

# Six Mile Lake Lakeshed Assessment

The lakeshed vitals table identifies where to focus organizational and management efforts for each lake. Criteria were developed using limnological concepts to determine the effect to lake water quality.

| Lakeshed Vitals   |   | Rating      |
|---|---|-------------|
| Major Basin   | Upper Mississippi River   | descriptive |
| Major Watershed   | Leech Lake River  | descriptive |
| Minor Watershed   | 8075  | descriptive |
| Lakeshed  | Six Mile Brook (807500)   | descriptive |
| Ecoregion   | Northern Lakes and Forests  | descriptive |
| Lake Area   | 1,323 acres   | descriptive |
| Miles of Shoreline  | 7.77  | descriptive |
| Miles of Stream   | 1.34  | descriptive |
| Miles of Road   | 8.8   | descriptive |
| Lake Max Depth  | 68 ft. (20.7 m)   | descriptive |
| Lake Mean Depth   | NA  | NA          |
| Water Residence Time  | NA  | NA          |
| Municipalities  | None  | +           |
| Sewage Management   | Individual waste treatment systems (septic systems and holding tanks) | -           |
| Public Drainage Ditches   | 1   | x           |
| Lake Management Plan  | None  | x           |
| Lake Vegetation Survey/Plan   | None  | x           |
| Forestry Practices  | None  | +           |
| Development Classification  | Recreational Development  | x           |
| Shoreline Development Index   | 1.5   | +           |
| Total Lakeshed to Lake Area Ratio (total lakeshed includes lake area) | 4:1   | x           |
| Public Lake Accesses  | 1   | x           |
| Inlets  | 3 – Unnamed   | x           |
| Outlets   | 1 – Six Mile Brook  | x           |
| Feedlots  | None  | +           |
| Agriculture Zoning  | None  | +           |
| Public Land : Private Land  | 21:1  | +           |
| Wetland Coverage  | 25%   | +           |
| Lake Transparency Trend   | NA  | NA          |
| Exotic Species  | None  | +           |

**Rating Key:**

+ beneficial to the lake

- possibly detrimental to the lake

x warrants attention

## Lakeshed



Understanding a lakeshed requires the understanding of basic hydrology. A watershed is the area of land that drains into a surface water body such as a stream, river, or lake and contributes to the recharge of groundwater. There are three categories of watersheds: 1) basins, 2) major watersheds, and 3) minor watersheds.

Six Mile Lake is found within the **Upper Mississippi River Basin**, which includes the **Leech Lake River Major Watershed** as one of its sixteen major watersheds (Figure 1). The basin covers 20,000 square miles, while the Leech Lake River Watershed covers 1,335 square miles (approximately 854,349 acres). Six Mile Lake falls within **minor watershed 8075**, one of the 75 minor watersheds that comprise the Leech Lake River Major Watershed (Figure 2).

Within this watershed hierarchy, lakesheds also exist. A lakeshed is defined simply as the land area that drains to a lake. While some lakes may have only one or two minor watersheds draining into them, others may be connected to a large number of minor watersheds, reflecting a larger drainage area via stream or river networks. Six Mile Lake falls within the **Six Mile Brook (807500) lakeshed**, covering 5,323 acres (includes lake area) (Figure 3). Even though Six Mile Lake receives water from minor watershed 8032, for the purpose of this assessment it is decided that only the immediate lakeshed be inventoried and assessed.

## Six Mile Lake Lakeshed Water Quality Protection Strategy

Each lakeshed has a different makeup of public and private lands. Looking in more detail at the makeup of these lands can give insight on where to focus protection efforts. The protected lands (easements, wetlands, public land) are the future water quality infrastructure for the lake. Developed land and agriculture have the highest phosphorus runoff coefficients, so this land should be minimized for water quality protection.

Although the majority of land in Six Mile Lake's lakeshed is public, private forested uplands can be the focus of development and protection efforts in the lakeshed.

