Connecting lakes and lakesheds; how healthy is our lake?

How do we define and measure lake health? What information helps us be better stewards of our lakes? These are tough questions, but the information in the WHAF for Lakes application is designed to summarize issues that impact lake health.

What is a healthy lake?

A healthy lake is one that is nearest to its natural state. It is free from our pollution and has a natural shoreline that protects the bank and filters runoff. It is surrounded by a landscape that delivers water and energy consistent with its self-sustaining plant and animal communities.

A healthy lake can withstand changing conditions and seasonal fluctuations. Most importantly, it has a human community that values these resources and invests in the protection and restoration of the lake and the surrounding landscape.

When is a lake unhealthy?

An unhealthy lake is out of balance with water and nutrient flows. Stressors cause changes in the composition of fish and plant communities, making the lake more susceptible to becoming dominated by non-native species. A degraded lake is less resilient and may decline further under changing conditions.

Restoring a degraded lake back to a healthy condition is usually a lengthy, expensive, and complex challenge. In contrast, protecting a healthy lake and the surrounding land helps ensure that the ecological and economic benefits that it currently provides are more resilient and likely to be sustained into the future.

Steps for Exploring Lake Health

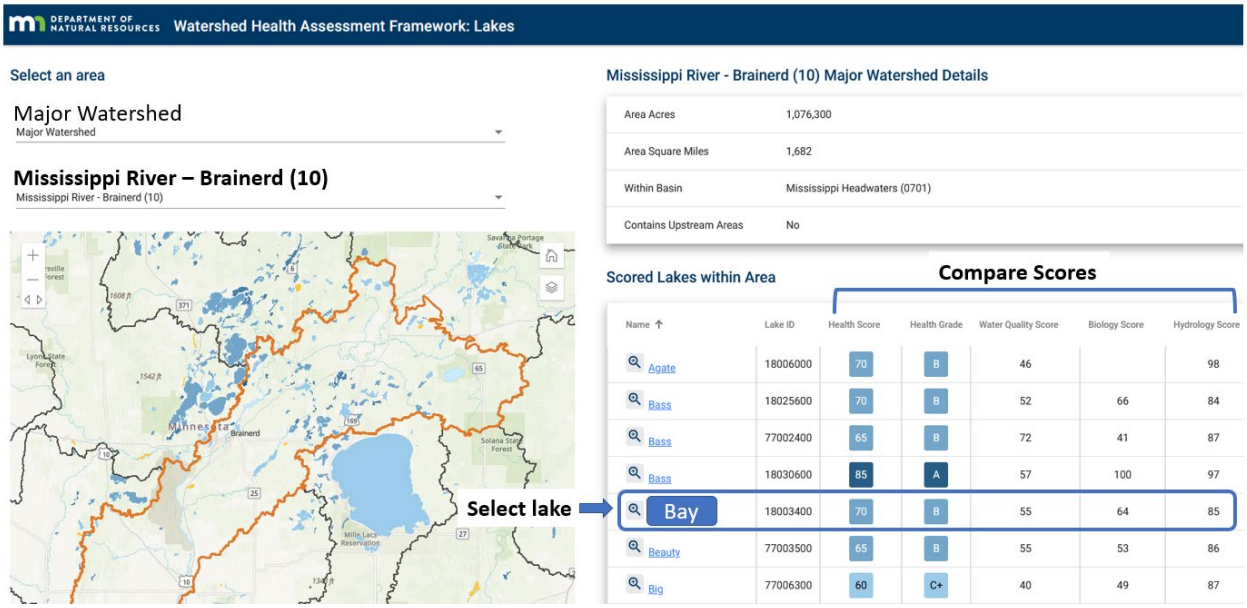
Almost 3,000 lakes in Minnesota have been given health scores. The overall score can help you compare a lake of interest to other lakes across the state, or to other lakes nearby. In the example below, the Mississippi River - Brainerd major watershed is being highlighted. The health scores for the lakes within that watershed range from a low score of 40 to a high score of 85, on a 0-100 scale.

