

IMPLEMENTATION: GEOLOGIC CONTEXT

There are many geomorphic regions (landforms) of Crow Wing County, all which were formed by various glacial actions which led to the surficial geology of today's landscape. Glacial deposits on the landscape can generally be sorted into two categories: *till* (heavier loams and clay soils that were deposited directly by the glacier) and *outwash* (sands & gravels deposited by flowing glacial melt water).

A map showing the generalized surficial geology of Crow Wing County (by minor watershed is included on the next page). The Crow Wing County Geologic Atlas (incorporated here by reference) provides a more detailed explanation of the surficial geology of the County (Plate 3) that includes an explanation of the glacial advances and resulting deposits in the area.

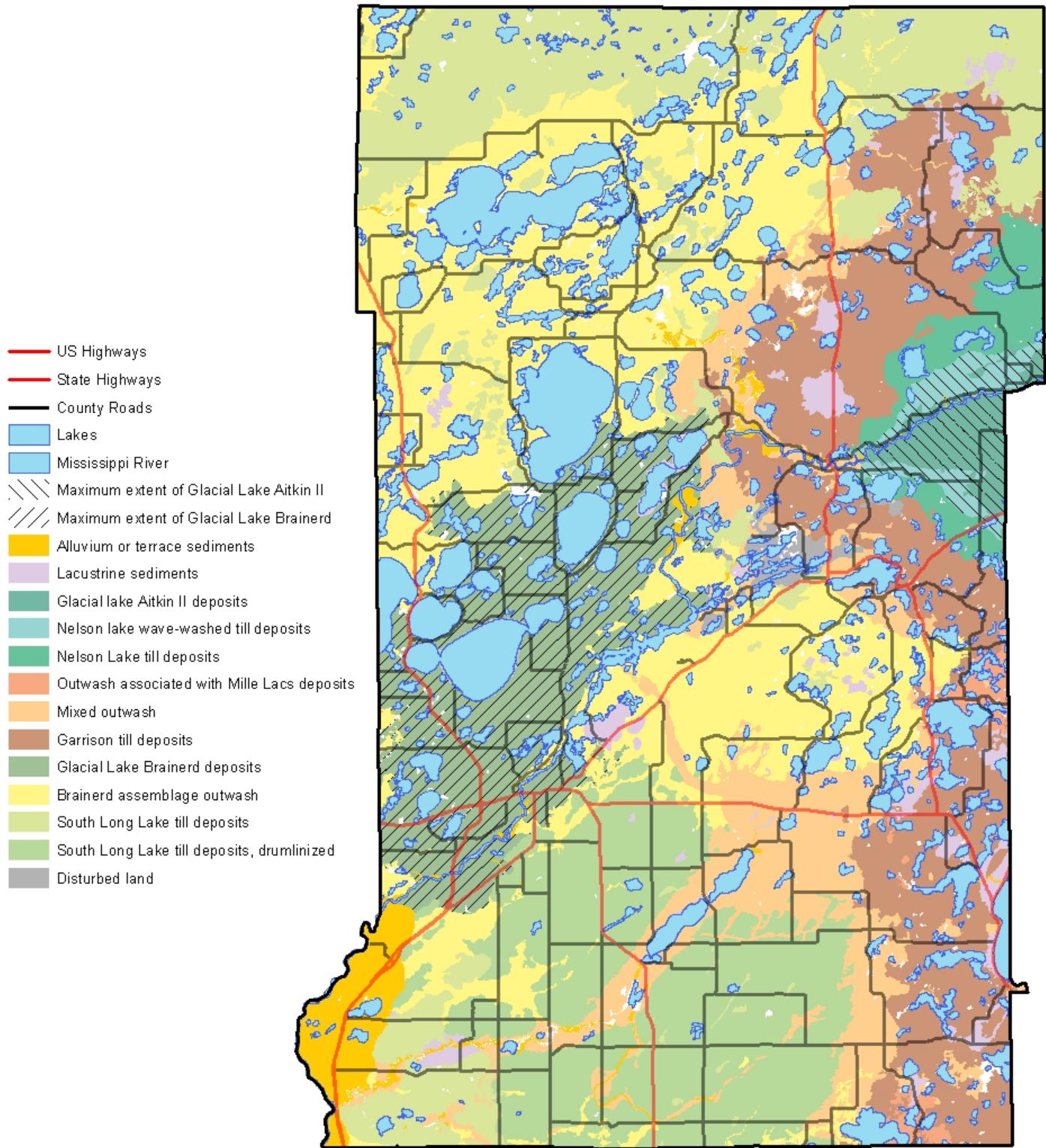
Geomorphology and surficial geology are critical drivers of watershed health for a number of reasons. Crow Wing County is blessed with a large amount of outwash areas that allow better infiltration for both groundwater recharge and stormwater management than till. However, these areas are also more erodible and can also be more difficult to stabilize. The heavier till soils shed more water and when eroded can contribute sediment further downstream.