|  | Private (3.5%)        |                       |   |                                     |                                       | 24.5%      | Public (72%)             |              |                 |
|--|-----------------------|-----------------------|---|-------------------------------------|---------------------------------------|------------|--------------------------|--------------|-----------------|
|  | Developed             | Agriculture           | Forested Uplands  | Other                               | Wetlands                              | Open Water | County                   | State        | Federal         |
| <b>Land Use (%)</b>                                      | 0.7%                  | 0%                    | 1.8%  | 0%                                  | 1%                                    | 24.5%      | 0%                       | 20%          | 52%             |
| <b>Runoff Coefficient</b><br>Lbs of phosphorus/acre/year | 0.45 - 1.5            | 0.26 - 0.9            | 0.09  |                                     | 0.09                                  |            | 0.09                     | 0.09         | 0.09            |
| <b>Description</b>                                       | Focused on Shoreland  | Cropland              | Focus of development and protection efforts   | Open, pasture, grassland, shrubland | Protected                             |            |                          |              |                 |
| <b>Potential Phase 3 Discussion Items</b>                | Shoreline restoration | Restore wetlands; CRP | Forest stewardship planning, 3 <sup>rd</sup> party certification, SFIA, local woodland cooperatives |                                     | Protected by Wetland Conservation Act |            | County Tax Forfeit Lands | State Forest | National Forest |

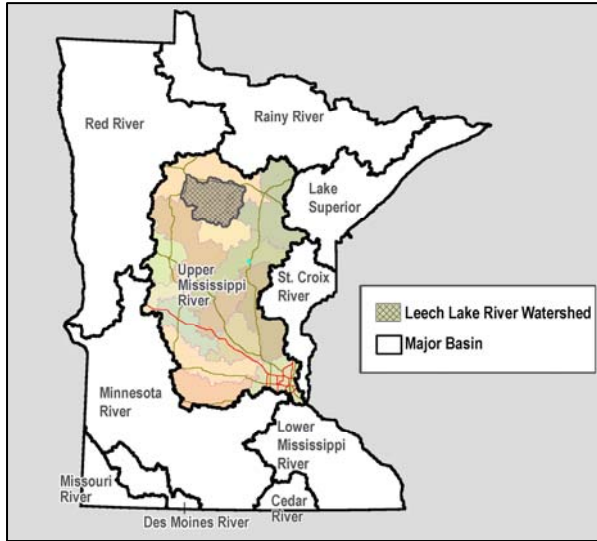


Figure 1. Upper Mississippi Basin and the Leech Lake River Watershed.

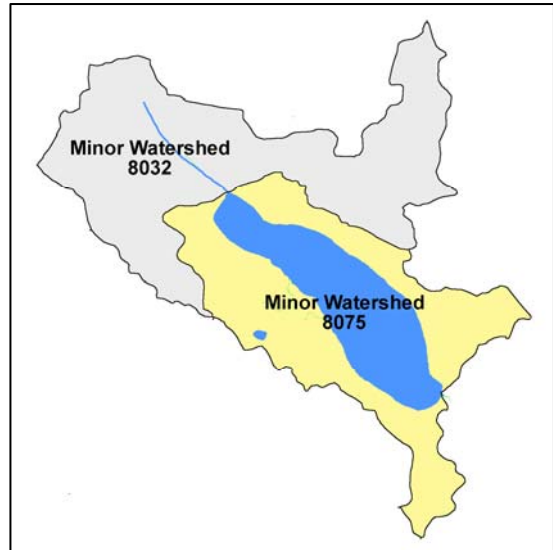


Figure 2. Minor Watersheds 8075 & 8032 contribute water to Six Mile Lake.

