PRIOR LAKE - SPRING LAKE
WATERSHED DISTRICT

January 05, 2015

Jennifer Satnik
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194

Re: MN0067377 Prior Lake-Spring Lake Ferric Chloride Inflow Treatment System:

Annual Progress Report

Dear Jennifer Satnik:

Enclosed is an Annual Progress Report for the Prior Lake-Spring Lake Ferric Chloride Treatment System as required by the permit.

The Discharge Monitoring Reports and Supplemental Report Forms for the National Pollutant Discharge Elimination System permit for the operating year 2014 have been submitted electronically.

If you have any questions about the enclosed materials or the operation of the Prior Lake-Spring Lake Ferric Chloride Inflow Treatment System in 2014, please contact me at (952) 440-0068 or jrockney@plslwd.org.

Sincerely,

Jaime Rockney

Water Resources Specialist

Ferric Chloride Water Treatment Facility
2014 Annual Report
NPDES/SDS Permit No. MN0067377

Mailed to:
Submittals Center
Minnesota Pollution Control Agency
520 Lafayette Road North
Saint Paul, MN 55155

January 2015

PRIOR LAKE - SPRING LAKE
WATERSHED DISTRICT

Background

Spring Lake is a recreational lake located in central Scott County, Minnesota. The lake is listed on the State Impaired Waters List as impaired for aquatic recreation due to excess nutrients. Monitoring completed by the Prior Lake-Spring Lake Watershed District (PLSLWD) in the 1990's identified phosphorus as the nutrient most contributing to water quality impairment and algae blooms. That study also noted that a significant portion of the phosphorus entering Spring Lake was in the form of dissolved phosphorus (soluble reactive phosphorus, or SRP) thus making it readily available for algal uptake. Spring Lake flows directly into Upper Prior Lake, which is also listed as impaired due to excess nutrients.

In 1998, the PLSLWD constructed a ferric chloride ($FeCl_3$) treatment system to precipitate SRP out of stormwater from County Ditch 13, the main inflow to Spring Lake. The system was constructed as part of a Minnesota Pollution Control Agency (MPCA) Clean Water Partnership Implementation Project. The treatment system began operating under a permit from the Department of Natural Resources. In 2004, the treatment system permit was renewed as a National Pollutant Discharge Elimination System permit administered by the MPCA. The District applied to the MPCA for a renewed permit in 2009. That permit was approved in 2012.

The treatment system involves the injection of 32.5% liquid $FeCl_3$ solution into a stormwater pond, or desiltation basin. The iron within the $FeCl_3$ binds with the dissolved phosphorus in the water and creates colloidal particles (floc) which settle at the bottom of the basin. The treated water then flows downstream into Spring Lake.

Prior to 2013, the $FeCl_3$ system had not operated since 2011 because it no longer met the requirements of the permit. During this time, the District was working toward a design that would meet requirements of the new MPCA permit. In July 2013, the treatment facility began operating again after it was retrofitted to meet new MPCA permit requirements. The old system injected $FeCl_3$ directly into the channel immediately downstream of the weir on the south side of Highway 13 where it would mix until reaching the desiltation pond. The new design transfers $FeCl_3$ from the treatment building through a double walled pipe to a culvert north of Highway 13 that flows directly into the desiltation basin (see Figure 1). The new design addresses the previous concerns of the MPCA by avoiding direct discharge into a water of the state, and instead, goes directly into a stormwater pond. A new pump was also installed by Vessco in 2013 in order to accommodate the new pumping requirements.

The retrofit project was designed by consultants Bolton and Menk, Inc. and installed by S.M. Hentges & Sons, Inc. The new design allowed for more water to be treated as compared to the old system. With the old system, high flows could resuspend phosphorus-iron flocculants within the basin and flush the flocculent downstream and into Spring Lake. The new system was designed to overtop a bypass weir (and flow around the desiltation basin) before the flows reached a point of resuspension in the pond. This allows for the maximum amount of phosphorus to be treated without resuspending the material in the desiltation basin.

Figure 1 Aerial Map of Ferric Chloride Treatment System

Summary of Results

In 2014, the Prior Lake-Spring Lake Watershed District (PLSLWD) started injecting $FeCl_3$ into the stormwater pond on April 1st and discontinued it on October 31, as part of its winter schedule.

During operation in 2014, the system treated approximately 959 million gallons (MG) of water. The system reduced the average concentration of Total Phosphorus (TP) by 0.19 mg/L (43%) and removed a calculated 550 pounds of phosphorus. The concentration of SRP was reduced by an average of 0.10 mg/L (72%) and approximately 752 pounds of SRP were removed from the system (see Table 1 and **Error! Reference source not found.** for detail).