Open the **WHAF for Lakes** application.

Step 1: **Click on the map** to set a location or **select a major watershed** from the drop-down list.

NOTE: You can also change scale to a different boundary (e.g. select by County)

Step 2: Review the list of lakes within the area you selected.



Learn More

What does the lake 'health score' mean?

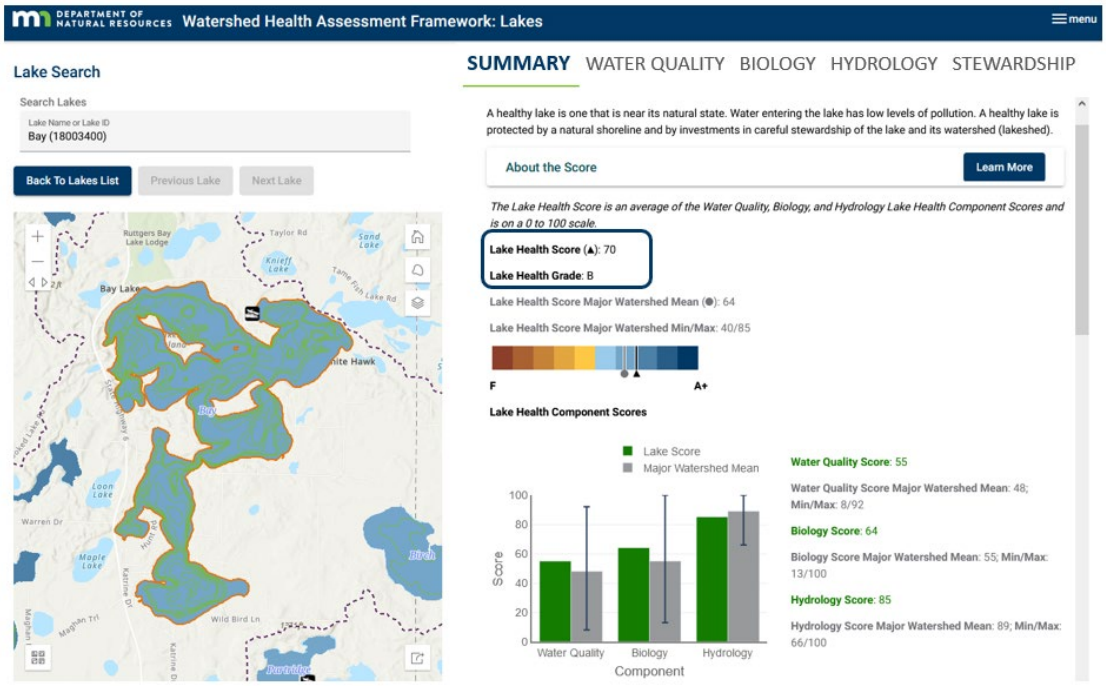
The Lake Health Score is a single measure that is comparable for all scored lakes and helps you see the range of lake conditions across Minnesota.

The Health Score for each lake is determined by combining three sub-scores known as 'Component Scores', which include Water Quality, Biology, and Hydrology. These sub-scores reflect both measured conditions in the lake and how land use activities in the lakeshed may pose risks to lake conditions.

