

Google Earth Map, 2003

Lake Monitoring Results for Gorman and Sabre Lakes, Le Sueur County, Minnesota, 2007 and 2008

[Lake Sampling Conducted: May - September, 2007 and 2008]

Prepared for:
LeSueur County

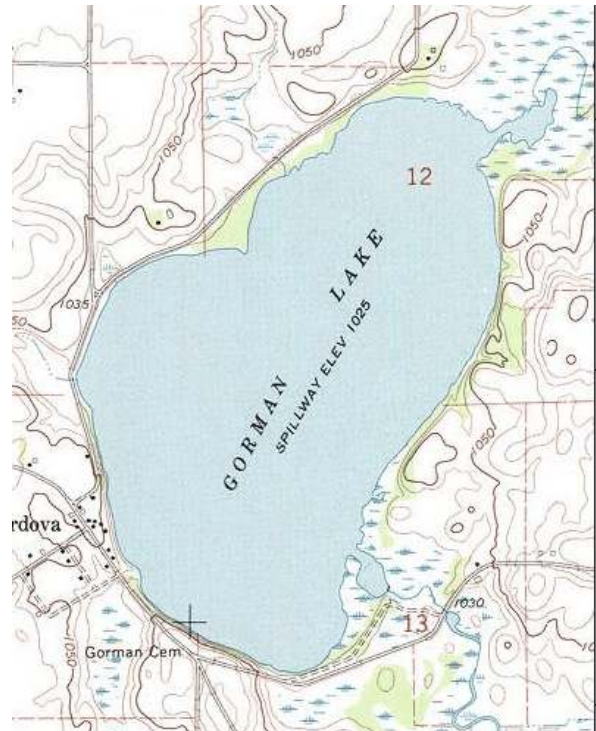
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Prepared April 2009

Gorman Lake (40-0032) LeSueur County, Minnesota

Gorman Lake (499 acres) was monitored 10 times from May through September in 2007 and in 2008.

The summertime (May-September) mean total phosphorus concentration has been extremely high in both 2007 and 2008. However, the lake's Secchi disc transparency has been fair with a summer mean of 4 feet in 2007 and 4.3 feet in 2008. The algae population shows wide ranging swings in surface water densities.



Gorman Lake: Maximum depth is 14 feet and average depth is about 7 feet. It has a surface area of 499 acres.

Gorman Lake

2007 Data

Date (2007)	Secchi Disc (ft)	Gorman Total Phos ($\mu\text{g/l}$)		Chl a ($\mu\text{g/l}$)	TKN (mg/l)	N:P Ratio
		top	bottom			
5.8	10.2	386	403	<1	--	--
5.21	5.3	590	628	4.4	--	--
6.6	2.7	820	820	20.3	--	--
6.19	3.6	1,040	1,080	68.8	--	--
7.10	2.1	1,390	1,390	37.2	--	--
7.20	5.3	1,310	1,340	9.2	--	--
8.15	2.1	1,660	1,980	61.4	1.9	1.1
8.28	4.0	1,450	1,490	13.1	--	--
9.12	2.3	1,170	1,140	42.3	2.2	1.9
9.27	1.7	1,070	1,110	11.1	1.6	1.5
Avg (May-Sept)	4.0	1,089	1,137	26.9		

2008 Data

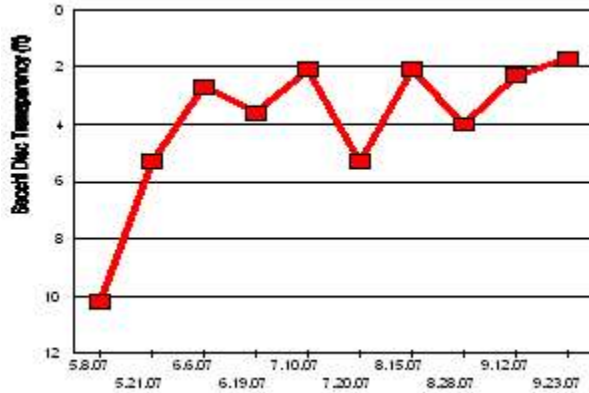
Date (2008)	Secchi Disc (ft)	Total Phos ($\mu\text{g/l}$)	Chl a ($\mu\text{g/l}$)	TKN (mg/l)	Gorman				
					$\text{NO}_3\text{-N}$ (mg/l)	N:P Ratio	TSS	TVS	Chloride
5.14	6.7	118	<1	1.1	0.70	15.3	4	108	18.8
5.29	8.6	191	1.6	1.3	<0.2	6.8	<2	<2	19.5
6.11	4.5	341	<1	1.6	0.63	6.5	<2	152	17.7
6.20	5.8	333	5.4	1.9	0.38	6.9	25	130	18.9
7.8	2.3	693	52.1	2.3	<0.2	3.3	16	--	18.1
7.30	3.5	1,050	13.7	2.0	<0.2	1.9	3	170	20.2
8.8	1.4	1,420	27.3	5.1	<0.2	3.6	10	200	19.0
8.26	4.1	1,500	41.9	2.3	<0.2	1.5	8	157	20.0
9.9	2.9	1,380	16.3	1.6	<0.2	1.2	9	4	20.7
9.30	3.6	1,210	48.1	2.9	<0.2	2.4	10	98	20.5
Avg (May-Sept)	4.3	824	20.8	2.2	0.3	4.9	9	113	19.3