Table 1 – Phosphorus Concentration Reductions

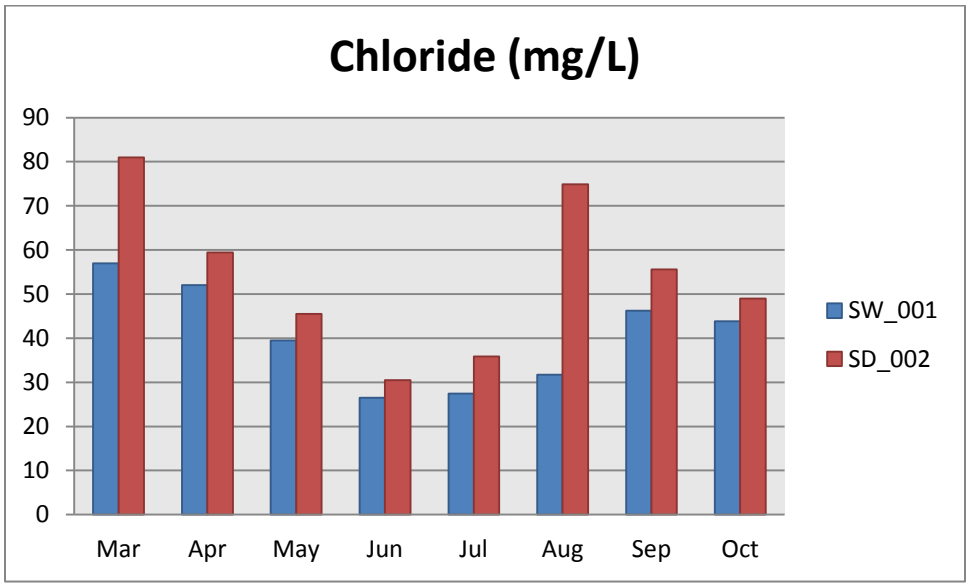
	Station SW001		Station SD002			
Month	**Total Phosphorous (mg/l)**	**SRP (mg/l)**	**Total Phosphorous (mg/l)**	**TP % Removal**	**SRP (mg/l)**	**SRP % Removal**
April	0.23	0.13	0.25	-8.7	0.06	53.8
May	0.13	0.07	0.12	7.7	0.02	71.4
June	0.29	0.19	0.25	13.8	0.08	57.9
July	0.23	0.19	0.12	47.8	0.02	89.5
August	0.59	0.19	0.08	86.4	0.01	94.7
September	0.52	0.09	0.09	82.7	0.01	88.9
October	0.32	0.08	0.1	68.8	0.04	50.0