The two old glacial lakebeds found in Crow Wing County are generally fairly flat and have groundwater near the surface, which has led to flooding / drainage issues in the past.

Also present in the southwestern part of Crow Wing County are flat, sandy / silty areas along the Mississippi River. These are old terraces were deposited by the glacial Crow Wing River as it brought sediment from the meltwater of the retreating Des Moines lobe that originally broke through the St. Croix Moraine in the Pillager area.

The relationship between geomorphology and stream characteristics, forest cover, and watershed storage (lakes & wetlands) in relation to peak flow events, such as spring snow melt and high rain events is significant. Retired US Forest Service Hydrologist, Sandy Verry, has provided a model for determining risk from these peak flow events based on the amount of forest cover and watershed storage for excessive water during these events. This is included in figures 45 and 46 of this plan.

Figure 17. Surficial Geology



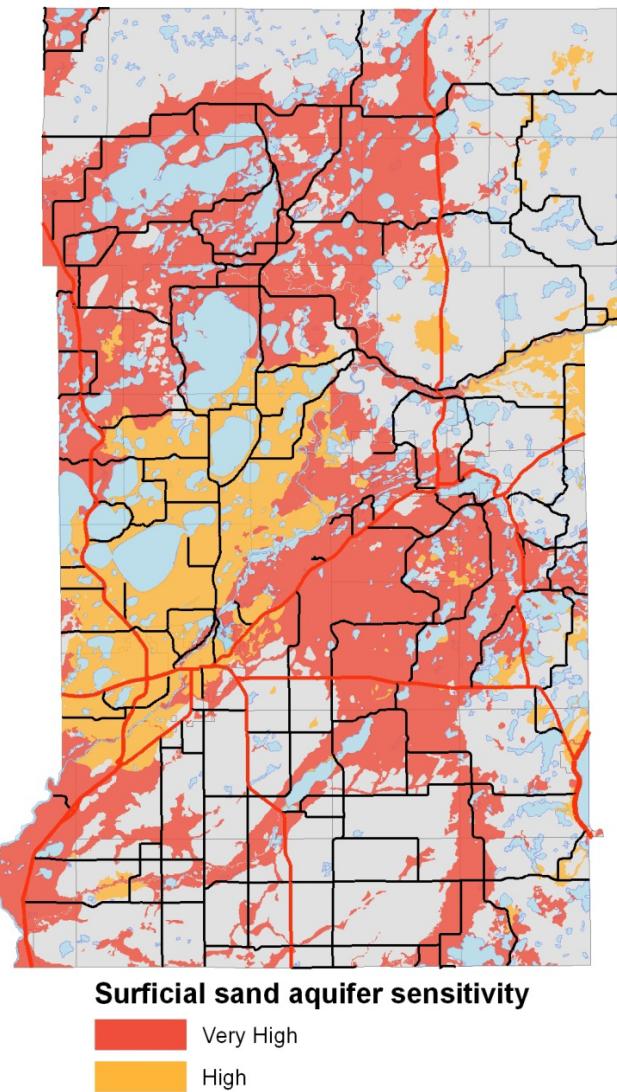
IMPLEMENTATION: GROUNDWATER

