Clean Water Report for 2013

Annual Summary of Water Quality Monitoring Program
Shell Rock River Watershed District

What's inside:

- **Extra monitoring aids Fountain Lake restoration project**
- **Surprising improvements in lake water clarity**
- **Heavy spring rains trigger high stream flows**
- **Goose Lake restoration project approaches implementation**
- **Severe winter threatens fish populations**

Shell Rock River Watershed District
Working Together to Improve Water Quality

March 2014

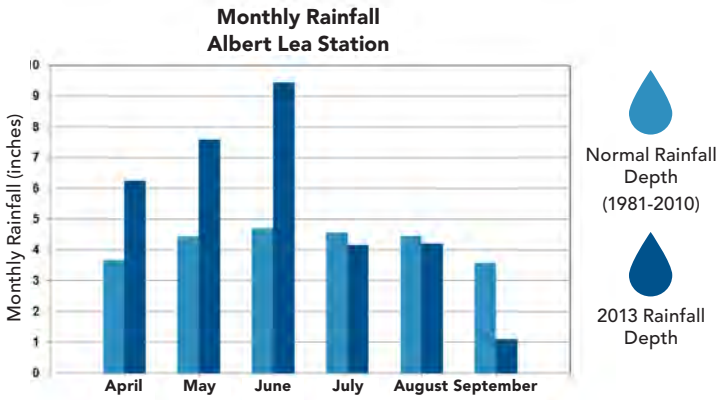
Water Quality Monitoring

Understanding History to Prepare for the Future

District staff tracked the responses of local lakes and streams to the extreme weather of 2013 by sampling water at 12 lake-monitoring sites and 12 stream-monitoring sites. The District monitors its lakes and streams each year to identify long-term water-quality trends and to understand the causes of year-to-year variation in water quality. The relationships between rainfall, runoff, and water quality recorded in 2013 will be used to support future restoration activities, such as dredging for the Fountain Lake Restoration Project.

Record Spring Rains Dominate 2013 Monitoring Season

The spring of 2013 was one of the wettest and coldest on record for the Shell Rock River Watershed District. Rainfall from April through June was more than ten inches above normal, resulting in flooding near many lakes and streams. Weather patterns reversed course in late summer, causing lakes to recede and streams to dry up, as less than two inches of rain fell between August 15 and September 30.



A Focus on Fountain Lake

Fountain Lake has suffered from poor water quality for years and was added to the Minnesota Pollution Control Agency's list of impaired waters in 2008 due to excess phosphorus concentrations. Too much phosphorus is problematic in lakes because it often results in overabundant algae that reduce water clarity.

The District has been working to improve water quality in Fountain Lake since its inception in 2003. Numerous management activities have been undertaken to reduce the amount of phosphorus reaching Fountain Lake from its upstream watershed, including installation of stream and ditch buffers, septic system compliance assistance, streambank erosion control projects, fish barrier installation, and rough fish eradication.

While upstream improvements have reduced watershed phosphorus contributions, a significant portion of the phosphorus problem in Fountain Lake comes from within the lake itself. tLarge amounts of phosphorus-rich sediment from the upstream watershed have historically been deposited in Fountain Lake. Under certain conditions, this phosphorus can be released from the lake sediments into the water, causing algal blooms. The District hopes to reduce this internal phosphorus loading by dredging portions of the lake and removing the top layer of phosphorus-rich sediment. During 2013, the District began working with regulators to understand the water quality impacts of the proposed dredging project. This preparatory work included an extensive sediment and water monitoring effort and development of a lake model to simulate different dredging scenarios and their effects on lake water quality.

Sediment Core Sampling Reveals Extensive Sediment and Phosphorus Accumulation

To better understand the extent of sediment and phosphorus accumulation, District staff assisted engineering crews with sediment core sampling on Fountain Lake during March and July of 2013. The crews took 23 sediment cores, typically 9 feet deep, throughout Fountain Lake. The cores help the engineers understand the type and depths of material on the lake bottom, which influences how the sediment is dewatered and transported upon removal. The sediment cores were also analyzed to help understand the amount of phosphorus in the sediment layers. Samples were collected every few inches along the cores, to identify the layers in the sediment and the areas within the lake that contain the type of phosphorus with the highest contribution to water quality deterioration. Results of this sampling help determine where and how deep the lake should be dredged to maximize water quality benefits.

