2010 Stream Monitoring Report

Shell Rock River Watershed District

The Shell Rock River Watershed District contains a vast network of ditches and creeks, in addition to the Shell Rock River. Many of these ditches and creeks flow into area lakes, transporting pollutants from the upstream watershed. The District monitors many of the streams within the watershed; the 2010 monitoring stations are shown in green on the map to the right.

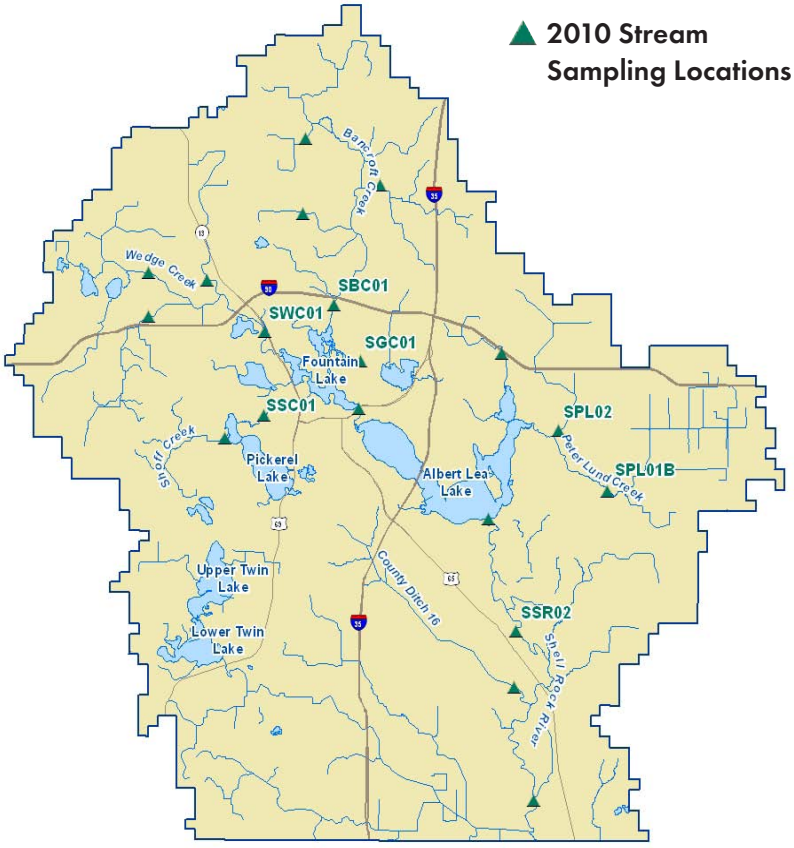
What information is collected?

The streams within the District are monitored for flow, physical characteristics such as temperature, dissolved oxygen, and pH, and several water quality parameters such as turbidity, phosphorus, and total suspended solids.

How is the stream monitoring data used?

The stream monitoring data is used to determine the amount of runoff, sediment, and pollutants being transported to downstream waterbodies.

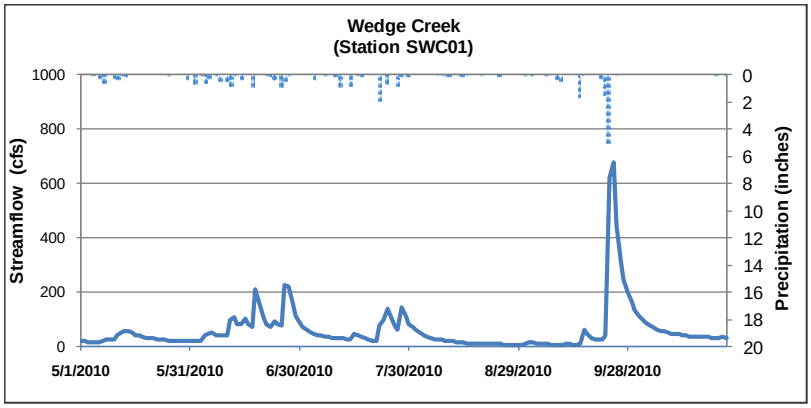
The data is also used to assess long-term water quality trends, determine achievable water quality management goals, and track the District's progress toward those goals.