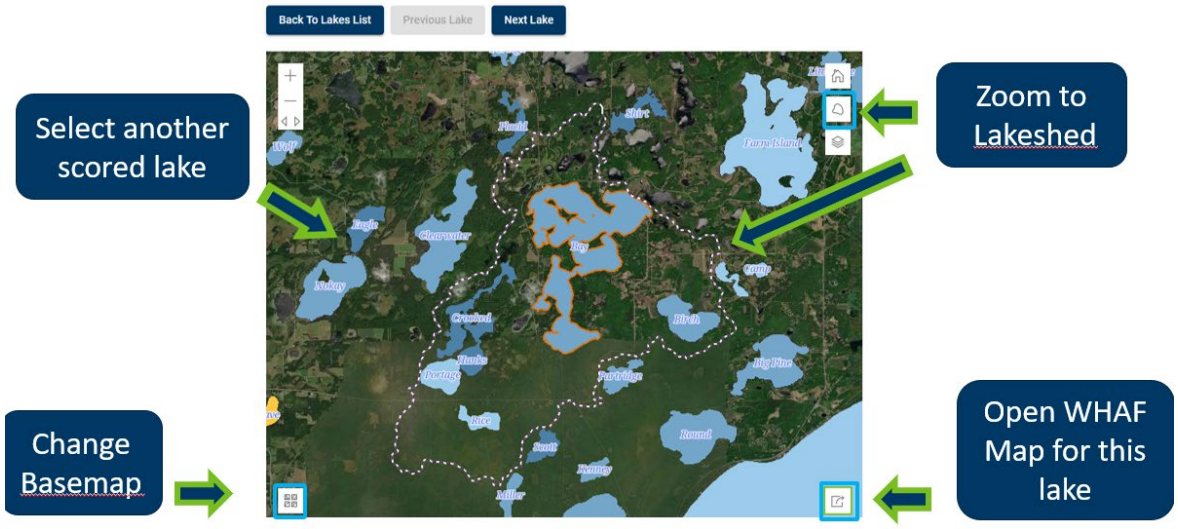
We know that conditions in a healthy shallow lake are very different than in a healthy deep lake. To provide meaningful comparisons, lake health scores are calculated based on expectations for lakes with similar characteristics such as depth type and location (ecoregion).

Step 3: Click on a lake name to open the health score pages for a particular lake of interest. The application will open the Lake Summary page. This page shows the overall Lake Health Score, a corresponding Lake Health Grade and the three Component Scores that combine to create the

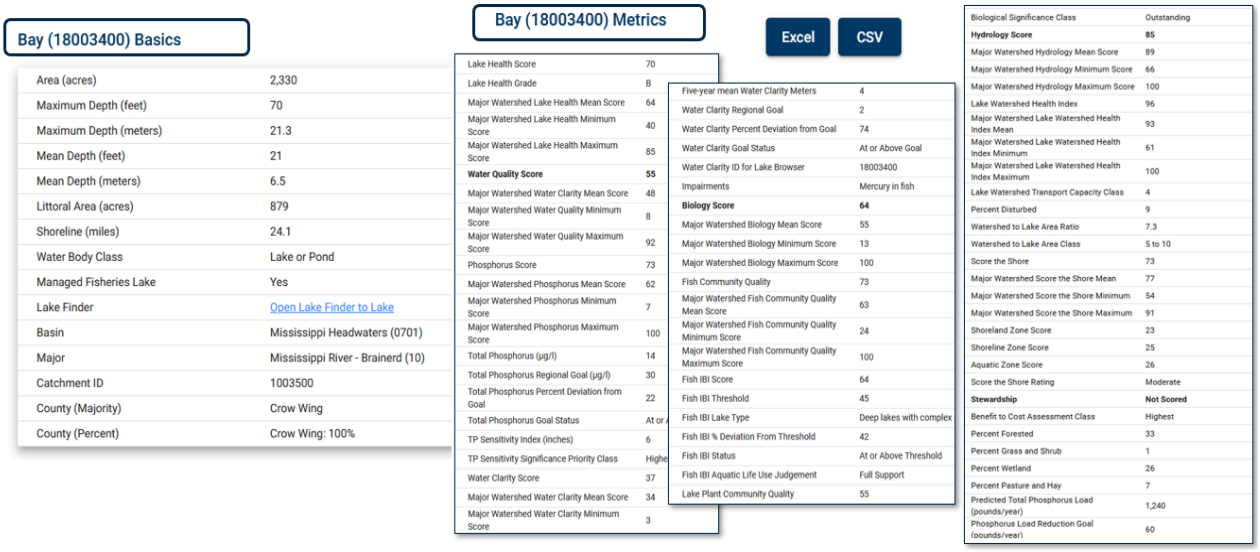
overall Lake Health Score. The page also displays the minimum/maximum and average scores (dark gray) for all measured lakes within the same major watershed.