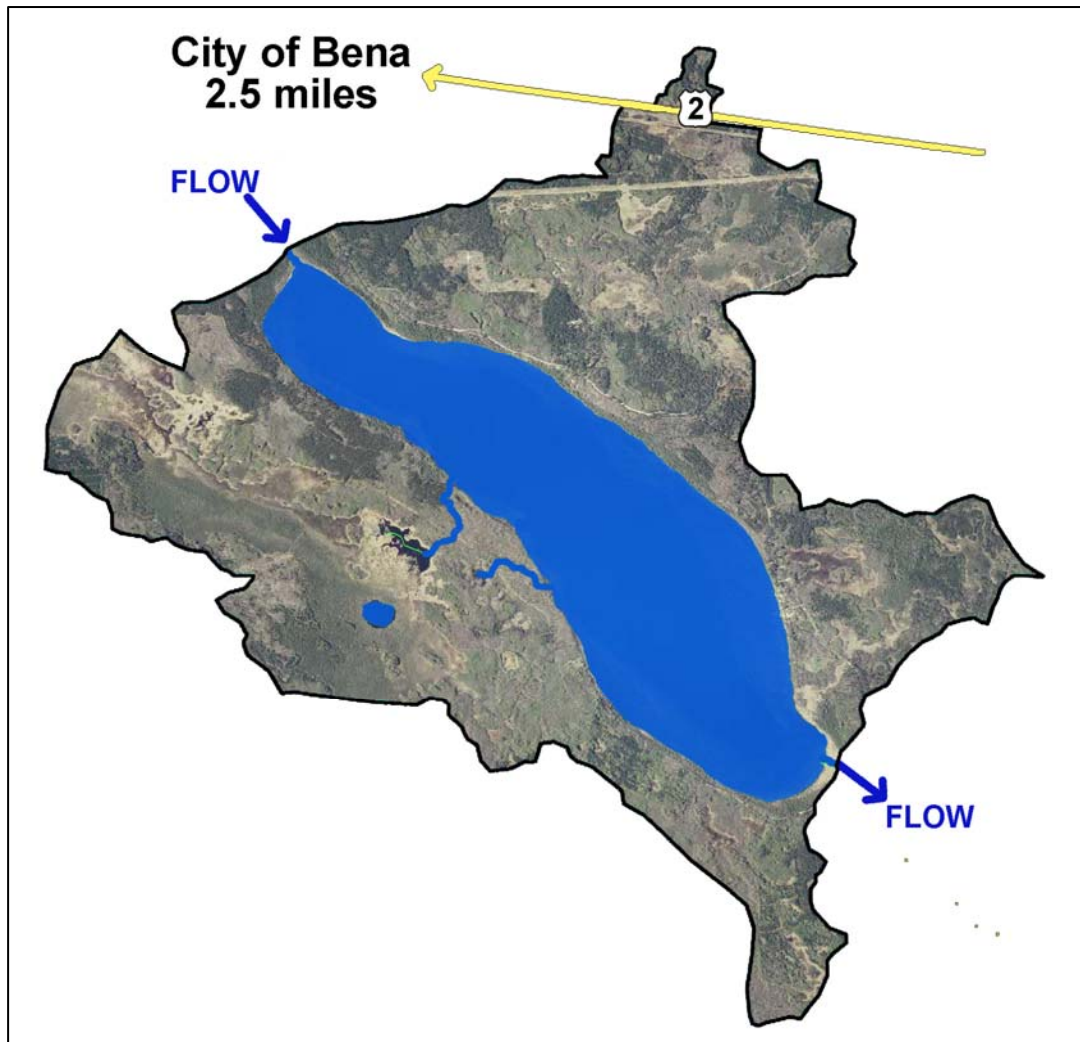


Figure 3. The Six Mile Brook (807500) Lakeshed (Aerial Imagery 2008 1M).

## Land Cover / Land Use

The activities that occur on the land within the lakeshed can greatly impact a lake. Land use planning helps ensure the use of land resources in an organized fashion so that the needs of the present and future generations can be best addressed. The basic purpose of land use planning is to ensure that each area of land will be used in a manner that provides maximum social benefits without degradation of the land resource.

Changes in land use, and ultimately land cover, impact the hydrology of a lakeshed. Land cover is also directly related to the land's ability to absorb and store water rather than cause it to flow

overland (gathering nutrients and sediment as it moves) towards the lowest point, typically the lake. Impervious intensity describes the land's inability to absorb water; the higher the % impervious intensity, the more area that water cannot penetrate into the soils. Monitoring the changes in land use can assist in future planning procedures to address the needs of future generations.

Phosphorus export, which is the main cause of lake eutrophication, depends on the type of land cover occurring in the lakeshed. Figure 5 depicts Six Mile Lake's lakeshed land cover.

The University of Minnesota has online records of land cover statistics from years 1990 and 2000 (<http://land.umn.edu>). Table 1 describes Six Mile Lake's lakeshed land cover statistics and percent change from 1990 to 2000. Due to the many factors that influence demographics, one cannot determine with certainty the projected statistics over the next 10, 20, 30+ years, but one can see the transition within the lakeshed from agriculture, forest, and water acreages to grass/shrub/wetland acreage. The largest change in percentage is the decrease in agriculture cover (100%); however, in acreage, grass/shrub/wetland cover has increased the most (159 acres). In addition, the impervious intensity has increased, which has implications for storm water runoff into the lake. The increase in impervious intensity is consistent with the increase in urban acreage.