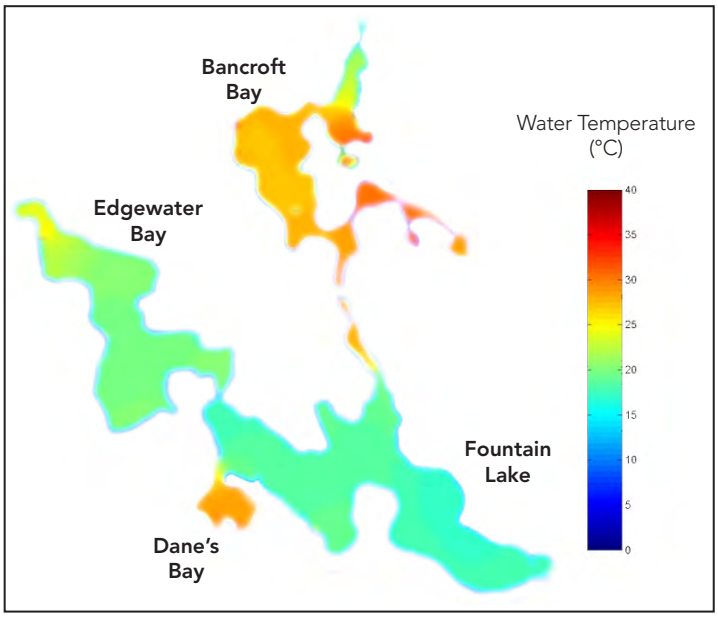
Preparing for Restoration Project

(Left) An example of a sediment core taken from the Main Bay portion of Fountain Lake, which identified five feet of silt at the lake bottom. The cores helped to understand the variation in sediment characteristics throughout the lake. Additional sediment phosphorus analysis was conducted to understand the chemistry within these layers since visual observations alone could lead to overestimating the amount of sediment removal necessary to reduce phosphorus impacts.

Using Modeling to Predict Dredging Impacts

Predicting the potential impacts of dredging on Fountain Lake water quality is an important, but highly challenging and complex endeavor. To address this question, the District is using an innovative modeling software (Delft 3D) from the Netherlands to create a three-dimensional (3D) representation of Fountain Lake. The 3D model can track the pathways of water flowing through the lake, indicating where sediment is likely to be deposited and where it is likely to be washed away. Then the model estimates how much phosphorus will relocate from the deposited sediment into the lake water, in order to predict how it would stimulate algal growth.

The innovative model can predict variation in water characteristics throughout the different areas of the lake, such as temperature or dissolved oxygen levels at varying water depths. For example, the image below shows how water temperature at the bottom of the lake varies from warmer temperatures in the shallows of Bancroft Bay and Danes Bay to cooler temperatures in the deeper parts of the lake. Higher water temperatures can degrade water quality by speeding the movement of phosphorus from sediment to lake water.

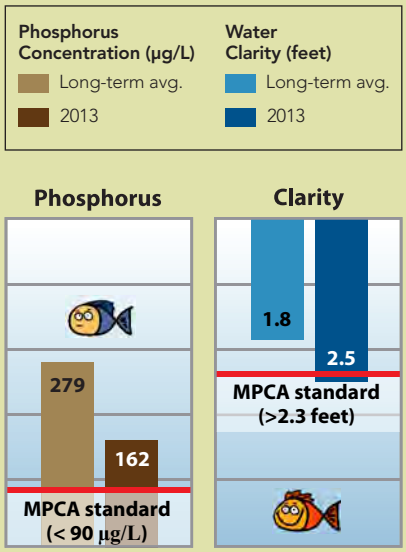


Temperature variations at the lake bottom throughout Fountain Lake.

Fountain Lake

Maintaining recent gains

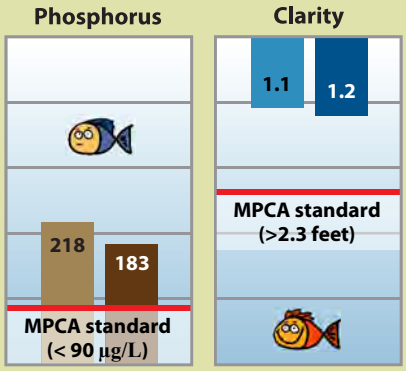
In 2013, Fountain Lake's phosphorus concentration and clarity were both better than their long-term averages. The lake's clarity has been better than its long-term average in each of the last five years, and has met the state standard in three of those years.