Flow

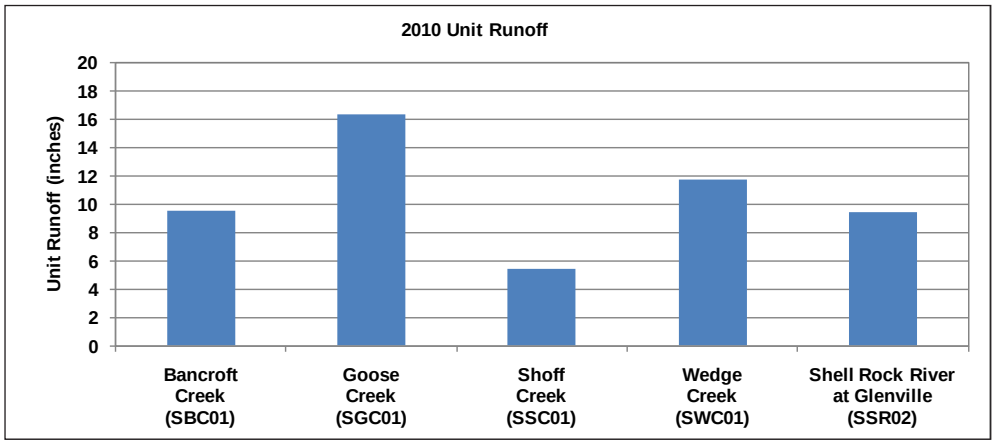
Flow is measured using automated gages at 18 locations throughout the watershed. The monitored flow is used to estimate the amount of runoff from the watershed. The graph at right shows the continuous streamflow measurements from Wedge Creek during the 2010 monitoring season (dark blue line). The daily precipitation is also shown from the top of the graph.

As seen in the figure, flows in Wedge Creek generally ranged from 0 to 200 cfs. The large rain event in late-September (greater than 5 inches) resulted in very high flows in Wedge Creek, and other streams in the District.



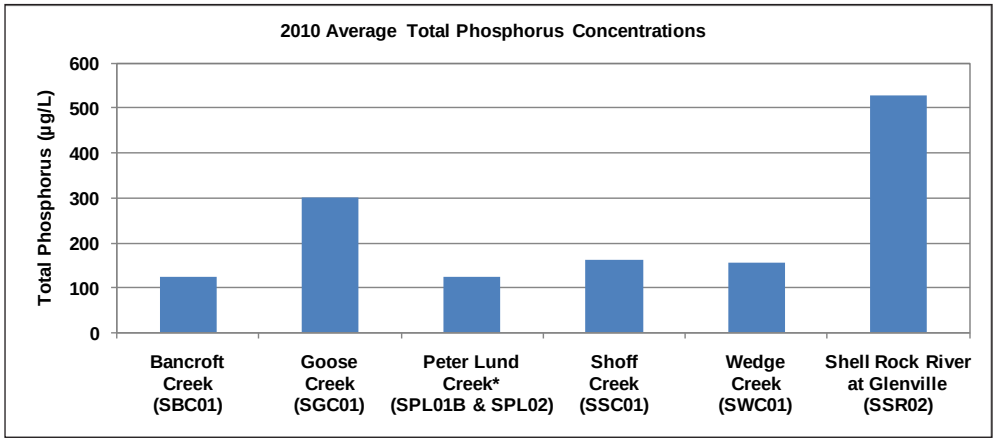
Continued on reverse

2010 Stream Monitoring Report Card



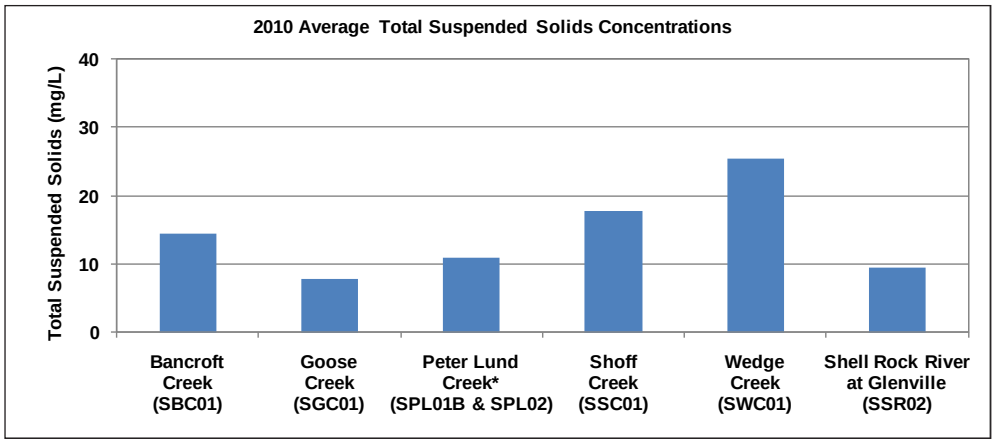
Watershed Runoff

The graph to the left shows the estimated runoff generated from several watersheds during the 2010 monitoring period (April to October). The runoff yields ranged from 5.5 to 16.3 inches, depending on factors such as the amount of developed land, crop patterns, storage from upstream waterbodies, and precipitation patterns. The Goose Creek watershed had the highest runoff yield, due to the amount of developed land in the watershed. The increased impervious surface area results in more stormwater runoff.



Phosphorus Concentrations

The graph to the left shows the average total phosphorus concentrations at each monitoring station, based on the grab samples collected throughout the monitoring period. The Shell Rock River had the highest average phosphorus concentration at over 500 µg/L. The high phosphorus levels are typical at this location, primarily due to the discharge from the wastewater treatment plant.