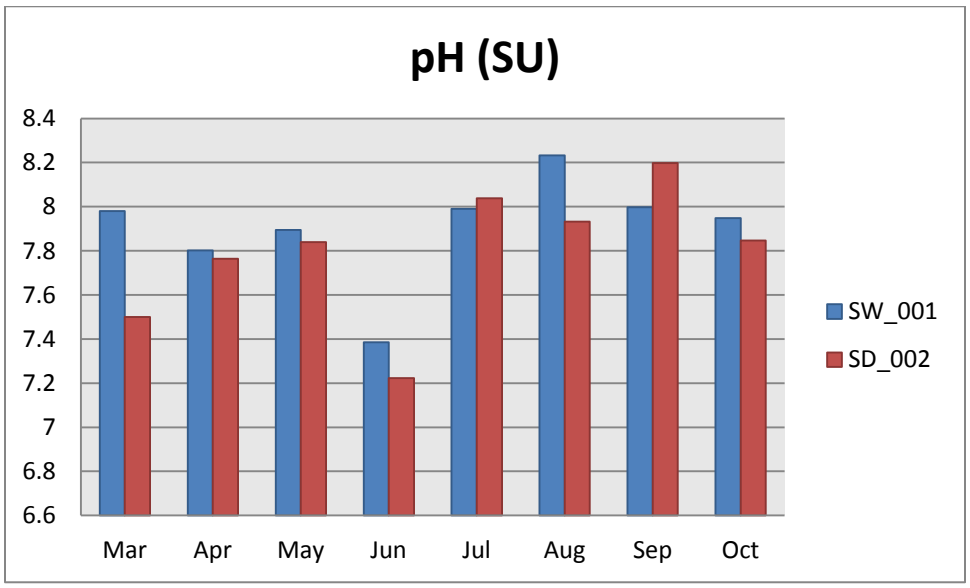
Table 2 Phosphorus Load Reductions

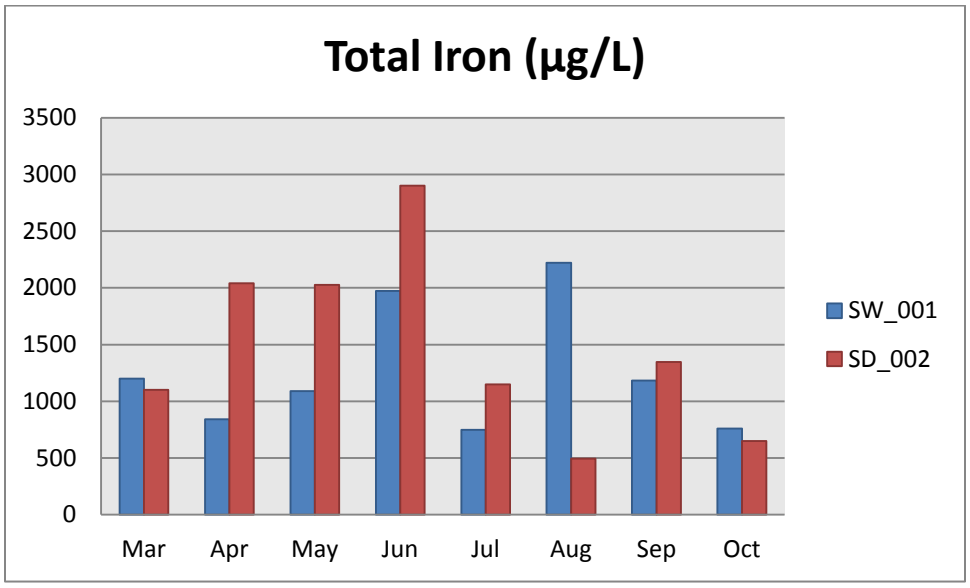
		SW-001	SD-002
April	Average TP (mg/L)	0.23	0.25
	Average SRP (mg/L)	0.13	0.06
	Treated Water (MG)		201.00
	TP Load Reduction (pounds)		-33.57
	SRP Load Reduction (pounds)		117.50
May	Average TP (mg/L)	0.13	0.12
	Average SRP (mg/L)	0.07	0.02
	Treated Water (MG)		246.00
	TP Load Reduction (pounds)		20.54
	SRP Load Reduction (pounds)		102.72
June	Average TP (mg/L)	0.29	0.25
	Average SRP (mg/L)	0.19	0.08
	Treated Water (MG)		299.00
	TP Load Reduction (pounds)		99.88
	SRP Load Reduction (pounds)		274.66
July	Average TP (mg/L)	0.23	0.12
	Average SRP (mg/L)	0.19	0.02
	Treated Water (MG)		118.00
	TP Load Reduction (pounds)		108.39
	SRP Load Reduction (pounds)		167.52
August	Average TP (mg/L)	0.59	0.08
	Average SRP (mg/L)	0.19	0.01
	Treated Water (MG)		42.00
	TP Load Reduction (pounds)		178.88
	SRP Load Reduction (pounds)		63.13
September	Average TP (mg/L)	0.52	0.09
	Average SRP (mg/L)	0.09	0.01
	Treated Water (MG)		26.00
	TP Load Reduction (pounds)		93.36
	SRP Load Reduction (pounds)		17.37
October	Average TP (mg/L)	0.32	0.10
	Average SRP (mg/L)	0.08	0.04
	Treated Water (MG)		27.00
	TP Load Reduction (pounds)		49.60
	SRP Load Reduction (pounds)		9.02
Total	Total TP Load Reduction (pounds)		550
	Total SRP Load Reduction (pounds)		752