Step 4: Use the map to explore your lake's watershed, or ***lakeshed,*** shown with a dotted line. You can navigate to another scored lake by panning and clicking on another lake or change the basemap using the button in the lower left corner of the map. You can also open the main WHAF Map application (centered on your selected lake) by using the button in the lower right corner of the map.



Step 5: Scroll down the Summary page to find downloadable tables with basic information about your selected lake and all the values associated with the lake including input metrics that contribute to scores and additional useful data.



Bay (18003400) Basics

Area (acres)	2,330
Maximum Depth (feet)	70
Maximum Depth (meters)	21.3
Mean Depth (feet)	21
Mean Depth (meters)	6.5
Littoral Area (acres)	879
Shoreline (miles)	24.1
Water Body Class	Lake or Pond
Managed Fisheries Lake	Yes
Lake Finder	Open Lake Finder to Lake
Basin	Mississippi Headwaters (0701)
Major	Mississippi River - Brainerd (10)
Catchment ID	1003500
County (Majority)	Crow Wing
County (Percent)	Crow Wing: 100%

Bay (18003400) Metrics

Excel CSV

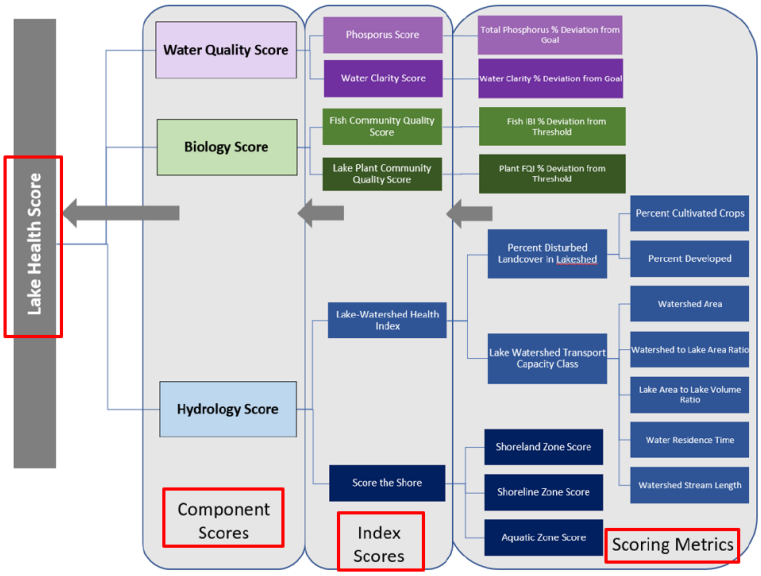
Lake Health Score	70
Lake Health Grade	B
Major Watershed Lake Health Mean Score	64
Major Watershed Lake Health Minimum Score	40
Major Watershed Lake Health Maximum Score	85
Water Quality Score	**55**
Major Watershed Water Clarity Mean Score	48
Major Watershed Water Quality Minimum Score	8
Major Watershed Water Quality Maximum Score	92
Phosphorus Score	73
Major Watershed Phosphorus Mean Score	62
Major Watershed Phosphorus Minimum Score	7
Major Watershed Phosphorus Maximum Score	100
Total Phosphorus (µg/l)	14
Total Phosphorus Regional Goal (µg/l)	30
Total Phosphorus Percent Deviation from Goal	22
Total Phosphorus Goal Status	At or A
TP Sensitivity Index (inches)	6
TP Sensitivity Significance Priority Class	Highe
Water Clarity Score	37
Major Watershed Water Clarity Mean Score	34
Major Watershed Water Clarity Minimum Score	3