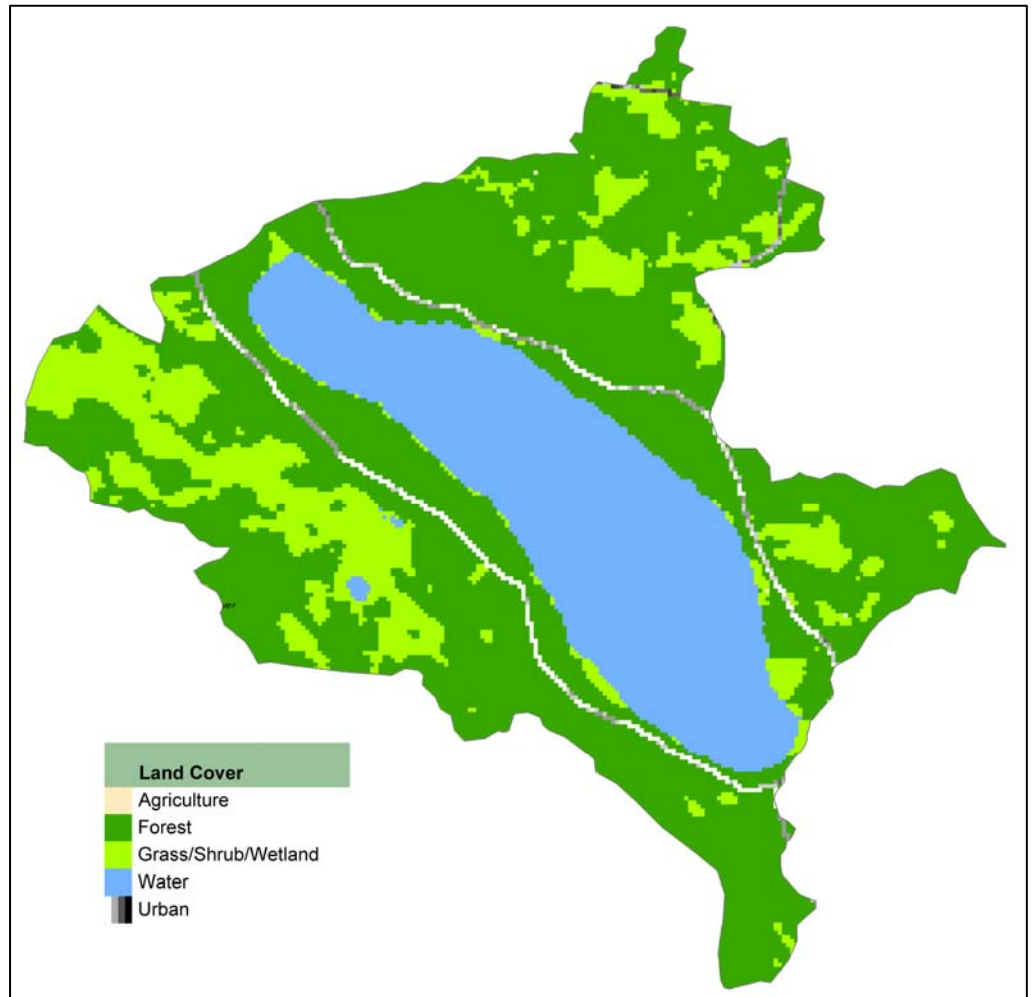


Figure 5. The Six Mile Brook (807500) lakeshed land cover (<http://land.umn.edu>).

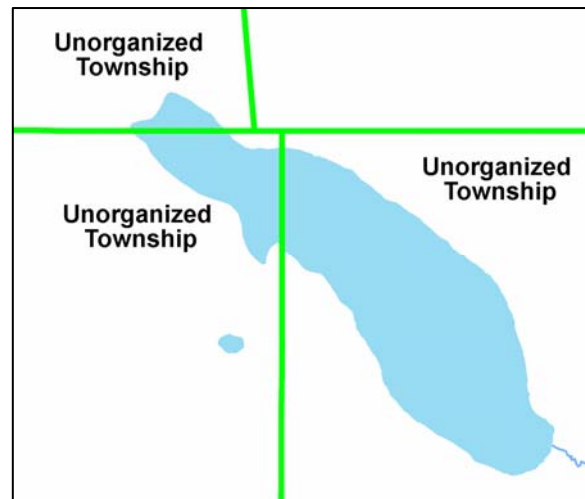
Table 1. Six Mile Lake's lakeshed land cover statistics and % change from 1990 to 2000 (<http://land.umn.edu>).