Outwash areas with a surficial geology of sands or gravels are the most critical areas to focus on in terms of both groundwater recharge and potential contamination. Many residents rely on this surficial aquifer for their source of drinking water. Since there is a direct connection from the surface to this aquifer, any contamination from human uses at the surface could have a direct effect. In addition, any disruptions to the recharge capacity of this aquifer could affect water levels in the groundwater and lakes / streams. See Figure 17 below for a map showing this surficial aquifer as well as its relatively sensitivity to contamination.

Nitrates

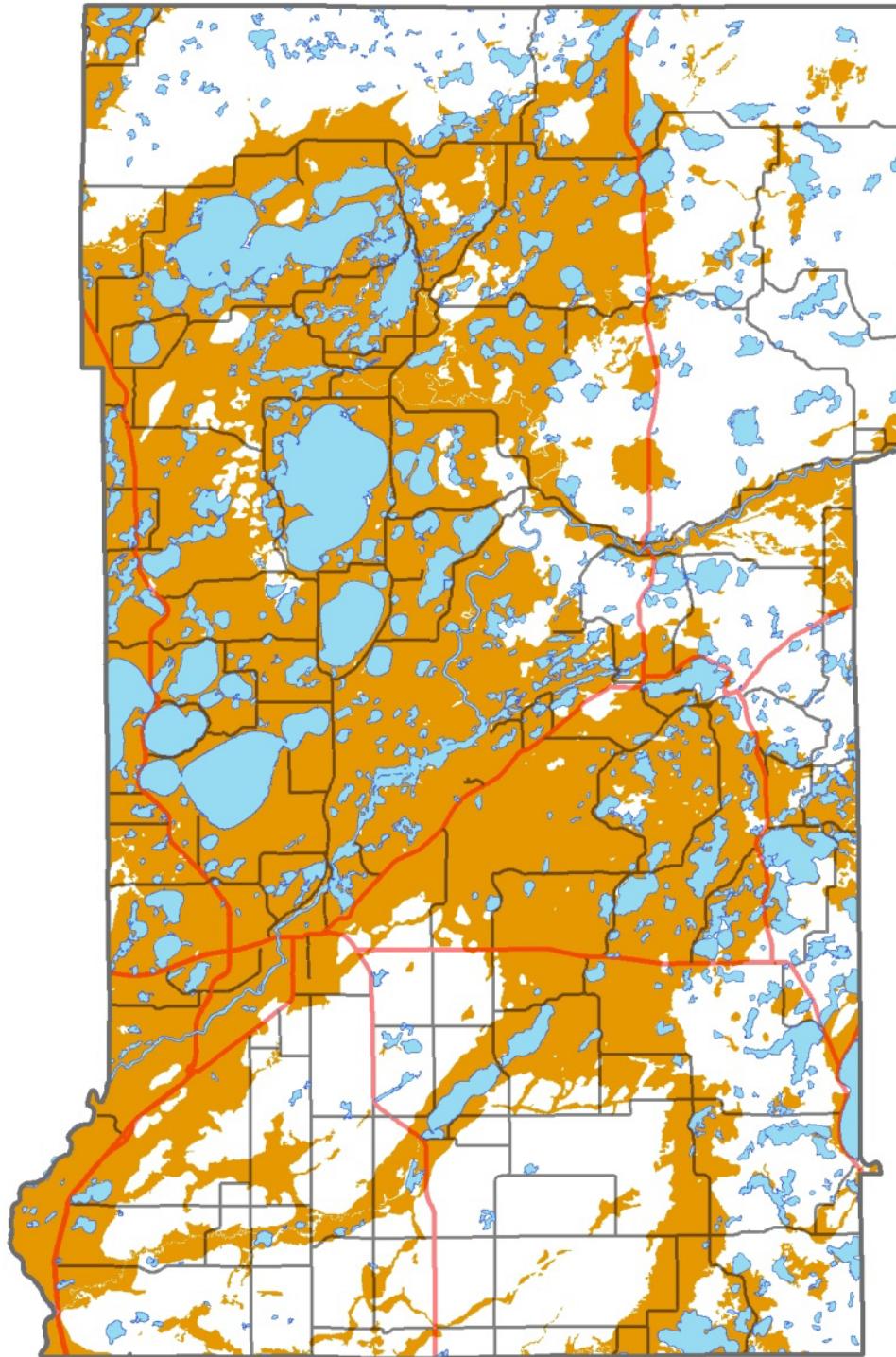
While all agricultural areas have some potential to contribute to elevated nitrate levels in the groundwater, the County is generally more focused on nitrates in agricultural areas that have a sandy aquifer at the surface and also a high number of landowners with wells in these areas. Fortunately, to date, only one area (south of Brainerd/Baxter) has been identified as having nitrate issues. Additional testing by Crow Wing County and the Department of Agriculture is currently being conducted.

