U.S. Geological Survey (USGS)

Minnesota District

Quarterly Project Progress Report

Quarter ending 31 March, 2012

April 16, 2012

Project Name: Characterizing Groundwater and Surface-Water Interactions in White Bear Lake, Minnesota

Project Number: NQ00EHR Begin Date: March 2011 End Date: September, 2012

Project Chief: Perry M. Jones

Cooperator: White Bear Lake Conservation District (WBLCD) and Minnesota Pollution Control Agency (MPCA)

Objective

The primary objective of this study is to characterize groundwater and surface-water interactions in White Bear Lake and the response of lake water levels to changes in precipitation and groundwater flow conditions.

Progress During This Quarter

The project chief will work with USGS hydrologists to complete the analysis of collected water-quality and hydrologic data. A draft of the introduction and methods section of the final report were completed. The amount of lake water outflowing from White Bear Lake to buried glacial and bedrock aquifers was determine from two water balances, one in March 2011 and one in August 2011, calculated for the lake. The residual from these water balances were considered to represent the amount of lake water outflowing to the buried glacial and bedrock aquifers. Groundwater level, precipitation, evaporation, and lake-level data collected by the USG and Minnesota Department of Natural Resources (MDNR) during those months was used in the analysis. The water balance analyses of White Bear Lake in March and August 2011 indicate a total monthly outflow leakage of 0.23 and 4.38 inches, respectively, from the lake to local buried glacial and bedrock aquifers. Increasing hydraulic gradients between the lake and the underlying aquifers, particularly in summer during peak groundwater withdrawals, may be increasing lake water outflow to local aquifers and contributing to a new lower mean lake stage.

The following meetings and presentations were held or given to inform cooperators, local government officials, and the general public of the results from the study.

* On January 20, the project chief informally met with members of the Town of White Bear board to discuss results from the study and water-quality results with the White Bear Township municipal wells.
* On February 10, the project chief gave a brief update on the groundwater/surface-water interactions study of White Bear Lake to U.S. Representative Betty McCollum, Mayor Jo Emerson, the city of White Bear Lake, and other representatives for the city of White Bear Lake.
* On February 14, the project chief, Jared Trost, Jennifer Bode, Mindy Erikson, Don Hansen and Jim Stark, Minnesota Water Science Center, met with representatives from the Minnesota Pollution Control Agency (MPCA), MDNR, Minnesota Department of Health, and Minnesota Board of Water and Soil Resources to brief the leaders of these agencies regarding key findings of the groundwater/surface-water interactions study of White Bear Lake.
* On February 21, the project chief and Jared Trost, Minnesota Water Science Center hydrologist, presented results from the study to the general public at White Bear Lake Conservation District monthly meeting. Approximately 150 people were present at the meeting and asked a variety of questions and concerns associated with the study results and possible explanations for the lower water levels in White Bear Lake. The presentation was posted on the USGS Minnesota Water Science Center web page (<http://mn.water.usgs.gov/index.html> under Current Issues: White Bear Lake Project in the News) and the White Bear Lake Conservation District web page (<http://wblcd.org/>).
* On March 9, the project chief met with the city of White Bear Lake Chamber of Commerce and local business people to discuss the results of the study and potential solutions to the low water levels in White Bear Lake.
* On April 5, the project chief met with members of the city of Shoreview, Lake Regulations Committee to discuss results from the White Bear Lake study and water levels in lakes in the city.
* On April 10, the project chief, Jared Trost, and Jim Stark, Minnesota Water Science Center, met with board members of the Turtle Lake Home Owners Association to present results from the White Bear Lake groundwater/surface-water interaction study and discuss further work in assessing groundwater/lake interactions in the NE Twin Cities Metropolitan Area.
* On April 11, the project chief presented results from the White Bear Lake groundwater/surface-water interaction study to board members of the Rice Creek Watershed District and discuss further work in assessing groundwater/lake interactions in the NE Twin Cities Metropolitan Area.

Several newspaper and television interviews were given highlighting results from the study.