| Land Cover   | 1990  |         | 2000  |         | % Change 1990 to 2000 |
|--|-------|---------|-------|---------|-----------------------|
|  | Acres | Percent | Acres | Percent |                       |
| <b>Agriculture</b>   | 14    | 0.26    | 0     | 0       | 100 % Decrease        |
| <b>Forest</b>  | 3,183 | 59.8    | 3,073 | 57.73   | 3.5 % Decrease        |
| <b>Grass/Shrub/Wetland</b>   | 662   | 12.44   | 821   | 15.42   | 24.0 % Increase       |
| <b>Water</b>   | 1,313 | 24.67   | 1,278 | 24.01   | 2.7 % Decrease        |
| <b>Urban</b>   | 147   | 2.76    | 147   | 2.76    | No Change             |
| <b>Impervious Intensity %</b>  |       |         |       |         |                       |
| <b>0</b>   | 5,277 | 99.21   | 5,241 | 98.53   | 0.7 % Decrease        |
| <b>1-10</b>  | 24    | 0.45    | 34    | 0.64    | 41.7 % Increase       |
| <b>11-25</b>   | 14    | 0.26    | 36    | 0.68    | 157.1 % Increase      |
| <b>26-40</b>   | 3     | 0.06    | 7     | 0.13    | 133.3 % Increase      |
| <b>41-60</b>   | 0     | 0       | 1     | 0.02    | 100 % Increase        |
| <b>61-80</b>   | 0     | 0       | 0     | 0       | No Change             |
| <b>81-100</b>  | 0     | 0       | 0     | 0       | No Change             |
| <b>Total Area</b>  | 5,323 |         | 5,323 |         |                       |
| <b>Total Impervious Area</b><br>(Percent Impervious Area<br>Excludes Water Area) | 5     | 0.12    | 10    | 0.25    | 100 % Increase        |

## Demographics

Six Mile Lake is classified as a recreational development lake. Recreational development lakes usually have between 60 and 225 acres of water per mile of shoreline, between 3 and 25 dwellings per mile of shoreline, and are more than 15 feet deep.

The Minnesota Department of Administration Geographic and Demographic Analysis Division extrapolated future population in 5-year increments out to 2035. However, Six Mile Lake lies within three unorganized townships, so no extrapolated population growth projections are available.



## Status of the Fishery (DNR, as of 8/11/2003)

Six Mile Lake is a 1288-acre lake located near Bena, MN that has 7.5 miles of shoreline and a maximum depth of 68 feet. There is a US Forest Service public access located on the east shore. The Minnesota Department of Natural Resources (MNDNR) has classified Minnesota's lakes into 43 different classes based on physical, chemical, and other characteristics. Six Mile Lake is in Lake Class 27; lakes in this class are generally very large, deep, hard water, and regularly shaped lakes. This lake is primarily managed for walleye and secondarily for northern pike, yellow perch, and cisco.

Walleye abundance has been consistent with historical catch rates. The 2001 year-class was dominant in our sampling gear, which will provide some fishing opportunities in the future. The mean length for walleye was 16 inches and fish up to 25 inches were sampled. Northern pike were abundant in Six Mile Lake when compared to similar lakes of Lake Class 27. Fish up to 34 inches were sampled with an average length of 21 inches. Fifty-four percent of the northern pike sampled were between 21 and 28 inches.

Other fish species that are available for anglers to catch are black crappie, brown bullhead, largemouth bass, pumpkinseed sunfish, rock bass, cisco, white sucker, yellow bullhead, and yellow perch.

Anglers can help maintain or improve the quality of fishing by practicing selective harvest. Selective harvest allows for the harvest of smaller fish for table fare, but encourages release of medium- to large-sized fish. Releasing these fish can help maintain balance in the fish community in Six Mile Lake and provide anglers the opportunity to catch more and larger fish in the future.

Shoreline areas on the land and into the shallow water provide essential habitat for fish and wildlife that live in or near Minnesota's lakes. Overdeveloped shorelines can't support the fish, wildlife, and clean water that are associated with natural undeveloped lakes. The combined effects of all lakeshore owners "fixing up" their property can destroy a lake's valuable natural shorelines.

Shoreline habitat consists of aquatic plants, woody plants, and natural lake bottom soils. Plants in the water and at the water's edge provide habitat, prevent erosion, and absorb excess nutrients. Shrubs, trees, and woody debris such as fallen trees or limbs provide good habitat both above and below the water and should be left in place. Natural lake bottom materials like silt or gravel are more ecologically productive than pure sand trucked in for a swimming beach. A tidy lawn and a sandy beach make great spots for sunbathing and swimming but do little to provide habitat for fish and wildlife. By leaving a buffer strip of natural vegetation along the shoreline, property owners can reduce erosion, help maintain water quality, and provide habitat and travel corridors for wildlife.

Only if more lakeshore owners manage their shoreline in a natural condition can fish and wildlife populations on Minnesota lakes remain healthy and abundant. More specific information on protecting or restoring shorelines and watersheds is available through the local DNR Fisheries office.

See the link below for specific information on gillnet surveys, stocking information, and fish consumption guidelines. <http://www.dnr.state.mn.us/lakefind/showreport.html?downum=11014600>