Notes and Comments: Phosphorus is extremely high in Gorman Lake in 2007 and 2008. However, the water clarity has not been proportional to the phosphorus concentration, in fact, its been better than would be expected. It appears Gorman Lake algae are not phosphorus limited as is the case in most lakes. Rather, the algae are nitrogen limited for much of the summer. The low N:P ratios confirm this.

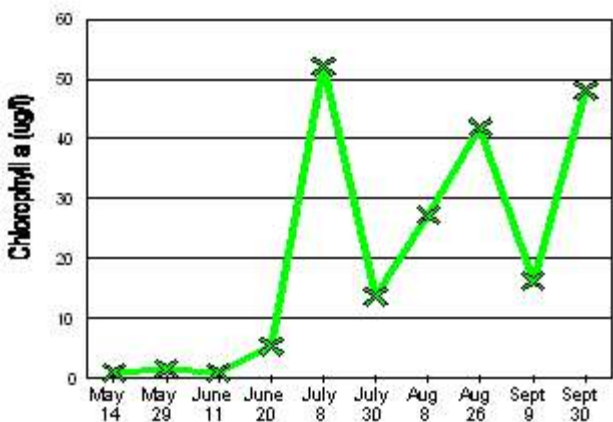
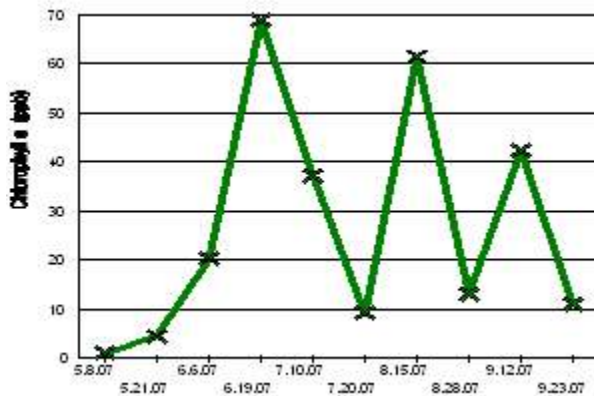
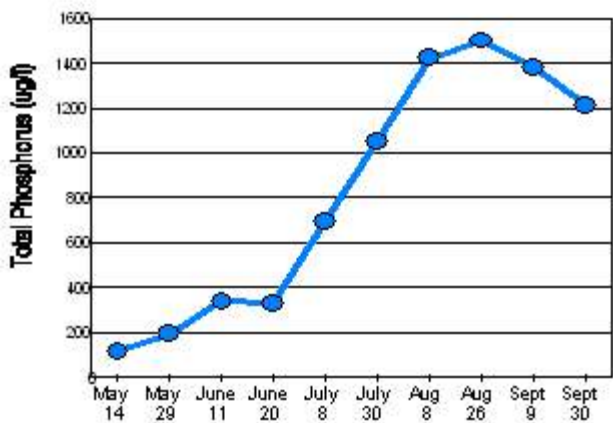
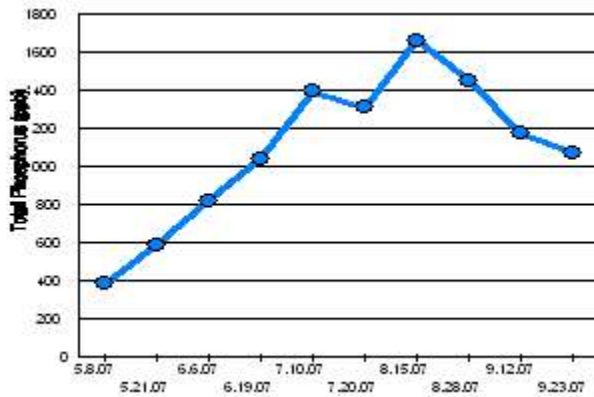
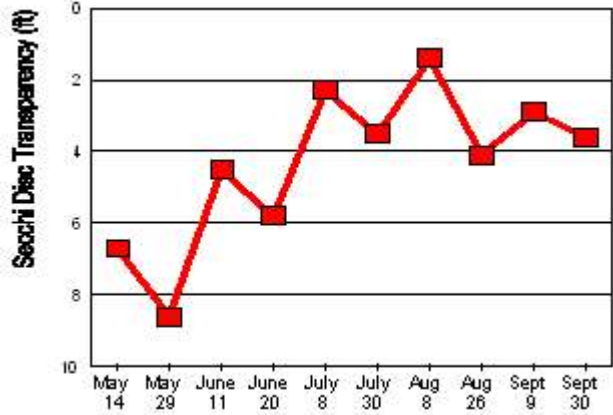
Gorman Lake

