetland into three groups: lacustrine, palustrine, and riverine depending on whether the wetlands were likely formed in a lake setting, a floodplain, or river setting. The NWI is good starting point to determine whether wetlands may be present on a parcel of land. To learn more, go to: www.fws.gov/wetlands/NWI/index.html.



Fens

Fens are wetlands that are primarily fed by groundwater instead of surface water. Calcareous fens are a type of fen containing unique plant species that have adapted to soils that are rich in calcium and magnesium bicarbonates. Calcareous fens are the rarest wetland plant community in Minnesota (and also one of the rarest in North America) and they are specially protected as Outstanding Resource Value Waters by state law. Within Rochester, there are five known calcareous fens that have been identified by the Department of Natural Resources (DNR). There are also similar wetlands at other locations that may be calcareous fens, but those have not undergone classification by the DNR. In Rochester, calcareous fens are most commonly located on shallow terraces within the Decorah Edge geologic setting, but they are also found where groundwater discharges from glacial till deposits.

- Rochester’s Calcareous Fens:**
- 1) High Forest 15 (by the airport)
 - 2) Marion 8 (SE Rochester)
 - 3) Joyce Park (SE Rochester)
 - 4) Rochester 23 (SW Rochester)
 - 5) Haverhill 19 (NE Rochester)

Haverhill 19 Calcareous Fen



Source: Deb Las

Check out the Calcareous Fens Fact Sheet: www.bwsr.state.mn.us/wetlands/Calc_fen-factsheet.pdf

The Decorah Edge is a group of bedrock formations (the Decorah, Platteville, and Glenwood shale layers), that create an impermeable layer between the upper Galena Limestone layer and the lower St. Peter sandstone layer. Water can move downward through the upper permeable rock unit until it reaches the shale layers. There the water can only move downward through the shale very slowly. But the water can also move more quickly along the top of the shale until it reaches a hillside or road cut. The Zumbro River and its tributaries carved a valley through the rock layers surrounding Rochester, so there are many hillsides



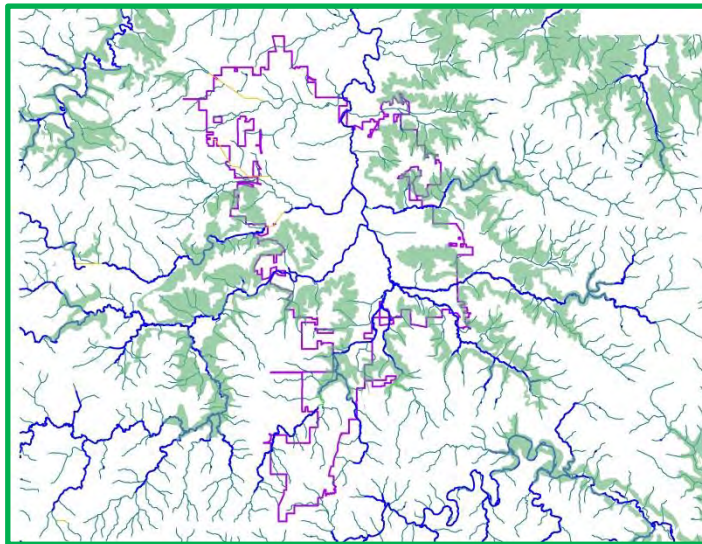
A seep is a moist place where groundwater reaches the surface.



where the shale is exposed and groundwater can discharge. Not all hillsides experience discharge, but where discharges occur, they can be in the form of focused discharge (springs) or diffuse discharge (seeps). A study by the US Geological Survey (USGS) has shown that a hillside fen can take up excess nitrogen from the Galena aquifer before it is recharges the St. Peter aquifer, thereby protecting our water supply.

The Decorah Edge (shown in green on the following map) surrounds much of the City (City limits shown in purple). The Minnesota Geological Survey (MGS) has done many studies to learn about groundwater recharge in the Rochester area. They have learned that 50% of the groundwater recharge comes from the Decorah Edge area. Together, the MGS and USGS point to the importance of protecting hillside wetlands in Rochester.