White Lake

A typical (bad) year

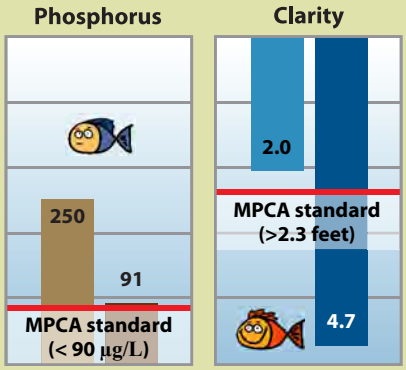
White Lake's phosphorus concentration and clarity were similar to their long-term averages in 2013. Water quality fell significantly short of the state standards by both measures.



Pickerel Lake

Stellar returns

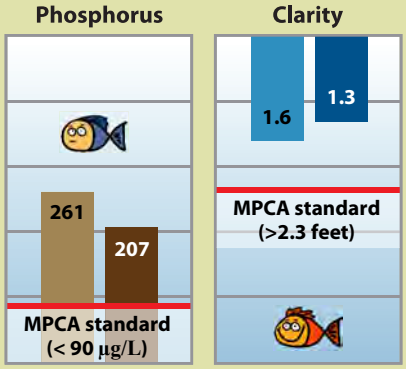
Pickerel Lake turned in another stellar performance in 2013. Clarity has far exceeded the state standard every summer since the fall 2009 reclamation project. Phosphorus concentration narrowly exceeded the standard in 2013, but was less than half the long-term average.