Total Suspended Solids (TSS)

The graph to the left shows the average TSS concentrations at each monitoring station, based on the grab samples collected throughout the monitoring period. All of the 2010 average TSS concentrations were below the Minnesota Pollution Control Agency threshold for TSS in streams (58 mg/L).

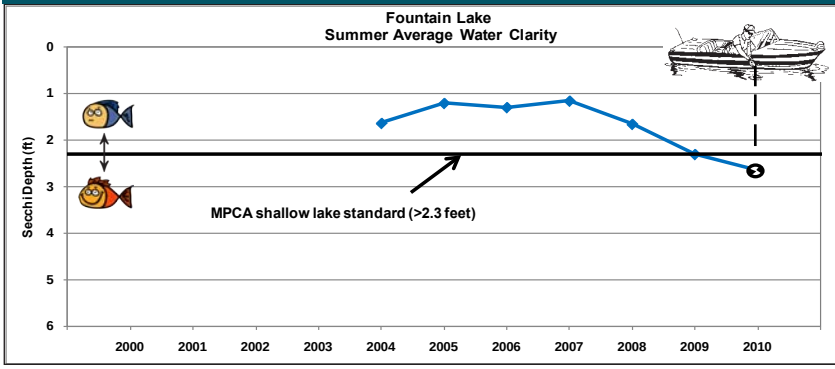
*Represents the average concentrations from the two monitoring stations.

Prepared for the Shell Rock River Watershed District by Barr Engineering Company • March 2011

2010 Clean Water Report Card: **Fountain Lake**

Watershed area: 62,700 acres • Lake surface area: 555 acres• Maximum lake depth: 9.5 feet • Mean lake depth: 6.0 feet

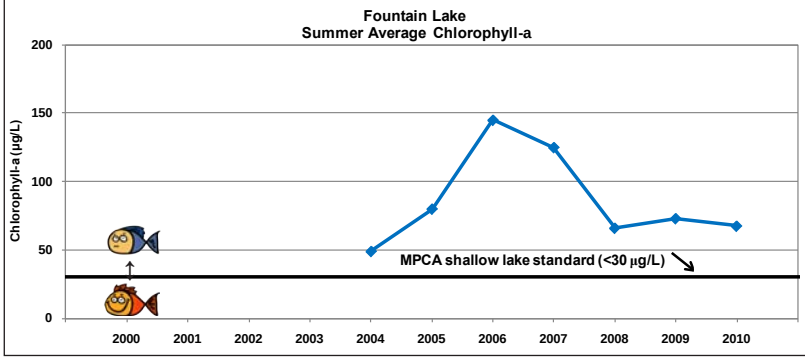
Water Quality Indicator: **Water Clarity**



The water clarity of Fountain Lake has been monitored regularly since 2004. The clarity of the water is measured by lowering a black and white disk (Secchi disk) into the water and identifying the depth at which the disk is no longer visible.

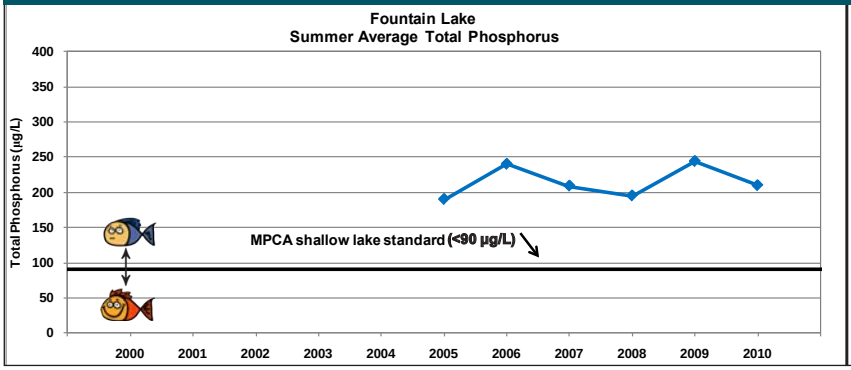
As shown in the figure, the summer-average clarity of Fountain Lake has improved in recent years, meeting the Minnesota Pollution Control Agency's (MPCA) standard for shallow lakes in southern Minnesota in 2009 and 2010.

Water Quality Indicator: **Chlorophyll *a***



Chlorophyll *a* is the main photosynthetic pigment found in algae, and is often measured to determine the amount of algae in water. The Shell Rock River Watershed District has monitored chlorophyll *a* in Fountain Lake since 2004. Although recent years have seen improvements, the summer-average chlorophyll *a* concentrations in the lake have historically been higher than the MPCA's standard for shallow lakes in southern Minnesota. These high chlorophyll *a* levels typically indicate an abundance of algae in the lake, which is also evident by the pea-green color of the water at times.