Decorah Edge



Source: Rochester Public Works

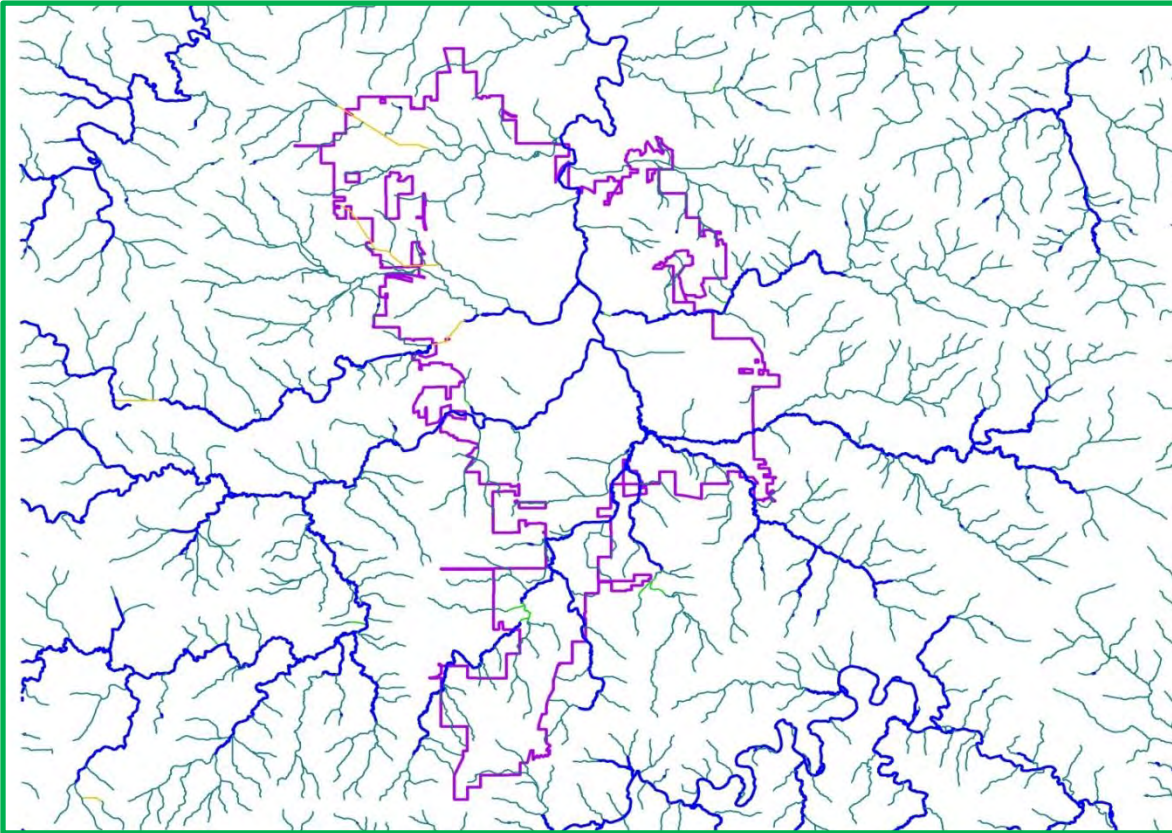
The other important natural water feature in Rochester is groundwater. It is discussed in Ch. 1 (Water Cycle and Geology) and in Ch. 5 (Water Supply).



Case Study: Watersheds

Try drawing your own watershed boundaries. The map below shows the Zumbro River and its tributaries. Draw lines around the streams to outline the divides and color in the watersheds. (An answer key is provided on the next map). The City limits are outlined in purple. Students should be reminded that water flows downhill from divides and the divides separate watersheds.