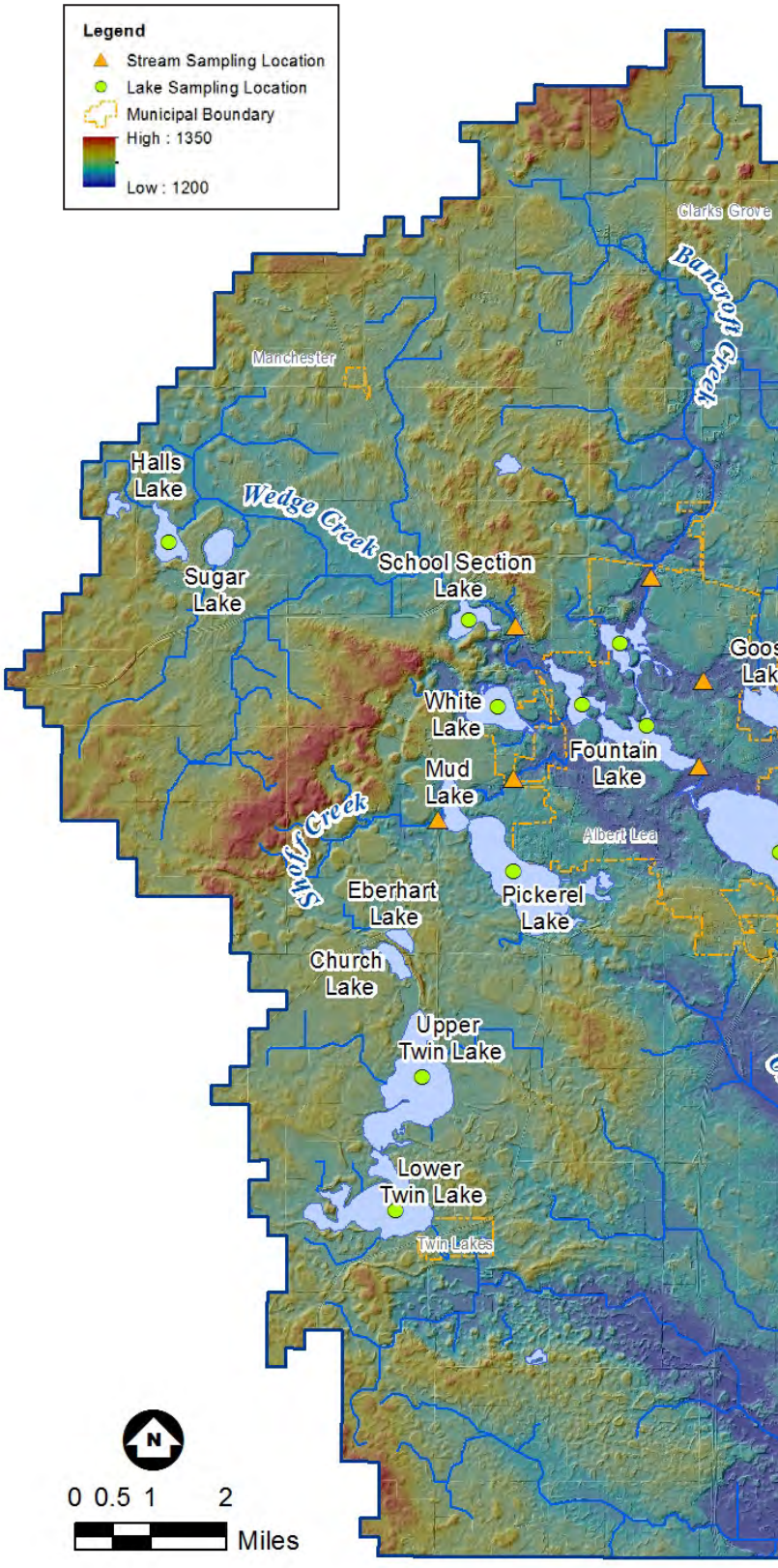
Albert Lea Lake

Mixed results

Phosphorus concentration was slightly better than average while clarity was slightly worse. Profuse algal blooms caused water quality in Albert Lea Lake to rapidly decline after August first.



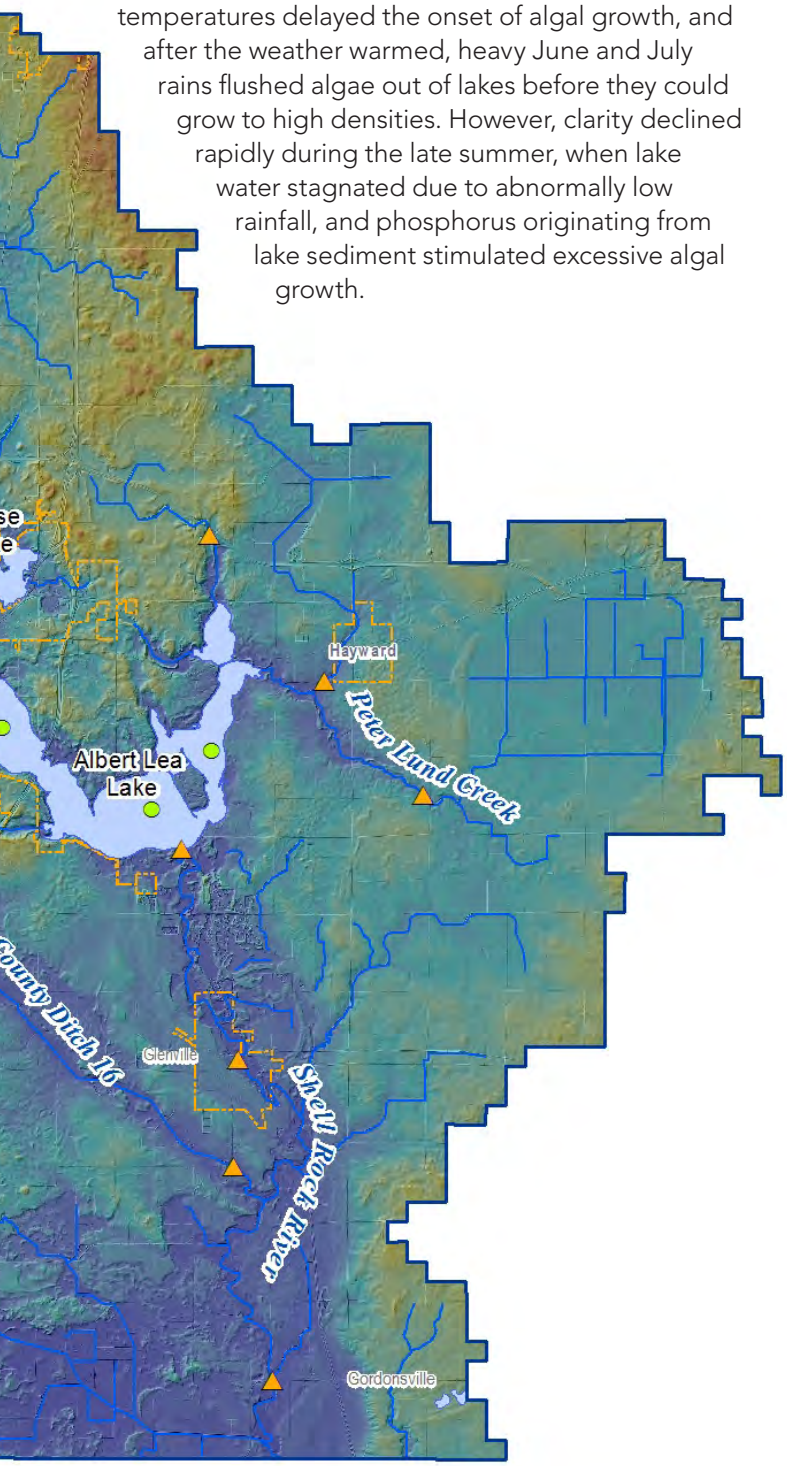
Across the Watershed: 2013 Lake Water Quality

