

White Bear Lake: A Disappearing Lake and Efforts to Restore It

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Background

White Bear Lake is a 2,531-acre natural water body in Ramsey County, Minnesota, 12 miles northeast of the state capital, St. Paul. It is one of the larger lakes in the Twin Cities metropolitan region and has an average water depth of 83 feet and water clarity of 10.2 feet. By 1881, the area was a popular recreational destination that boasted numerous cabins and resorts; Mark Twain even included White Bear Lake as the resort in his *Life on the Mississippi* in 1874. The city of White Bear Lake, incorporated in 1921, is located on the western shore of the lake and as of the 2014 census is home to 24,986 residents (US Census, 2014). The city had a burst of growth from 1950–1960, but has maintained a fairly stable population since 1970. The rest of the area around the lake is a mix of towns, wetlands, and rural landscapes, and has experienced significant suburban growth since 1960.

Ordinary high water level for the lake is 924.89 feet above sea level, last seen in 2003. Beginning in 2004, water levels have been decreasing at a rate of about 6 inches per year. The result is that many homeowners on the lake have seen their shorelines recede, in some cases up to 200 feet. Diminishing access to the water has negatively affected property values for lakeshore homes. Public beaches have been closed to swimming as beaches give way to rocks and dangerous drop-offs. Marinas, boat rentals, and restaurants with dockside dining have seen their business decline due to limited dock space on their remaining shorelines. Navigational hazards, such as sand bars, submerged logs and rocks, and shallow depths where water was once deeper, have made recreational boating difficult in many areas.

Problem

White Bear Lake water levels have fallen five feet below their ordinary high water mark, resulting in broad areas of exposed lakebed. In November, 2012, the White Bear Lake Restoration Association and the White Bear Lake Homeowners Association filed a joint lawsuit against the Minnesota Department of Natural Resources (DNR), claiming mismanagement of the region's groundwater resources by allowing too many permits to be issued for groundwater extraction. Specifically, the suit alleges violations of the Minnesota Environmental Rights Act and the Public Trust Doctrine that allowed White Bear Lake's neighboring cities to pump increasing amounts of groundwater out of the underlying Prairie du Chien and Jordan aquifers, which are known to supply groundwater to the lake. This lawsuit came after findings were released from a 2011 study conducted by the U.S. Geological Survey (USGS), which concluded that the lake's declining water levels corresponded to declining water levels in the underlying aquifers. The study also concluded that increases in high-capacity groundwater pumping are a likely cause for the declines in the aquifers. The lawsuit claims that since 1980, annual groundwater withdrawals by high-capacity wells near White Bear Lake more than doubled to a peak of nearly 6 billion gallons in 2008 because of the DNR's approval of municipal water appropriation permits.

The lawsuit alleges that if the DNR doesn't restore the lake and stop excessive water withdrawals from the underlying aquifers, declining water levels are likely to cause continued or increased degradation of the lake. The lawsuit asks the court to force the DNR to restore the lake to about 4 feet above its current level. It also asks the court to set a protected elevation for the underlying aquifer and prevent the DNR and other agencies from allowing pumping that would drop the lake and aquifer below the protected elevation.

Stakeholders

Stakeholders for the problem of declining water levels include the claimants in the lawsuit as well as others that have an interest in the lake, which include:

- White Bear Lake Restoration Association
- White Bear Lake Homeowner's Association
- Minnesota Department of Natural Resources
- Metropolitan Council of the Twin Cities
- US Geological Survey (USGS)
- Cities of White Bear Lake, Forest Lake, Vadnais Heights, Hugo, White Bear Township
- Businesses that rely on the lake (marinas, restaurants, charters, etc.)
- Taxpayers of Minnesota

Proposed Solutions

In addition to water conservation efforts, possible long-term solutions that have been proposed include:

- Switching community water sources from municipal wells drawing from the aquifer to the St. Paul Regional Water Services. *Cost:* more than \$100 million. *Impact:* uncertain.
- Reuse treated waste water by piping it into the lake. Currently, wastewater is channeled into the Metropolitan Wastewater Treatment Plant located on the Mississippi River in St. Paul, MN. *Cost:* more than \$100 million. *Impact:* uncertain.
- Direct ditch runoff into the lake. *Cost:* less than \$10 million. *Impact:* uncertain.
- Altered watershed management to provide more runoff into the lake. *Cost:* less than \$1 million. *Impact:* uncertain.
- Augment the lake with water from Bald Eagle Lake (a 1,000 acre lake one mile to the northwest of White Bear Lake). *Cost:* \$2 million to \$5 million. *Impact:* could raise lake levels 1 to 6 inches per year. *Impact on Bald Eagle Lake:* uncertain.
- Alter well-pumping schedules to have less effect on the lake. *Cost:* \$50,000 to \$100,000. *Impact:* uncertain.
- Augment the lake with well water. *Cost:* \$2 million to \$3 million. *Impact:* could raise lake levels 6 to 12 inches per year.
- Augment the lake with discharge from a nearby food manufacturing plant. *Cost:* less than \$1 million. *Impact:* could raise lake levels up to 1 inch per year.
- Pump St. Paul Regional Water Services water (which draws its water from the Mississippi river north of the Twin Cities) directly into lake. *Cost:* high. *Impact:* could raise lake levels by 6 to 12 inches per year.
- Do nothing and let nature take its course. *Cost:* nothing. *Impact:* uncertain.

Funding for any option is still undetermined.

To determine which of the proposed solutions could be the most practical and effective, the hydrology of the lake and its watershed needs to be explored. The factors that drive the level fluctuations of White Bear Lake are the components of the hydrologic cycle: precipitation, runoff, surface outflow, evaporation and lake-ground water exchange. In the case of White Bear Lake, pumped augmentation from ground water to the lake historically has been another factor that has affected lake levels, but this augmentation practice was ended in 1978.

Activity

Your task is to supply water to 70,000 people (population estimate for the towns of White Bear Lake, Forest Lake and Hugo) sustainably without affecting long-term water levels in White Bear Lake.

Presentation

Familiarize yourself with the PowerPoint presentation provided with this case study ([white_bear_lake_sup.pptx](#)). This file provides a visual background of the problem and data pertinent to exploring the issue.

Spreadsheet

Use the Excel spreadsheet provided with this case study ([white_bear_lake_sup.xlsx](#)) to explore different values for:

- rainfall;
- water well pumping volumes from the aquifers; and
- water augmentation from nearby surface water bodies (streamflow).

The Task 1 sheet is designed to explore how changes in rainfall affect lake levels and consequently water available from underlying aquifers. The Task 2 sheet is designed to explore how changes in area population affect water availability from underlying aquifers and subsequent lake levels.

Questions

1. What rainfall value (Task 1) did you determine was required to keep lake levels from declining based upon current water needs around the lake? Is this a reasonable value, based upon what you know of the climate in the region?

2. Try to get the “GW pumping exceeding needs based on 30"/yr rainfall” calculation to balance (Task 2 sheet). What values for which parameters are required for the lake level to be maintained?

3. Is 100 gallons/day/person a reasonable estimate for daily water usage? What water conservation practices can reduce this usage, allowing for smaller impacts to the lake?

4. Which of the possible solutions proposed do you think is the most-likely to succeed in restoring and maintaining lake levels?
5. Which of the proposed solutions do you think will likely be enacted (based upon economics, politics, and public opinion)?

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