Rochester's Watersheds



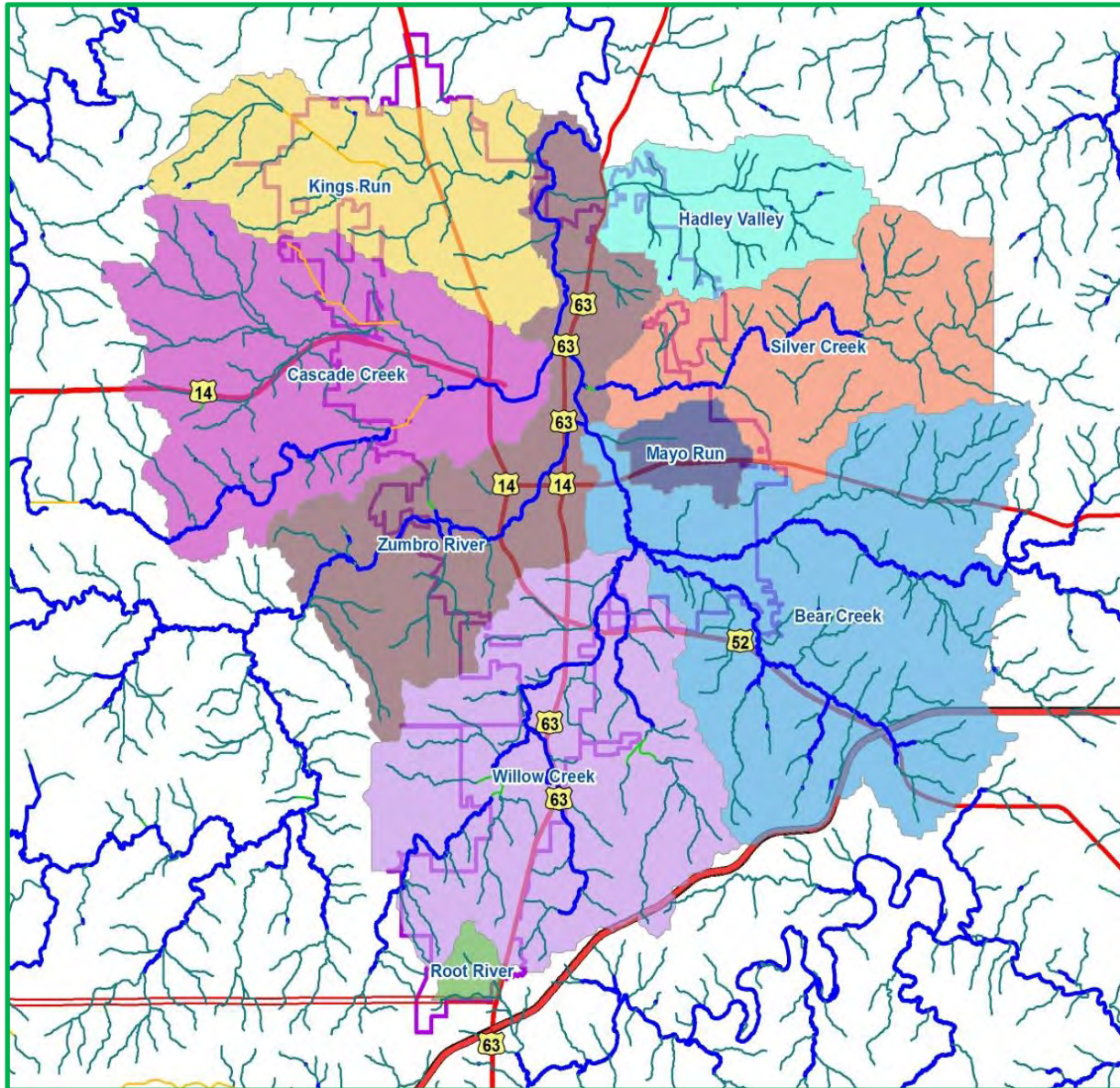
Source: Rochester Public Works

Part 1 Questions:

- 1) Compare your map to that of others and the suggested answer key. Do they match exactly?
- 2) What are the differences?
- 3) Where are the higher elevations on the map? How can you tell?
- 4) Where are the lower elevations on the map? How can you tell?
- 5) Select a random point on the map. With your finger, follow the flow of water across the map. Where do you end up?



Answer Key - Rochester's Main Watersheds



Source: Rochester Public Works

Part 2 Questions:

1. Which of Rochester's smaller watersheds is your school in?
2. What is the shortest distance from your school to the river or creek that drains your watershed?