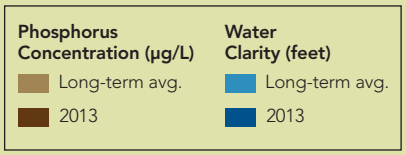


Unexpected Results

Lake water quality monitoring during 2013 revealed some unusual relationships between phosphorus and water clarity. High phosphorus concentrations typically lead to high algae densities, which result in poor water clarity. In 2013, summer-average phosphorus concentrations (measured from June through September) failed to meet the state standard in any of the eight monitored lakes, yet summer-average water clarity did meet the state standard in five of the lakes.

Clarity was better than expected because cool spring temperatures delayed the onset of algal growth, and after the weather warmed, heavy June and July rains flushed algae out of lakes before they could grow to high densities. However, clarity declined rapidly during the late summer, when lake water stagnated due to abnormally low rainfall, and phosphorus originating from lake sediment stimulated excessive algal growth.

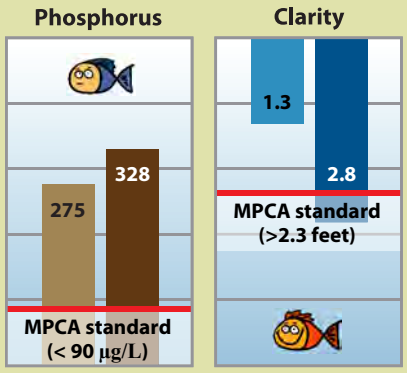




Upper Twin Lake

A pleasant surprise

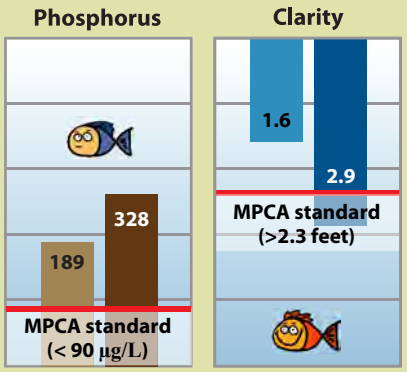
Upper Twin Lake went completely dry during the drought of 2012. Spring rain and snow-melt refilled the lake in 2013, and although phosphorus concentration was higher than usual, clarity met the state standard for the first time on record.



Lower Twin Lake

Summer decline

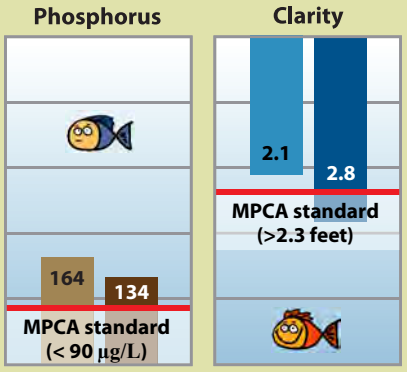
Lower Twin Lake had better than average clarity in 2013. Like Upper Twin Lake, clarity met the state standard for the first time on record, even though the phosphorus concentrations were higher than the long-term average.