Water Quality Indicator: **Phosphorus**



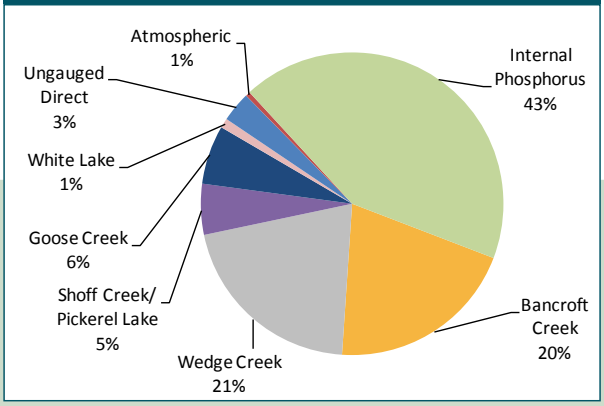
Phosphorus is a plant nutrient in the soil that stimulates the growth of algae when in lake water. Summer-average phosphorus concentrations in the lake have historically been, and continue to be, higher than the MPCA's standard for shallow lakes in southern Minnesota. These high levels of phosphorus often result in severe algal blooms. Sources of phosphorus to Fountain Lake include stormwater runoff from the lake's direct watershed (including portions of Albert Lea), water from upstream lakes and tributary streams, and the release of phosphorus from lake sediments (see reverse).

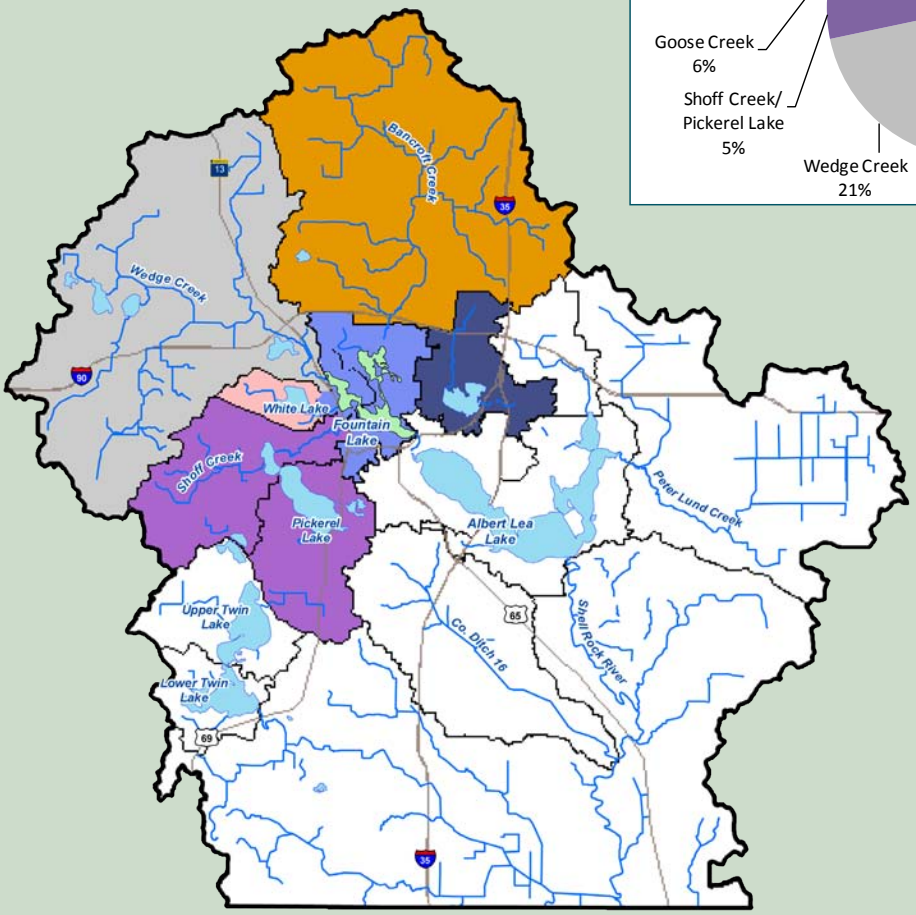
Continued on reverse

A Closer Look: **Phosphorus Contributions to Fountain Lake**

Contributions of phosphorus, a nutrient that can degrade water quality in several ways, were estimated based on water quality monitoring data collected from Fountain Lake and the upstream lakes and streams. The pie chart at right shows a breakdown of the phosphorus sources to the lake during the 2010 monitoring season (April through October). The areas that correspond to each of the sources are shown on the map below.