* Between February 10 and 21, the project chief was interviewed by the White Bear Press, the St. Paul Pioneer Press, Minnesota Public Radio, and KSTP-TV outlining the results of the groundwater/surface-water interactions study of White Bear Lake (<http://mn.water.usgs.gov/index.html>).
* On March 5, the project chief was interviewed by Bill Hudson, WCCO-TV, regarding findings from the USGS cooperative study of groundwater/surface-water interactions at White Bear Lake (<http://minnesota.cbslocal.com/2012/03/05/white-bear-lakes-low-water-levels-linked-to-tap-water/>).
* On March 14, the project chief met with Pat Sweeney, Freshwater Society, to discuss results from the White Bear Lake study in preparation of a news article to appear on the Freshwater Society web page.
* On April 4, the project chief was interviewed by Tom Snell, Executive Director, White Bear Lake Chamber of Commerce, on the Government Television Network GTN 16 program “Your Business Matters” regarding results from the groundwater/surface-water interactions study conducted on White Bear Lake and potential solutions to the low water levels in White Bear Lake (<http://www.youtube.com/watch?v=uqUA-G8vG-U&feature=player_embedded>).

On February 28, the project chief and Jared Trost presented the results of his recent work at White Bear Lake, MN at the Minnesota Geological Survey Seminar Series. This recent study defined the groundwater/surface water interactions and the effects of municipal pumping on lake levels in the northeast suburbs of St. Paul, MN.

Problems

None.

Plans for Next Quarter

The project chief will work with USGS hydrologists to complete a draft of the final report for the project. The draft report will be sent for colleague review following supervisory approval. The project chief will address colleague review comments and send draft figures and text to the USGS Publishing Service Center for editing and review.

Significant Results Since Last Reporting Period

Analysis of covariance of annual data indicates that the relation between annual lake level variation and annual precipitation was significantly different from 2003 through 2011 compared with 1978 through 2002, indicating an average of 4 additional inches of precipitation per year needed to maintain the lake level between 2003 and 2011. The combination of lower precipitation and increases in groundwater withdrawals can explain the recent change in the lake level response to precipitation. The recent decline in White Bear Lake water levels correlates with declining water levels in the Prairie du Chien and Jordan aquifers. Annual withdrawals from these aquifers has more than doubled from 1980 through 2010 in the northeast Twin Cities Metropolitan Area, increasing from a minimum of 1,873 million gallons in 1980 to a maximum of 4,557 million gallons in 2007. Stable isotope analyses of water samples collected from wells, precipitation, and lakes indicate that wells downgradient from White Bear Lake which are extracting water from the Prairie du Chien and/or Jordan aquifers are receiving a mixture of surface water and groundwater. Water balance analyses of White Bear Lake in March and August 2011 indicate a total monthly outflow leakage of 0.23 and 4.38 inches, respectively, from the lake to local aquifers. Increasing hydraulic gradients between the lake and the underlying aquifers, particularly in summer during peak groundwater withdrawals, may be increasing lake water outflow to local aquifers and contributing to a new lower mean lake stage.

Other Activities

A proposal was written and submitted to the Legislative-Citizens Commission on Minnesota Resources (LCCMR) on April 5 requesting funding for an expanded study of groundwater/surface-water interactions in the northeast part of the Twin Cities Metropolitan Area (NE TCMA). The proposal was submitted by the USGS Minnesota Water Science with the University of Minnesota, MDNR, MPCA, Minnesota Department of Health, Minnesota Board of Water and Soil Resources, Metropolitan Council, the city of White Bear Lake, and the town of White Bear. The proposed study would determine lake water interactions with municipal wells in the NE TCMA, determine water outflow locations and rates from White Bear Lake, and use groundwater-flow models and optimization simulations to develop optimal lake-level/ water-extraction management scenarios.

On March 30, the project chief and Eric Smith, Minnesota Water Science Center hydrologist, attended an meeting on the update of the Metro Groundwater-flow Model 2 hosted by the Metropolitan Council.

On March 15, the project chief met with MDNR and MPCA to select sentinel lake sites for potential groundwater flow and water-quality monitoring, as part of the MDNR Sentinal Lakes program.

Supervisor's Comments

Reference