Five-year mean Water Clarity Meters	4
Water Clarity Regional Goal	2
Water Clarity Percent Deviation from Goal	74
Water Clarity Goal Status	At or Above Goal
Water Clarity ID for Lake Browser	18003400
Impairments	Mercury in fish
Biology Score	**64**
Major Watershed Biology Mean Score	55
Major Watershed Biology Minimum Score	13
Major Watershed Biology Maximum Score	100
Fish Community Quality	73
Major Watershed Fish Community Quality Mean Score	63
Major Watershed Fish Community Quality Minimum Score	24
Major Watershed Fish Community Quality Maximum Score	100
Fish IBI Score	64
Fish IBI Threshold	45
Fish IBI Lake Type	Deep lakes with complex
Fish IBI % Deviation From Threshold	42
Fish IBI Status	At or Above Threshold
Fish IBI Aquatic Life Use Judgement	Full Support
Lake Plant Community Quality	55

Biological Significance Class	Outstanding
Hydrology Score	**85**
Major Watershed Hydrology Mean Score	89
Major Watershed Hydrology Minimum Score	66
Major Watershed Hydrology Maximum Score	100
Lake Watershed Health Index	96
Major Watershed Lake Watershed Health Index Mean	93
Major Watershed Lake Watershed Health Index Minimum	61
Major Watershed Lake Watershed Health Index Maximum	100
Lake Watershed Transport Capacity Class	4
Percent Disturbed	9
Watershed to Lake Area Ratio	7.3
Watershed to Lake Area Class	5 to 10
Score the Shore	73
Major Watershed Score the Shore Mean	77
Major Watershed Score the Shore Minimum	54
Major Watershed Score the Shore Maximum	91
Shoreland Zone Score	23
Shoreline Zone Score	25
Aquatic Zone Score	26
Score the Shore Rating	Moderate
Stewardship	**Not Scored**
Benefit to Cost Assessment Class	Highest
Percent Forested	33
Percent Grass and Shrub	1
Percent Wetland	26
Percent Pasture and Hay	7
Predicted Total Phosphorus Load (pounds/year)	1,240
Phosphorus Load Reduction Goal (pounds/year)	60

Step 6: Return to the top of the page to **Click the tabs** for more detail about your lake.

- View each component page to learn about the metrics that were selected to represent lake health and how the component index scores were calculated.
- Use the **Help Menu** to open the Use Guide for more about scoring, including this chart showing how the inputs build into the overall Lake Health Score.



- Click on the '**Learn More**' buttons throughout the app to understand the scoring approach and to learn more about each topic's relevance to lake health.
- Click on the Stewardship tab for information about how our actions impact lake health and ideas for managing your lake.

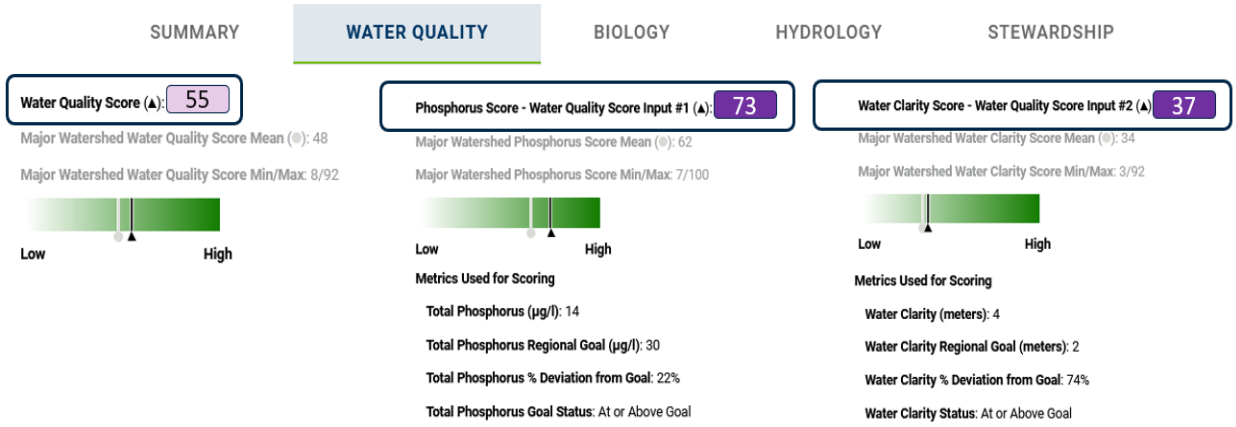
What did we learn about Bay Lake?