Sources of Phosphorus





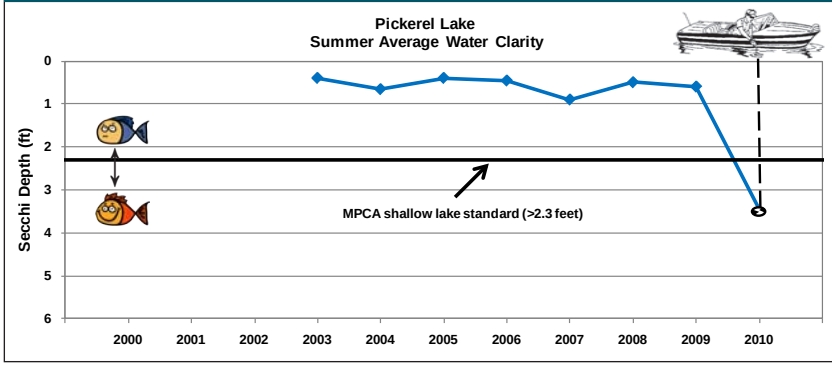
Stormwater is a significant source of phosphorus to Fountain Lake. When it rains, stormwater carries sediment and the phosphorus attached to sediment particles, from the land into nearby lakes and streams. Bancroft and Wedge Creeks, two of the largest tributaries to Fountain Lake, together contributed about 40% of the phosphorus loading to the lake during the 2010 monitoring period. Another significant source of phosphorus to Fountain Lake during the 2010 monitoring season was internal loading (about 43%). All lakes accumulate phosphorus (and other nutrients) in the sediment from the settling of particles and dead organisms. Internal loading occurs in some lakes as the phosphorus in the sediment is reintroduced into the lake water and becomes available again for uptake by plants. This complex process of internal loading can be affected by water temperature, oxygen, pH, wind mixing, and disturbance by bottom-feeding fish such as carp.

Prepared for the Shell Rock River Watershed District by Barr Engineering Company • March 2011

2010 Clean Water Report Card: **Pickerel Lake**

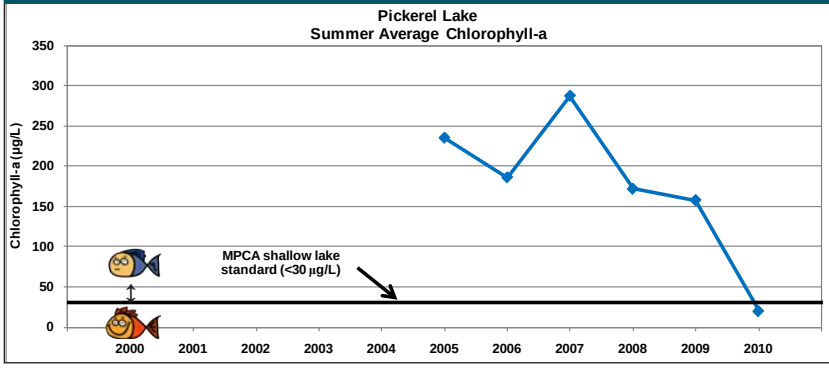
Watershed area: 5,120 acres • Lake surface area: 620 acres• Maximum lake depth: 6.0 feet • Mean lake depth: 3.8 feet

Water Quality Indicator: **Water Clarity**



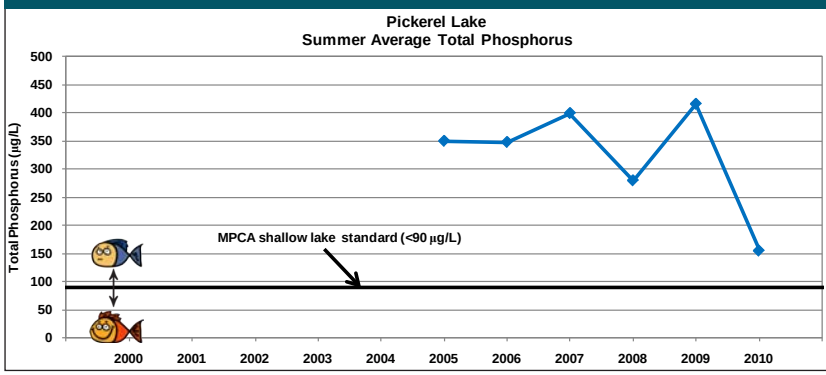
The Shell Rock River Watershed District has monitored Pickerel Lake's clarity since 2003. The clarity of the water is measured by lowering a black and white disk (Secchi disk) into the water and identifying the depth at which the disk is no longer visible. As shown in the figure, the summer-average clarity of Pickerel Lake was significantly better in 2010 than in previous years, meeting the Minnesota Pollution Control Agency's (MPCA) standard for shallow lakes in southern Minnesota for the first time on record. This improvement can be attributed to the District's recent project to control rough fish populations in the lake (see reverse).

Water Quality Indicator: **Chlorophyll *a***



Chlorophyll *a* is the main photosynthetic pigment found in algae, and is often measured to determine the amount of algae in water. The District has monitored chlorophyll *a* in Pickerel Lake since 2004. The summer-average chlorophyll *a* concentrations in the lake have historically been higher than the MPCA's standard for shallow lakes in southern Minnesota, indicating an abundance of algae in the lake. However, the 2010 summer average concentration met the MPCA's standard for the first time on record.