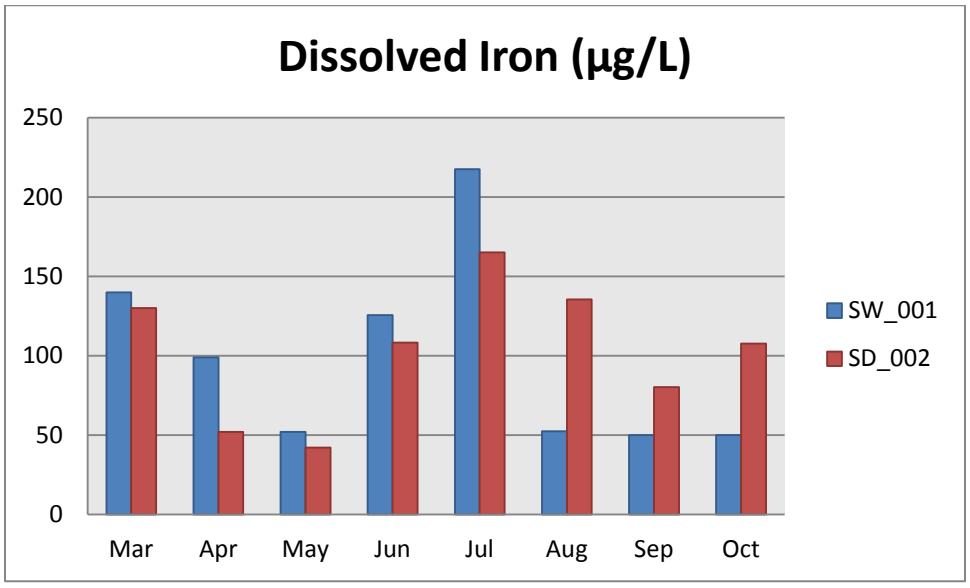
Data Graphs

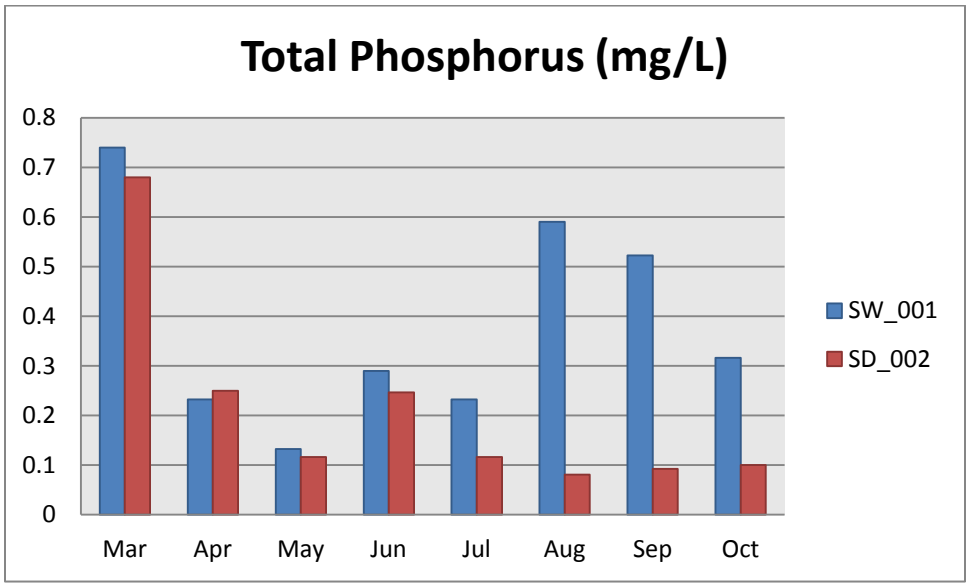
The following graphs represent the results of samples taken in 2014 at site SW-001 (upstream of treatment) and SD-002 (after treatment). One sample was taken in March before treatment began. Treatment began on April 1st and ceased on October 31st. From April through October, samples were taken once per week, and the results were averaged each month.