Hall's Lake

Making the grade

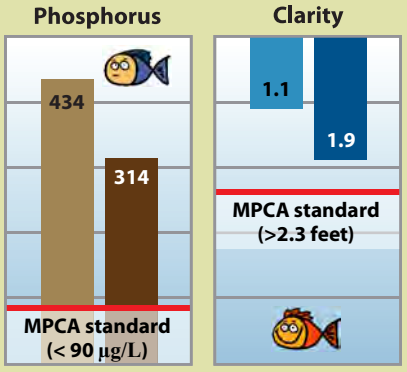
The District began monitoring Hall's Lake three years ago, and 2013 was the best year yet for both phosphorus and clarity. This was the first year that Hall's Lake met the state standard for water clarity.



School Section Lake

Algal bloom issues

School Section Lake had better than average phosphorus concentration and clarity in 2013. During the early summer, clarity showed marked improvement from past years, but clarity decreased rapidly when severe algal blooms appeared later in the summer.

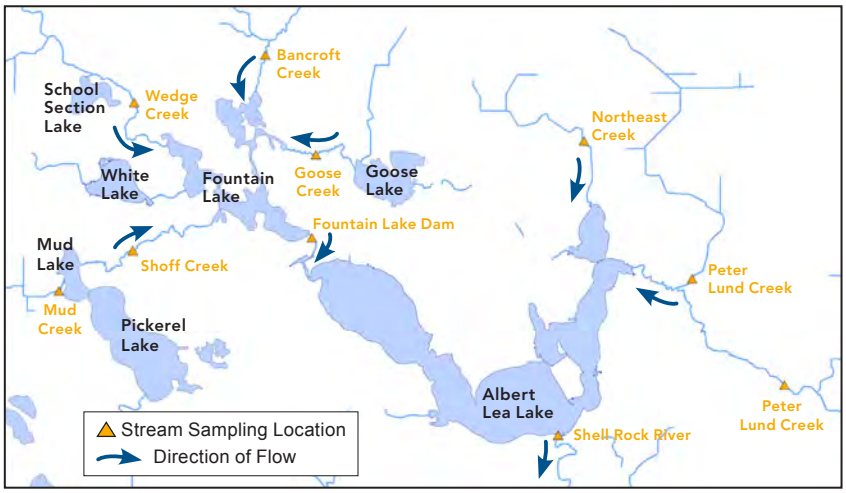


Stream Monitoring Summary

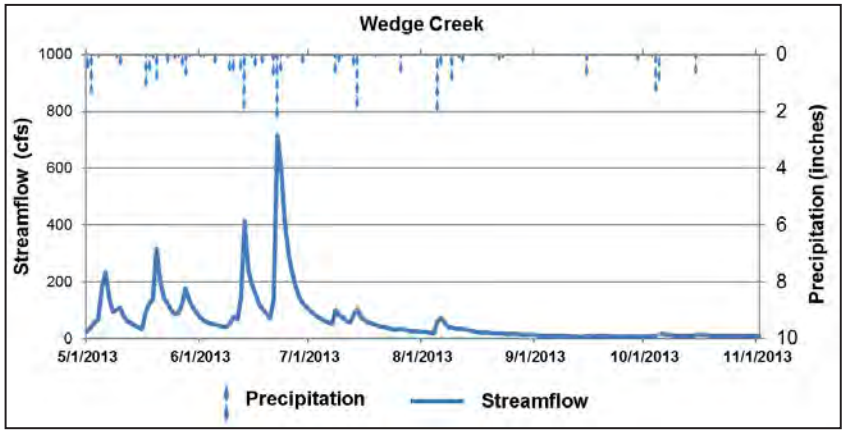
Heavy Runoff Presents Sampling Opportunities

The Shell Rock River Watershed District has a vast network of ditches and streams, many of which flow into area lakes, transporting runoff and pollutants from the upstream watershed. The District monitored their streams at twelve locations in 2013 (many shown in adjacent figure) to help understand how flow and pollutants travel through the watershed via streams and lakes, eventually reaching the Shell Rock River.