Bay Lake is 2330 acres of open water with a lakeshed of 16,970 acres. It has a maximum depth of 70 feet with a complex shoreline. This lake is being actively managed by DNR Fisheries.

Its overall health score was 70, giving it a 'B' grade. The majority (51%) of Minnesota lakes fall within this A-B range. These lakes should be monitored and protected so that risks to their shoreland and lakeshed areas are minimized to keep this healthy condition into the future.

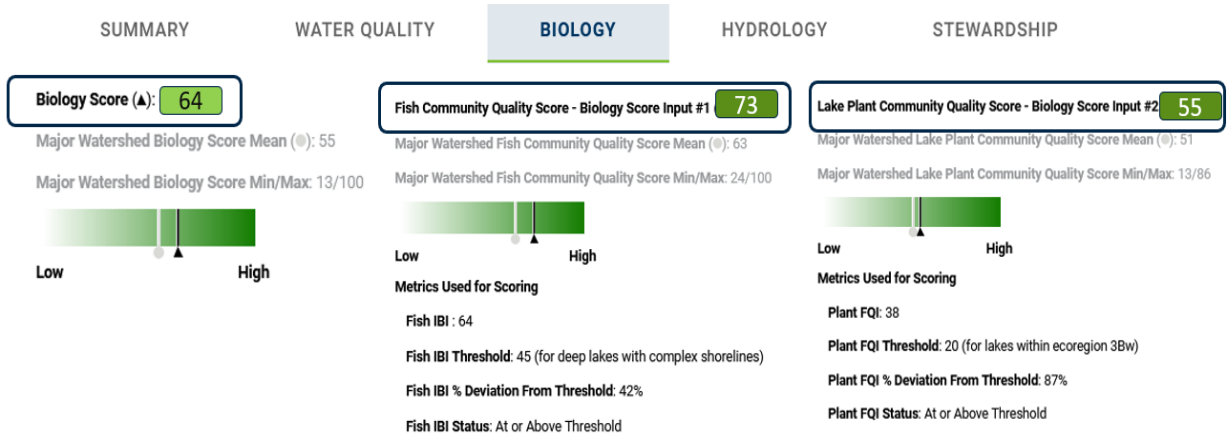
How is the Water Quality in Bay Lake?

The Water Quality Score is 55. This score combines the Phosphorus Score with the Water Clarity Score. The lake's Phosphorus Score is 73. This score reflects a total phosphorus level that is better (less phosphorus) than the regional goal for this lake by 22%. In contrast, Bay Lake has a Water Clarity Score of 37. While Bay Lake's water clarity exceeds the regional goal for clarity by 74%, there are other lakes in this watershed that are much further above the goal. This relative ranking reduces Bay Lake's score for clarity.