Figure 18. Surficial Aquifer Sensitivity



These areas with sandy soils at the surface are important focus areas for proper septic system maintenance. Wellhead protection and drinking water source areas in these sandy soils are also especially critical to focus on. Below is a map showing generalized septic and wellhead protection priority areas:

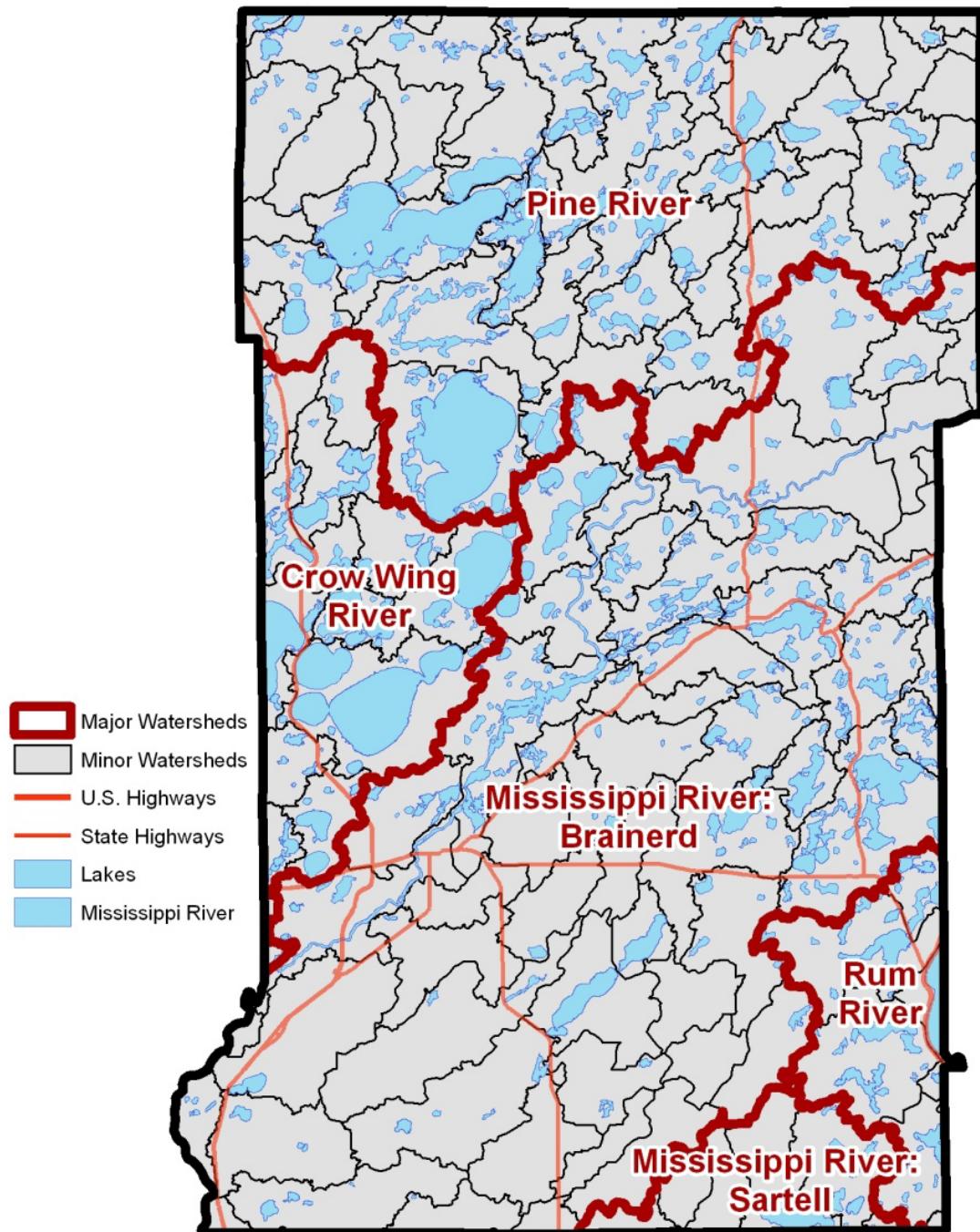
Figure 19. Groundwater Sensitivity Areas (Septic Systems & Wellhead Protection)