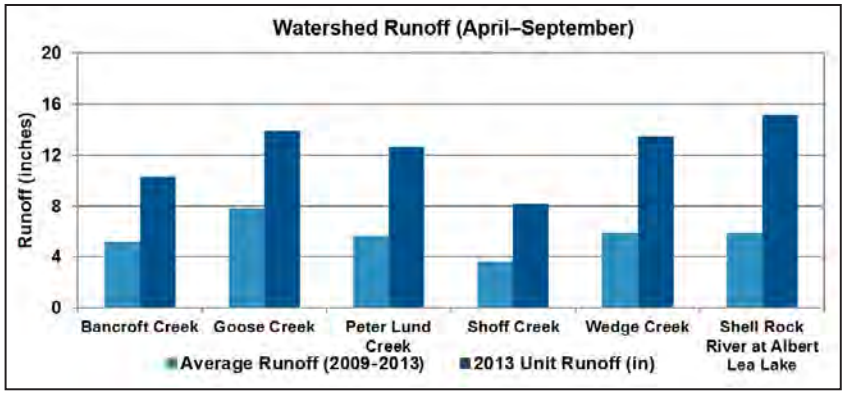
When monitoring streams, it is important to collect samples that represent a wide range of flow conditions, including when the streams are flowing at or near their peak flow rates. Capturing "snapshots" of flow and water quality during these short-lived events is especially important because streams can carry much higher concentrations of sediment and other pollutants during high flow periods. In 2013, early season rainstorms gave the District frequent opportunities to sample runoff events during the peak flow rate. District staff played "storm-chaser," mobilizing quickly once a storm had passed to collect samples during the highest flows. The data gathered during 2013 will be useful for developing more accurate predictions of stream flow and pollutant contributions from District streams and their watersheds.



A depiction of the District's chain of lakes, including many of the stream monitoring locations. District stream monitoring provides data on the travel patterns of pollutants throughout the flow network.



This graph shows the measured streamflow in Wedge Creek, along with the daily rainfall throughout the 2013 monitoring season. Heavy springtime rains and an unusually dry late-summer and fall were reflected in the variations in recorded streamflows.

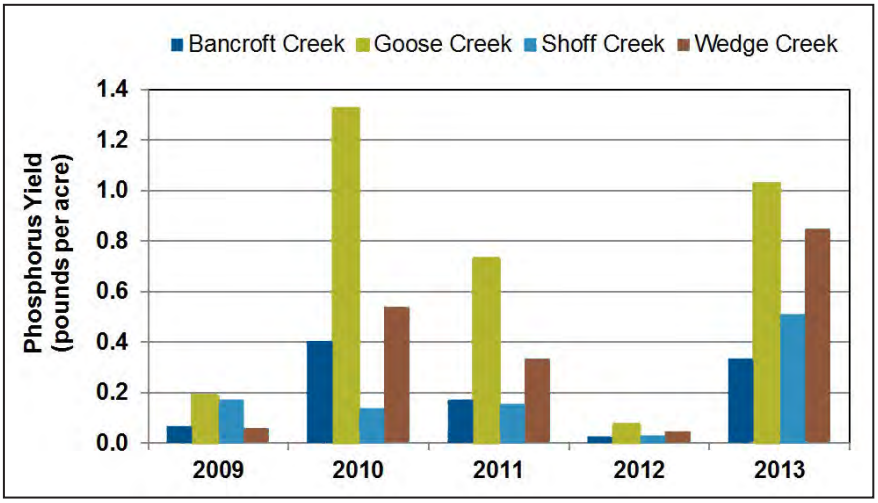


The spring of 2013 was one of the wettest on record in Freeborn County. The heavy early-season rainfall resulted in April–September watershed runoff well above the average, even though many ditches and streams were nearly dry by fall.

Monitoring Highlights Goose Lake Phosphorus Problem

Goose Lake, an approximately 80-acre lake nestled just north of Main Street on the east side of Albert Lea, serves as the headwaters for Goose Creek, one of the four major streams that flow into Fountain Lake. District staff collect water samples and monitor flow rates on these streams—the others are Bancroft Creek, Shoff Creek, and Wedge Creek—to assess the health of the streams and to measure the amounts of nutrients and sediment they carry to Fountain Lake. Monitoring results from recent years showed that when compared to the other streams, Goose Creek contributed the highest amount of phosphorus per acre of watershed in each of the past five years.

The Goose Creek watershed exports large amounts of phosphorus because Goose Lake is infested with large numbers of common carp, which travel upstream from Fountain Lake each spring to spawn in Goose Lake's warm, shallow waters. There, they stir up the phosphorus-rich lake bottom, suspending sediment and phosphorus alike in the lake water where it can easily wash downstream through Goose Creek to Fountain Lake.