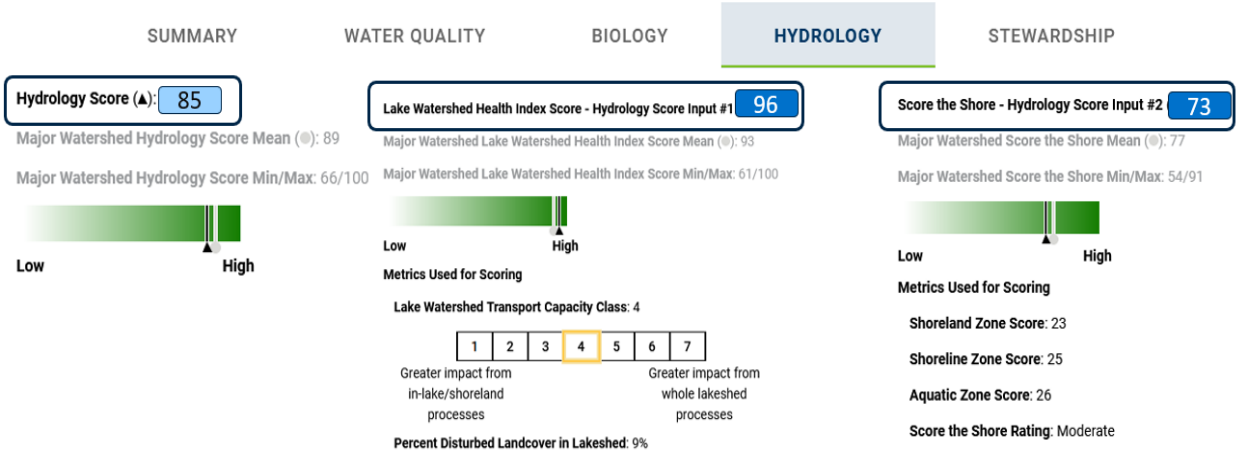
How healthy are the fish and plants in Bay Lake?

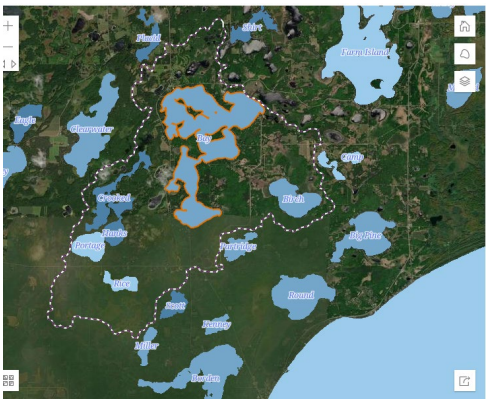
The Biology Score is 64, combining the Fish Community Quality Score of 73 with the Plant Community Quality Score of 55. Both of the input values for the Fish Index of Biotic Integrity (IBI) and Plant Floristic Quality Index (FQI) are considerably above the expected value threshold. The fish community is thriving with a broad diversity of species, and not dominated by species that are tolerant of human-induced stressors. The FQI indicates that the lake has high quality aquatic habitat with a diverse plant community that includes species that are sensitive to pollution.



How does lake hydrology affect Bay Lake's health?

The Hydrology Score of 85 reflects two input values. The Lake Watershed Health Index Score of 96 indicates that the minimal (9%) disturbance in the lakeshed is not likely to strongly disrupt in-lake or lakeshed processes. The lakeshed is mostly undeveloped with 30% open water and 60% forested and wetland land cover. The disturbed lands include primarily homes, resorts and roads.






The second input is the Score the Shore survey with a value of 73. This survey explores the shoreland, shoreline and aquatic zone conditions. Near-lake conditions show many docks and homes with considerable disturbed land cover such as mowed vegetation; however, there are areas of natural near-shore vegetation cover including trees as well as aquatic vegetation and dead trees along the shore that provide important fish habitat.

In summary, Bay Lake meets expectations for a healthy lake across the three components that are used to grade lake health. While the lake is currently in good condition, there are threats.

- If there are increasing disturbance and changes in land use within its lakeshed, or increased alteration of the shoreline, the lake health will degrade.
- This is an outstanding lake with important aquatic habitats, plant and animal communities, and high economic value for the local community.
- Investing in lake health protections will bring benefits to the lake and to the community.

Partners Make it Happen

The WHAF team would like to acknowledge the partners that helped us design and deliver the WHAF for Lakes, providing their expertise and assistance.

DNR Ecological and Water Resources; Lake Ecology Unit:

- Paul Radomski, Research Scientist
- Kristin Carlson, Decision Support Specialist
- Steve Kloiber, Unit Supervisor

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- Leif Olmanson, Research Associate