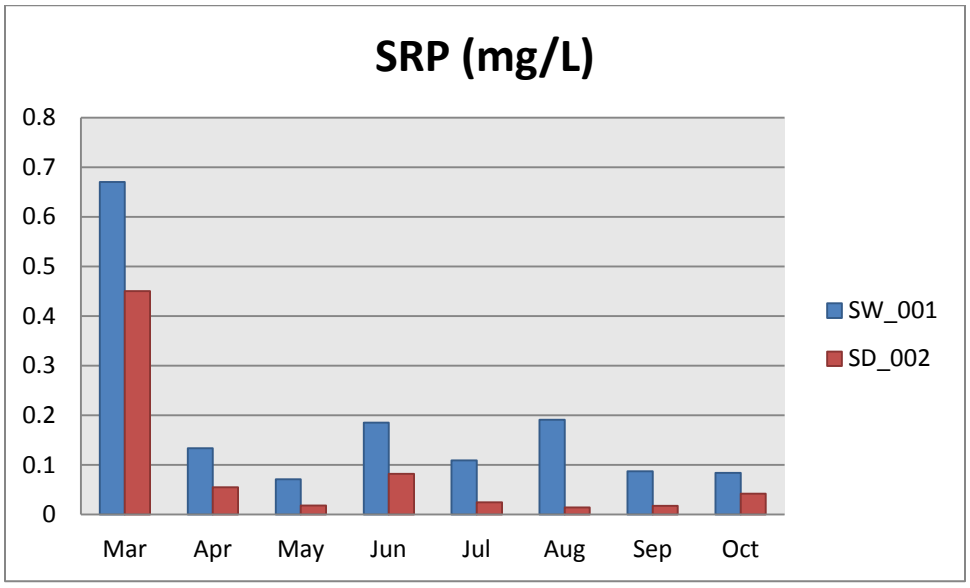


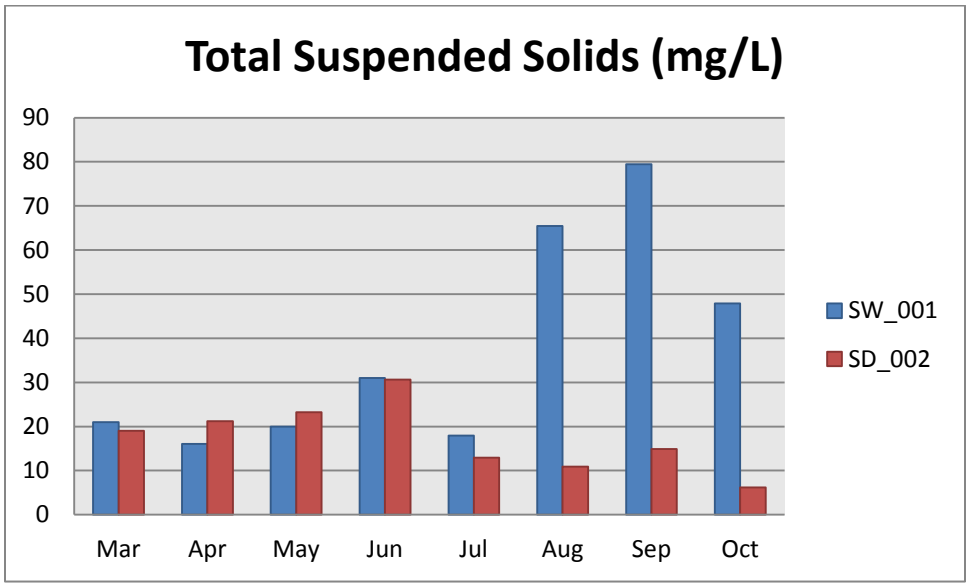


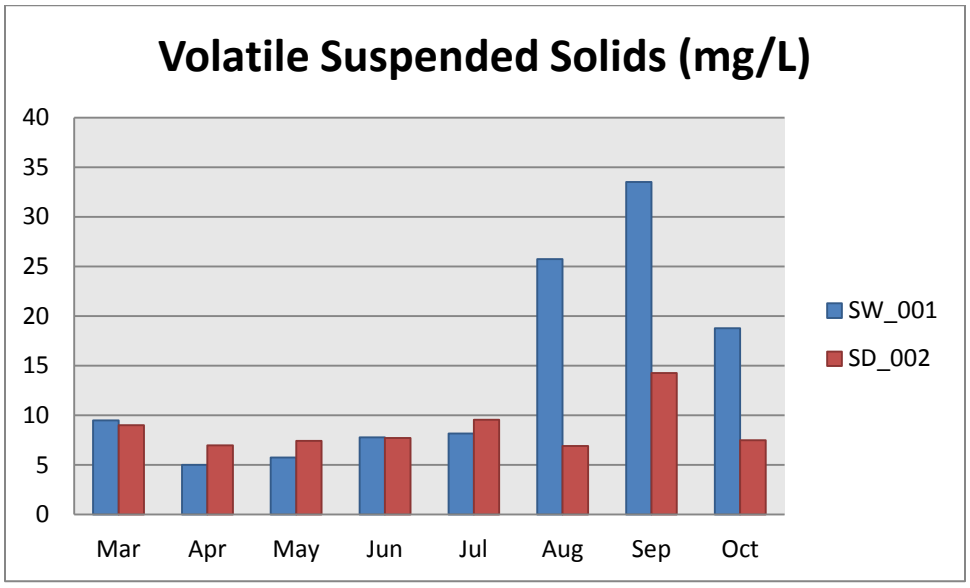

Total Iron (µg/L)
3500
3000
2500
2000
1500
1000
500
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
SW_001
SD_002


Dissolved Iron (µg/L)
250
200
150
100
50
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
SW_001
SD_002


Total Phosphorus (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
SW_001
SD_002


SRP (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
SW_001
SD_002


Total Suspended Solids (mg/L)
90
80
70
60
50
40
30
20
10
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
SW_001
SD_002


Volatile Suspended Solids (mg/L)
40
35
30
25
20
15
10
5
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
SW_001
SD_002