(Left) Stream monitoring results indicate that in recent years, Goose Creek has the highest phosphorus yield of the four major streams flowing into Fountain Lake. The problem is an overabundance of carp (above), which stir up the phosphorus-rich bottom sediments of the lake.

Last spring the District brought a group of state regulatory officials to the proposed barrier site to discuss the project, prior to applying for construction permits.

Goose Creek Fish Barrier to be Installed

The District received a $395,000 grant from the Conservation Partners Legacy (CPL) Grant Program for the Goose Lake restoration project, which includes installation of a Goose Creek fish barrier and eradication of all fish species and re-introduction of game fish.

In the fall of 2014, the District will install an electric fish barrier on Goose Creek between Fountain Lake and Goose Lake. In addition, a berm will be constructed on the banks of the creek at the east side of Green Lea Golf Course. The berm will prevent carp from swimming around the barrier if Goose Creek overflows its banks.

Secondarily, the District will team up with the DNR to eradicate all fish species in Goose Lake, and re-introduce game fish (bluegill, perch, and northern pike). This project will complement the existing fish barriers installed in 2008 and 2009—all part of a multi-prong approach to watershed and lake restorations in the SRRWD.

Looking Ahead: District Plans for 2014

Busy Construction Season Planned

2014 will be a busy construction year for the Shell Rock River Watershed District. In addition to the fish barrier on Goose Creek (page 6), a new outlet structure and fish barrier on Albert Lea Lake are planned for construction in the fall of 2014. The existing structure and access bridge, installed in 1922, are in dire need of repair. The new structure facilitates lake-water-level management, and combined with the electric fish barrier, it is expected to improve aquatic habitat; waterfowl nesting, breeding, and feeding habitat; desirable fish populations; and water quality and clarity.

The District will also continue to lay the groundwork for the Fountain Lake Restoration Project. District staff members have been involved in meetings at the State Capitol to support a request for funding through Governor Mark Dayton's 2014 bonding bill. Preliminary engineering efforts, including the dredge design, will continue throughout 2014, in collaboration with stakeholders and regulators.

Working Hard through Winter Months

The District watches dissolved oxygen levels in Albert Lea Lake, Fountain Lake, and Pickerel Lake throughout the winter to ensure fish populations can be sustained. When dissolved oxygen levels are low, the District uses lake aerators to increase oxygen and prevent winterkill. Shallow lakes with abundant aquatic plant communities are prone to winterkill, especially during long, harsh winters. This is because thick snow and ice cover on a lake limits the sunlight reaching the plants, reducing photosynthesis and oxygen levels. When the plants die and decompose, oxygen is further depleted. Ultimately, when oxygen levels become too low, fish are unable to survive.

The District recognizes the importance of recreational ice fishing on District lakes.

Dissolved oxygen levels were especially low late in 2013. In early 2014, District staff noted fish congregating at small openings on Pickerel Lake, seeking oxygen. Weeks later, a major fish kill occurred on Albert Lea Lake. Although game fish were lost, District staff are optimistic that the beneficial netting and removal of over 100,000 pounds of carp outweighed the loss of desirable fish. The District is planning to work with the DNR to restock the lake with game fish in the spring and expects fish populations to be back to normal in two to three years.

Source: Jerad Stricker

Carp congregating in open water below Fountain Lake Dam. 100,000 pounds of carp were netted and removed—carp that might have survived the winter.

About the Shell Rock River Watershed District

The mission of the Shell Rock River Watershed District is to implement reasonable and necessary improvements to the water-related and other natural resources of the District.

Board of Managers

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Dan DeBoer, Vice Chair
Gary Pestorious, Treasurer
Art Ludtke, Secretary
Alan Bakken
Scott Erlandson
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Andy Henschel, Director of Field Operations
Connie Enestvedt, Office Manager
Carmen Christensen, Financial Clerk and Recording Secretary
Jerad Stricker, Conservation Technician

For more information:
www.shellrock.org

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Cities and towns in the District:

- Albert Lea
- Hayward
- Glenville
- Twin Lakes
- Manchester
- Clarks Grove (partial)

Lakes in the District:

- Pickerel and Mud
- White (Chapeau)
- Fountain
- Albert Lea
- Goose
- School Section
- Upper and Lower Twin
- Halls
- Sugar
- Church
- Eberhart

Prepared for the Shell Rock River Watershed District by Barr Engineering Company • March 2014

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