Water Quality Indicator: **Phosphorus**



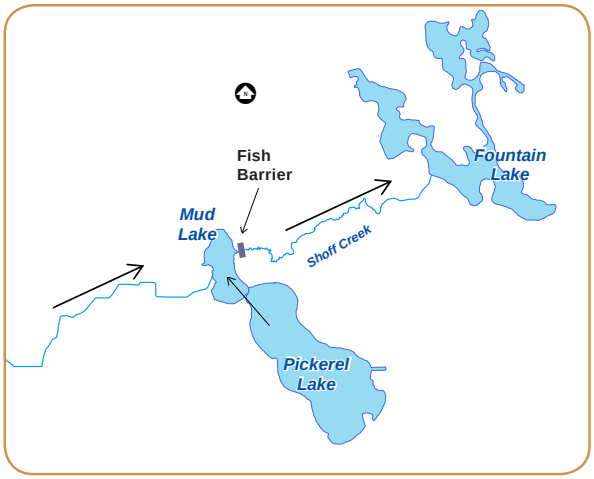
Phosphorus is a plant nutrient in the soil that stimulates the growth of algae when in lake water. The District has monitored phosphorus in Pickerel Lake since 2005. Summer-average phosphorus concentrations in the lake have historically been, and continue to be, higher than the MPCA's standard for shallow lakes in southern Minnesota. However, 2010 phosphorus concentrations were the lowest on record for Pickerel Lake, an improvement likely resulting from the District's recent reclamation project (see reverse).

Continued on reverse

In-Depth: **Pickerel Lake Reclamation**

Considered an impaired water body by the Minnesota Pollution Control Agency (MPCA), Pickerel Lake historically suffered from poor water quality. One of the main contributors to the poor water quality was an over-abundant population of rough fish, especially bottom-feeding carp. Carp disturb the lake bottom and re-suspend sediment and phosphorus into the water, making the water cloudy. This adversely affects water quality and aquatic vegetation, damaging habitat and contributing to algal blooms.

In 2008, the District began efforts to restore a healthy and balanced fish community to Pickerel Lake and improve the lake's water quality. The first phase of the project was construction of an electric fish barrier at the downstream end of Mud Lake (just downstream of Pickerel Lake), to prevent fish from entering or exiting the Pickerel and Mud chain of lakes.



In 2009, the Minnesota Department of Natural Resources (DNR) and the District treated Pickerel Lake with chemicals to eliminate the rough fish population. In the spring of 2010, the DNR restocked the lake with northern pike, yellow perch, and bluegill to re-establish a healthy game fish population. A healthy game fish population in the lake is important, as they can help maintain a clean water state in shallow, nutrient-rich lakes through the effect they have on the aquatic food chain.

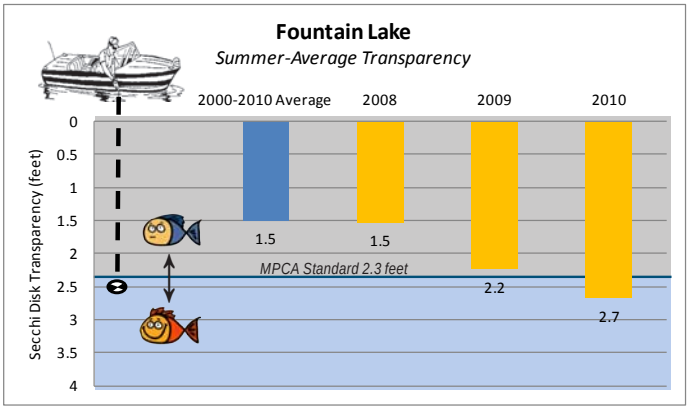
Water Quality Improving

Significant improvements to the lake's water quality were observed in 2010. The summer-average water clarity was 3.5 feet, the best on record for the lake (see Page 1). Phosphorus concentrations in the lake were significantly lower than previous years. The estimated internal phosphorus loading, the re-suspension of phosphorus into the water from lake sediments, was significantly lower in 2010 than in 2009 (a reduction of approximately 70%). This is likely a result of the reduced rough fish populations in 2010.

Improvements to aquatic habitat were also observed; native aquatic plant communities were re-established, which helped stabilize lake sediments against wave disturbance and provide shelter to young fish. The improved habitat has attracted more waterfowl to the lake; District staff report that record numbers of duck hunters enjoyed the revitalized lake in the fall of 2010.

Improvements Seen in Downstream Fountain Lake

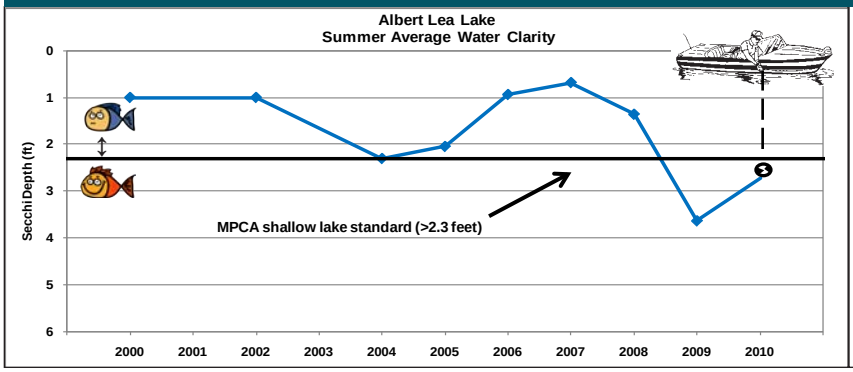
Water that leaves Pickerel Lake first flows through Mud Lake, and then to downstream Fountain Lake via Shoff Creek (see figure at left). Monitoring data from recent years indicates that the water quality in Shoff Creek is highly impacted by the quality of Pickerel Lake. In 2010, a significant reduction in the average (flow-weighted mean) total phosphorus concentration in Shoff Creek was observed—approximately 34% less than the 2009 average concentration. The reduced amount of phosphorus entering Fountain Lake in 2010 helped to achieve the best water clarity on record for Fountain Lake (see figure below).



