Chippewa County Groundwater Study

Preliminary Findings – Spring 2014

This 5-year groundwater study was commissioned in mid-2012 by Chippewa County to evaluate the impacts of industrial sand mines and irrigated agriculture on the county's water resources. The Wisconsin Geological and Natural History Survey (WGNHS) and the U.S. Geological Survey (USGS) are conducting the research and developing a tool, a groundwater flow model, to evaluate the impacts of changing landscapes and changes in groundwater pumping on groundwater resources in western Chippewa County both today and into the future. This document provides a brief overview of preliminary findings through the spring 2014 by both the Chippewa County Department of Land Conservation & Forest management (LCFM) and researchers at the WGNHS and USGS.

Materials and information about the study, including this document, are regularly posted to the Chippewa County website as they become available. To learn more go to ***co.chippewa.wi.us/lcfm*** and click on the tab ***Chippewa County Groundwater Study***.

Findings from Chippewa County Department of Land Conservation & Forest Management:

- In Chippewa County there are 26 monitoring wells at 5 mine sites with groundwater elevations being recorded once every three months and one mine site recording elevation once every 30 minutes. There are 5 high-capacity wells at three mine sites with monthly recording of pumping volumes. There are 2 weather stations at 2 mines with hourly recording.

- The on-site groundwater monitoring wells provide a new source of data. This data has allowed for the development of new water table maps for each industrial sand mine site. These maps reflect conditions at a finer scale than the county-wide 1 to 100,000 scale water table map published by the WGNHS in 1988.

Findings from the Wisconsin Geological and Natural History Survey and U.S. Geological Survey

- There are 3 stream gauging stations with continuous monitoring for stream depth, flow, temperature, and specific conductivity. Here are web links for each gaging stations as maintained on the U.S. Geological Survey website:
  - Como Creek tributary: http://waterdata.usgs.gov/wi/nwis/nwisman/?site_no=05364422
  - Trout Creek at CTH DD: http://waterdata.usgs.gov/wi/nwis/nwisman/?site_no=053674962
  - Trout Creek at 10th St: http://waterdata.usgs.gov/wi/nwis/nwisman/?site_no=053674967

- Based on compilation of approximately 915 water well records within the study area, the water table in western Chippewa County largely lies within the unconsolidated sand and gravel aquifer or within the Eau Claire and Mt. Simon bedrock formations. In some locations, the water table intersects the base of the Wonewoc Formation. The Tunnel City and most of the underlying Wonewoc Formations are above the water table in most of the study area. The groundwater flow model will ultimately integrate and simplify the stratigraphic and hydrologic data in order to simulate the water table in the study area.

- The same set of 915 well records was used to determine depth-to-bedrock and depth-to-Precambrian "basement" rock within the study area. These surfaces are important because they form the upper and lower boundary, respectively, of the bedrock aquifer system. The sand and gravel aquifer is defined by the land surface elevation and the top-of-bedrock.

- The elevation of the top-of-Precambrian surface ranges between 650 to 850 feet above sea level across the study area. The top-of-Precambrian surface generally dips to the southwest at roughly 15ft per mile across the study area.

- High-resolution borehole geophysical logs collected from three wells in the study area provide depths of the contacts between the Wonewoc, Eau Claire, and Mount Simon Formations. This data source identifies regionally extensive silt- or shale-rich lithofacies within the Eau Claire and Mt. Simon sandstones. Spinner flow meter logging provided evidence of higher groundwater flow within sandy intervals and lower groundwater flow within the silt- or shale-rich intervals.

- Based on records provided by the Wisconsin Department of Natural Resources in mid-February 2014, there are 57 high-capacity wells in the study area. Of these, approximately 5 are used for industrial sand mining or sand processing. About 31 high-capacity wells are used for irrigation or farm operations, and 6 high-capacity wells are used for municipal water supply. The remaining 15 wells are either for domestic supply or other uses. A high-capacity well is defined by Wisconsin regulations as a well that has an approved pump capacity of 70 or more gallons per minute, which is equivalent to 100,800 or more gallons per day.

- In the study area the amount of water used annually by an agricultural or municipal high-capacity well can vary by tens of millions of gallons, but is generally near 20 million gallons. By comparison, the annual water use by high-capacity wells at sand mines varies significantly from year to year and from site to site depending on natural conditions and water use efficiency. During 2012 and 2013 pumping rates ranged from less than 20 million gallons per year up to 95 million gallons per year per well. The patterns of water use vary throughout the year depending on the user's needs. While irrigation wells pump primarily during the growing months from May through September, wells at sand mine wash plants pump up to 10 months out of the year, depending upon the weather. Municipal wells pump year round to meet the needs of urban users.

- Precipitation, defined as the sum of rainfall and the water equivalent of snowfall, in the study area ranged from 17 to 44.5 inches per year from 1950-2012, with an average of 31 inches per year. Preliminary estimates of recharge indicate that about 27% of precipitation in the study area recharges the groundwater system. Based on the climate record from 1950 to 2012, preliminary estimates of annual average recharge varied from a minimum of 3 inches per year to a maximum of 15 inches per year. This is the recharge estimate for a year, averaged over the study area.

- Each year, recharge rates vary *within* the study area, as a function of soil type, land surface slope, and land cover. The water table in some areas typically receives more recharge than other areas. These preliminary estimates suggest that most of the landscape in the study area receives 4 to 16 inches of groundwater recharge in a typical year.