Lake surface area: 499 acres

2007



2008



Notes and Comments: What is striking is the variability in chlorophyll a concentration with little variation in total phosphorus.

Gorman Lake

5.21.07

Depth (m)	Gorman	
	DO (mg/l)	Temp (°C)
0	9.5	17.8
1	9.3	17.7
2	9.3	17.6
3	9.2	17.6
4	9.1	17.4

5.14.08

Depth (m)	Gorman	
	DO (mg/l)	Temp (°C)
0	13.5	13.1
1	13.4	13.0
2	13.4	13.0
3	13.4	13.0

6.19.07

Depth (m)	Gorman	
	DO (mg/l)	Temp (°C)
0	8.0	23.5
1	8.1	23.5
2	8.1	23.5
3	7.9	23.4
4	7.6	23.3

5.29.08

Depth (m)	DO (mg/l)	Gorman	
		Temp (°C)	pH
0	8.5	16.6	7.6
1	8.4	16.6	
2	8.4	16.6	
3	8.4	16.6	

7.10.07

Depth (m)	Gorman	
	DO (mg/l)	Temp (°C)
0	10.1	26.6
1	10.1	26.6
2	10.1	26.6
3	10.1	26.6
4	10.1	26.6

7.30.08

Depth (m)	Gorman	
	DO (mg/l)	Temp (°C)
0	7.9	26.1
1	7.8	26.0
2	7.5	25.9
3	7.1	25.7

Notes and Comments: Dissolved oxygen (DO) and temperature (Temp) readings for 2007 and 2008 indicate Gorman Lake is well-mixed and that DO is available throughout the lake's water column. This would indicate that significant phosphorus release from lake sediments is not expected. The phosphorus source to Gorman Lake is most likely the Cannon River and from fish effects in Gorman Lake.

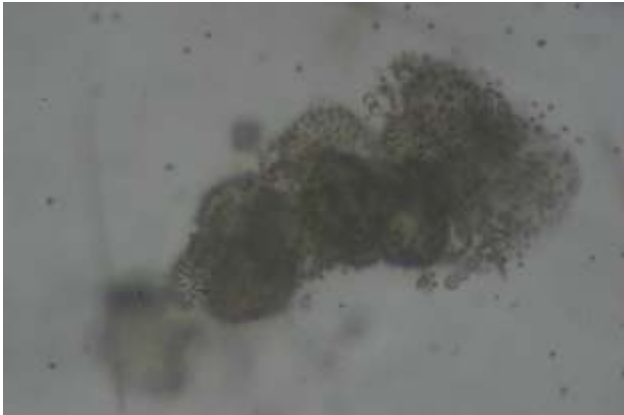
9.9.08

Depth (m)	DO (mg/l)	Gorman	
		Temp (°C)	pH
0	8.3	18.3	8.1
1	8.0	18.2	
2	7.4	18.2	
3	7.3	17.9	

9.30.08

Depth (m)	Gorman	
	DO (mg/l)	Temp (°C)
0	8.1	17.2
1	8.1	17.1
2	8.1	17.0
3	8.0	16.9

Gorman Lake - Algae



Algae samples from Gorman Lake on August 28, 2007. Algae in water samples (magnified 140 times) are dominated by blue-green algae.