2010 Clean Water Report Card: **Albert Lea Lake**

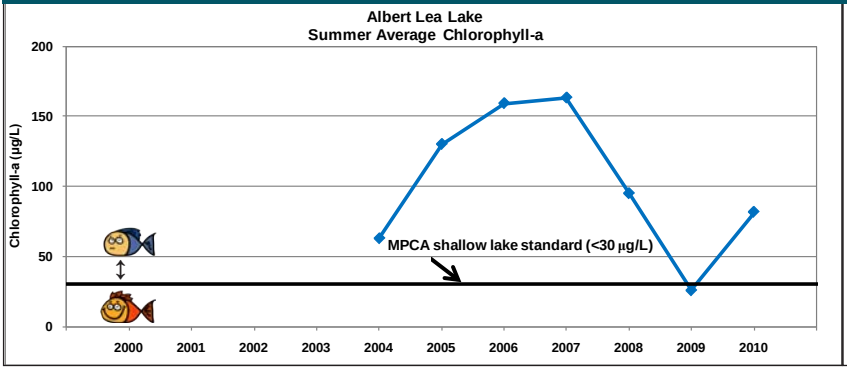
Watershed area: 93,370 acres • Lake surface area: 2,653 acres• Maximum lake depth: 6.0 feet • Mean lake depth: 3.5 feet

Water Quality Indicator: **Water Clarity**



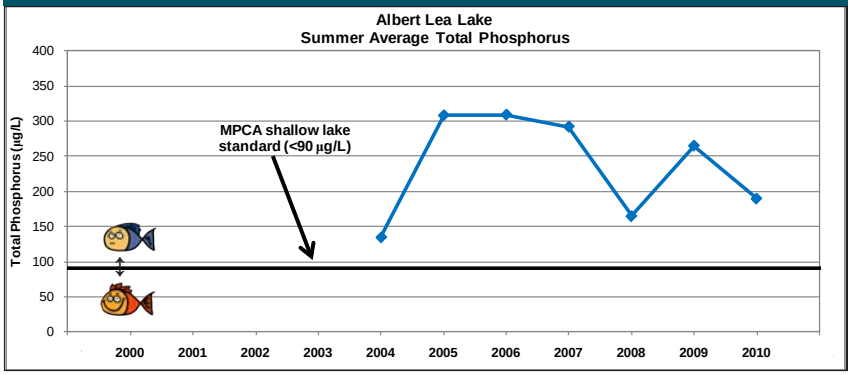
The water clarity of Albert Lea Lake has been monitored regularly since 2000. The clarity of the water is measured by lowering a black and white disk (Secchi disk) into the water and identifying the depth at which the disk is no longer visible. As shown in the figure, the summer-average clarity of Albert Lea Lake has improved in recent years, surpassing the Minnesota Pollution Control Agency's (MPCA) clarity standard for shallow lakes in southern Minnesota in 2009 and 2010. The standard was also met in 2004, a likely result of a winter fish kill that decreased the lake's carp population.

Water Quality Indicator: **Chlorophyll *a***



Chlorophyll *a* is the main photosynthetic pigment found in algae, and is often measured to determine the amount of algae in water. The District has monitored chlorophyll *a* in Albert Lea Lake since 2004. The summer-average chlorophyll *a* concentrations in the lake have historically been higher than the MPCA's standard for shallow lakes in southern Minnesota, with exception of 2009. These high chlorophyll *a* levels typically indicate an abundance of algae in the lake, which is also evident by the pea-green color of the water at times.

Water Quality Indicator: **Phosphorus**



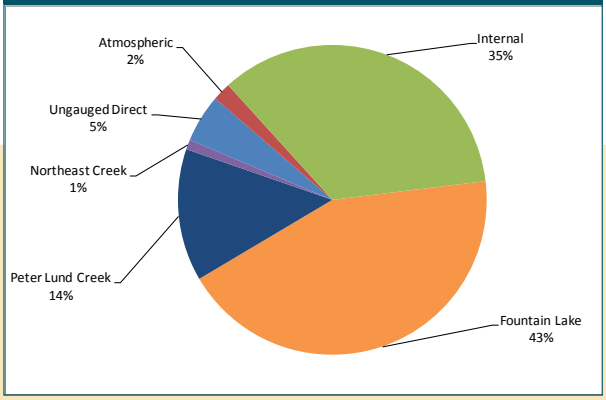
Phosphorus is an essential element for plant life, but when there is too much, it stimulates the growth of algae. Summer-average phosphorus concentrations in the lake are consistently higher than the MPCA's standard for shallow lakes in southern Minnesota. These high levels of phosphorus often result in severe algal blooms. Sources of phosphorus to the lake (see reverse) include stormwater runoff from Albert Lea and other upstream areas, water from Fountain Lake, and the release of phosphorus from lake sediments, a process that is aggravated by the botttom-feeding activities of carp.