IMPLEMENTATION: WATERSHED APPROACH

Crow Wing County has parts of 5 of the 81 major watersheds in the State of Minnesota. Each major watershed is divided into a number of smaller, minor watersheds that collectively contribute water to the major watershed. Crow Wing County has portions of 125 minor watersheds within the County with 70 being solely within the County.

Figure 20. Watersheds in Crow Wing County



Developing water resource protection strategies within a watershed context is a logical, scientific approach because it acknowledges what water users have known for years: that upstream activities affect those downstream. Although a major watershed can be analyzed and modeled, it is difficult to manage since they typically cross municipal, county, and/or state boundaries. Planning at the minor watershed level is much easier because trends and priorities are easier to determine and cause-and-effect relationships are more readily identifiable. Implementation is also easier since many minor watersheds are within a single jurisdiction and strategies can be better targeted and designed for optimal success and cost efficiencies. This approach will in turn ultimately result in a healthy major watershed in the most efficient manner.

For this plan, Crow Wing County took readily available spatial data that related to the County's Priority Concerns from various local, state, federal sources, and non-governmental sources and summarized it by minor watershed. Each data component was sorted individually from highest to lowest and mapped accordingly. In addition, top ranked or highly occurring elements were identified and used to craft specific targeted implementation strategies in the watersheds where they occurred, such as a focus on agricultural BMPs in a watershed with a high number of animal units or a focus on development in high population areas.

The MPCA is also conducting assessments of all of these major watersheds on a 10-year cycle. This intensive watershed monitoring schedule will provide comprehensive assessments of all of the major watersheds on a ten-year cycle. This schedule provides intensive monitoring of streams and lakes within each major watershed to determine overall health of the water resources, to identify impaired waters, and to identify those waters in need of additional protection to prevent future impairments. Biology, chemistry, and fish contaminant information is collected and analyzed. Based on results of intensive watershed monitoring, MPCA staff and its partners conduct a rigorous process to determine whether or not water resources meet water quality standards and designated uses. Waters that do not meet water quality standards are listed as impaired waters. Based on the watershed assessment, a TMDL study and/or protection strategy is completed. In Crow Wing County, the MPCA has begun work on the Crow Wing River Watershed (which includes Gull Lake and its tributaries) and the Pine River Watershed (which includes the Whitefish Chain). At this time, complete monitoring data is only available for the Crow Wing River Watershed. The remainder of the County will be monitored and assessed by the next revision to the water plan in 2023.