Gorman Lake: Findings of the Lake Monitoring

- Gorman Lake has extremely high TP in 2007 and in 2008, but Secchi clarity was not proportionately poor over that time period.
- N:P ratios show the lake is N-limited for most of the summer.
- Gorman Lake is shallow and dissolved oxygen/temperature profiles show the lake is mixed. The magnitude of bottom TP release from lake sediments is uncertain.
- Chlorides are constant and not elevated over the summer. There was no definitive sign of a sewage spill that occurred previously in the area.
- Chlorophyll (algae) has erratic growth over the summer.

Sabre Lake (40-0014) LeSueur County, Minnesota

Sabre Lake (263 acres) was monitored 10 times between mid-May through September in 2007 and in 2008. The water quality data and related graphs are presented on the following pages.

The summertime (May-September) mean total phosphorus concentrations in 2007 and 2008 have been extremely high. Surprisingly, the Secchi disc clarity was fair over this time period. Based on the low nitrogen to phosphorus ratios (less than 15), Sabre Lake appears to be phosphorus limited over much of the summer.



Sabre Lake: Maximum depth is 13 feet and mean depth is 10 feet. It has a surface area of 263 acres.

Sabre Lake

2007 Data

Date (2007)	Sabre					
	SD (ft)	Total Phos (µg/l)		Chl a (µg/l)	TKN (mg/l)	N:P Ratio
		top	bottom			
5.8	11.6	317	323	1.8	--	--
5.21	5.4	499	512	2.5	--	--
6.6	4.1	790	800	1.7	--	--
6.19	2.3	892	994	56.4	--	--
7.10	2.2	1,400	1,430	22.5	--	--
7.20	4.0	1,280	1,260	8.7	--	--
8.15	2.4	1,650	1,620	50.4	1.9	1.2
8.28	4.3	1,510	1,450	11.2	--	--
9.12	2.8	1,510	1,570	59.0	2.2	1.5
9.27	3.0	1,590	1,640	4.9	2.1	1.3
Avg (May-Sept)	4.3	1,144	1,160	21.9		

2008 Data

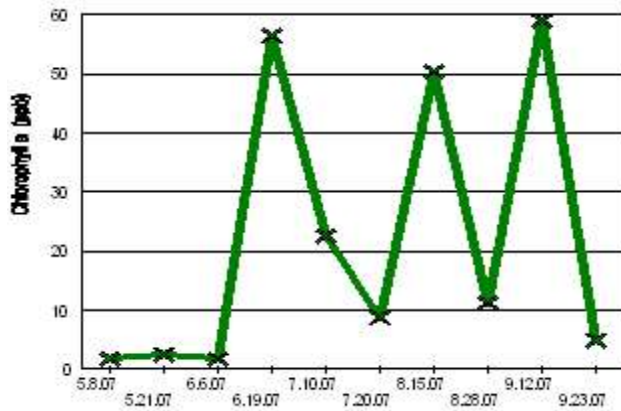
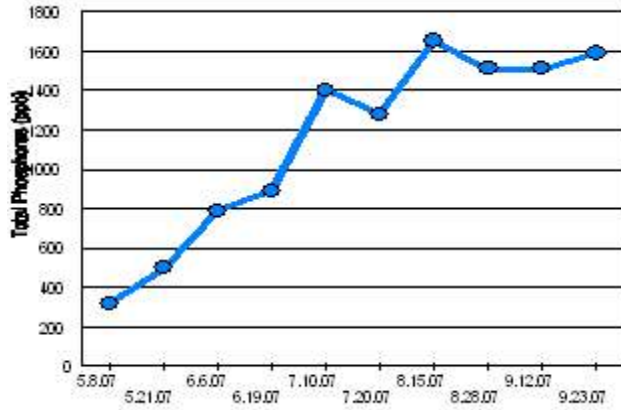
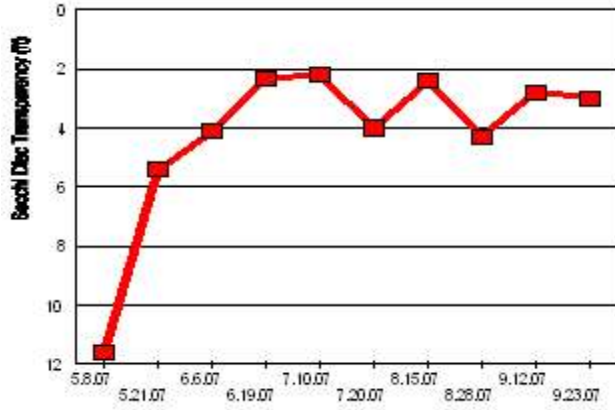
Date (2008)	Sabre								
	SD (ft)	Total Phos (µg/l)	Chl a (µg/l)	TKN (mg/l)	NO ₃ N (mg/l)	N:P Ratio	TSS (mg/l)	TVS (mg/l)	Chloride (mg/l)
5.14	7.1	125	<1	1.6	1.80	27.2	<2	116	18.8
5.29	9.4	175	1.2	1.5	0.54	11.7	<2	<2	19.1
6.10	5.5	307	<1	2.0	2.84	15.8	<2	230	17.3
6.20	6.9	339	1.9	2.1	1.65	11.1	54	147	18.8
7.8	9.1	576	3.7	2.0	0.22	3.9	<2	--	18.1
7.30	3.7	1,180	79.1	2.4	<0.2	2.0	12	177	19.5
8.8	4.8	1,270	7.4	2.9	<0.2	2.3	<2	187	17.9
8.26	1.5	1,500	43.1	2.8	<0.2	1.9	8	190	19.7
9.9	4.3	1,300	62.1	2.2	<0.2	1.7	17	13	20.1
9.30	2.6	1,540	8.6	2.1	<0.2	1.4	42	90	19.8
Avg (May - Sept)	5.5	831	20.9	2.2	0.8	7.9	14	128	18.9