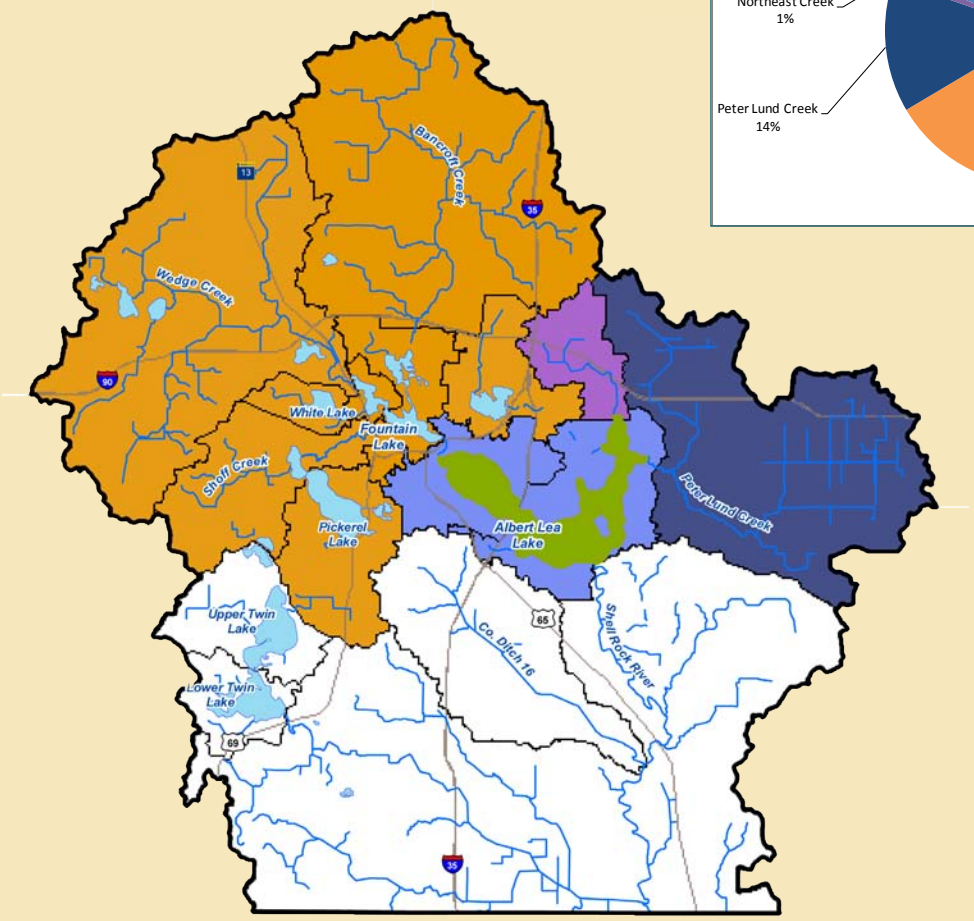
Continued on reverse

A Closer Look: **Phosphorus Contributions to Albert Lea Lake**

Contributions of phosphorus, a nutrient that can degrade water quality in several ways, were estimated based on water quality monitoring data collected from Albert Lea Lake and the upstream lakes and streams. The pie chart at right shows a breakdown of the phosphorus sources to the lake during the 2010 monitoring season (April through October). The areas that correspond to each of the sources are shown on the map below.

Sources of Phosphorus





Stormwater runoff is a significant source of phosphorus to Albert Lea Lake. When it rains, stormwater carries sediment and the phosphorus attached to sediment particles, from the land into nearby lakes and streams. The water from Fountain Lake and its tributary watershed was the largest source of phosphorus to Albert Lea Lake during the 2010 monitoring season (about 43%). An additional 14% of the phosphorus came from Peter Lund Creek.

Another significant source of phosphorus to Albert Lea Lake during the 2010 monitoring season was internal loading (about 35%). All lakes accumulate phosphorus (and other nutrients) in the sediment from the settling of particles and dead organisms. Internal loading occurs in some lakes as the phosphorus in the sediment is reintroduced into the lake water and becomes available again for uptake by plants. This complex process of internal loading can be affected by water temperature, oxygen, pH, wind mixing, and disturbance by bottom-feeding fish such as carp.

Prepared for the Shell Rock River Watershed District by Barr Engineering Company • March 2011

Shell Rock River Watershed District
Working Together to Improve Water Quality