Notes and Comments: Phosphorus is extremely high in Sabre Lake in 2007 and 2008 with the same order of magnitude as Gorman Lake. However, the water clarity has not been proportional to the phosphorus concentration, in fact, its been better than would be expected. It appears Sabre Lake algae are not phosphorus limited as is the case in most lakes. Rather, the algae are nitrogen limited for much of the summer. The low N:P ratios less than 15 confirm this.

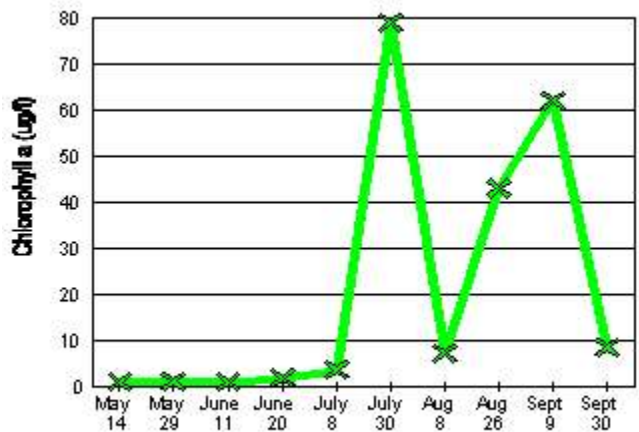
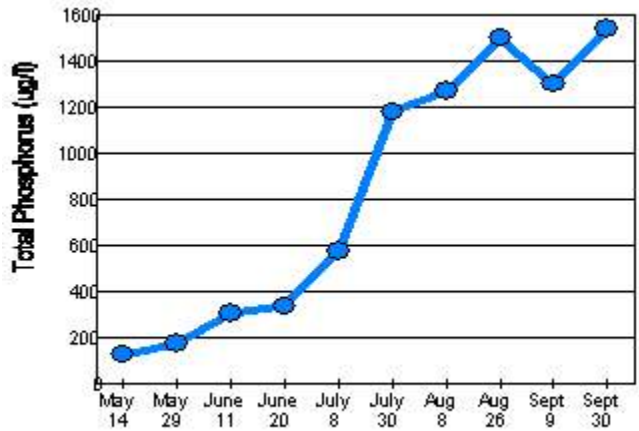
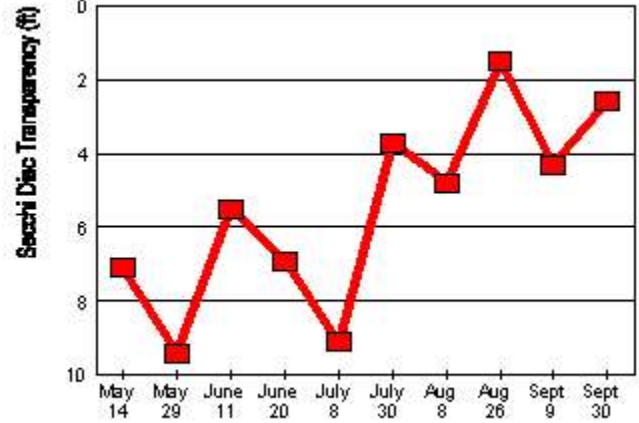
Sabre Lake

Lake surface area: 263 acres

2007



2008



Notes and Comments: Lake phosphorus concentrations are high. What is striking is the variability in chlorophyll a concentration with little variation in total phosphorus.

Sabre Lake

5.21.07

Depth (m)	Sabre	
	DO (mg/l)	Temp (°C)
0	8.5	18.4
1	8.4	18.4
2	8.3	18.4
3	8.0	18.3
4	8.0	18.3

5.14.08

Depth (m)	Sabre	
	DO (mg/l)	Temp (°C)
0	12.7	12.8
1		
2		
3		

7.10.07

Depth (m)	Sabre	
	DO (mg/l)	Temp (°C)
0	6.7	26.5
1	6.6	26.5
2	6.6	26.5
3	6.5	26.5

5.29.08

Depth (m)	DO (mg/l)	Sabre	
		Temp (°C)	pH
0	9.2	17.2	7.6
1	9.2	17.2	
2	9.2	17.2	
3	9.3	17.2	

8.15.07

Depth (m)	Sabre	
	DO (mg/l)	Temp (°C)
0	10.2	26.4
1	10.1	26.3
2	10.1	26.1

7.30.08

Depth (m)	Sabre	
	DO (mg/l)	Temp (°C)
0	7.5	25.8
1	7.3	25.6
2	7.2	25.3
3	6.8	25.2

Notes and Comments: Dissolved oxygen (DO) and temperature (Temp) readings for 2007 and 2008 indicate Sabre Lake is well-mixed and that DO is available throughout the lake's water column. This would indicate that significant phosphorus release from lake sediments is not expected. The phosphorus source to Sabre Lake is most likely the Cannon River and from fish effects in Sabre Lake.

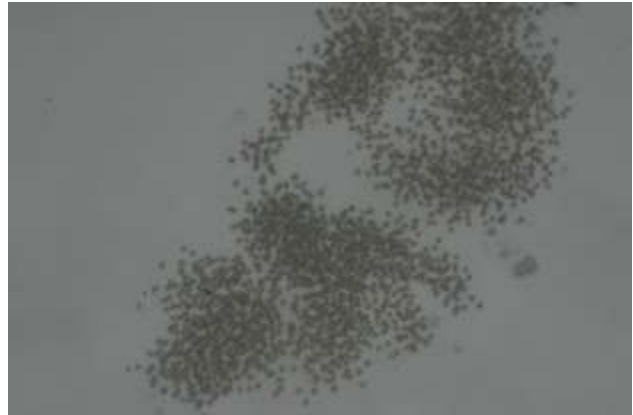
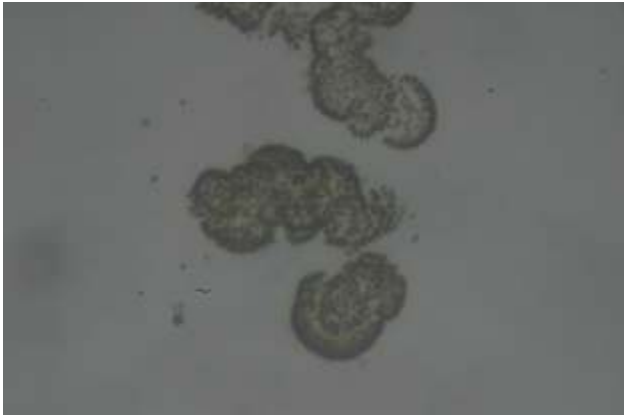
9.9.08

Depth (m)	DO (mg/l)	Sabre	
		Temp (°C)	pH
0	9.5	17.9	8.4
1	9.2	17.5	
2	9.0	17.4	
3	8.7	17.3	

9.30.08

Depth (m)	Sabre	
	DO (mg/l)	Temp (°C)
0	7.6	18.0
1	7.5	17.8
2	7.4	17.4
3	7.2	17.3

Sabre Lake - Algae



Algae samples from Sabre Lake on August 28, 2007. Algae in water samples (magnified 140 times) are dominated by blue-green algae.

Sabre Lake: Findings of the Lake Monitoring

- Sabre Lake has extremely high TP, but Secchi clarity is better than would be expected based on phosphorus concentrations.
- N:P ratios show lake is N-limited for most of the summer.
- DO/Temp profiles show the lake is mixed, and the magnitude of bottom TP release is uncertain.
- As was the finding in Gorman Lake, chloride concentrations are constant, and not elevated indicating there is not a definitive signature of a sewage spill impact.
- Chlorophyll (algae) has erratic growth over the summer.