Picture: School Lake near outlet, July 30, 2007

COMFORT LAKE-FOREST LAKE WATERSHED DISTRICT 2009 WATER MONITORING REPORT

Prepared for:

Comfort Lake-Forest Lake Watershed District

Prepared By:

Washington Conservation District

Memorandum

To: Comfort Lake-Forest Lake Watershed District Managers
From: Erik Anderson, Matt Downing, Wendy Griffin, Adam King, and Jessica Thiel --Washington Conservation District
Date: April 22, 2010
Re: CLFLWD 2009 Monitoring: Tributary to Sunrise River at Little Comfort Lake Inlet, Sunrise River at Forest Lake Outlet, Sunrise River at Comfort Lake Inlet, Sunrise River at Comfort Lake Outlet, Sunrise River at County Line Ditch, Sunrise River at Bixby Park, Birch Lake Drainage at Manning Trail, Tributary to School Lake at July Avenue, Tributary to Forest Lake at FL44 Outlet

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At the request of the Comfort Lake-Forest Lake Watershed District (CLFLWD), the Washington Conservation District (WCD) conducted:

Continuous discharge and stream water quality monitoring at:

- Tributary to Sunrise River at Little Comfort Lake Inlet (Grab Samples only)
- Sunrise River at Forest Lake Outlet (Flow only)
- Sunrise River at Comfort Lake Inlet (Grab Samples only)
- Sunrise River at Comfort Lake Outlet (Flow only)
- Sunrise River at County Line Ditch (Grab Samples only)
- Sunrise River at Bixby Park (Grab Samples only)
- Birch Lake Drainage at Manning Trail (Grab Samples only)
- Tributary to School Lake at July Avenue (Grab Samples only)
- Tributary to Forest Lake at FL44 Outlet (Grab Samples only)

A table of the locations and monitoring types can be found in Table 1. The locations of the monitoring sites can be found in Figure 1. The following report briefly summarizes our methods and results for monitoring conducted from January 1 - December 31, 2009. A complete list of detailed Washington Conservation District water monitoring methods and standard operating procedures can be found at http://www.mnwcd.org/water_monitoring_standards.php. This report and the accompanying data will also be provided in an electronic format. Please contact the Washington Conservation District at (651) 275-1136 to obtain historical data.

Continuous Stream Monitoring Sites: Tributary to Sunrise River at Little Comfort Lake Inlet, Sunrise River at Forest Lake Outlet, Sunrise River at County Line Ditch, Sunrise River at Comfort Lake Inlet, Sunrise River at Comfort Lake Outlet, Sunrise River at Bixby Park, Birch Lake Drainage at Manning Trail, Tributary to Forest Lake at FL44 outlet and Tributary to School Lake at July Avenue.

Continuous stage, velocity, and discharge measurements were taken every 15 minutes at the Tributary to Sunrise River at Little Comfort Lake Inlet from April 9-November 2, 2009, at Sunrise River at Forest Lake Outlet from April 9-November 2, 2009, at Sunrise River at County Line Ditch from April 3-November 3, 2009, at Sunrise River at Comfort Lake Inlet from April 3-November 2, 2009, at Sunrise River at Comfort Lake Outlet from April 22-November 2, 2009, at Sunrise River at Bixby Park from April 13-October 20, 2009, at Birch Lake Drainage at Manning Trail from April 2-November 2, 2009, and at Tributary to School Lake at July Avenue from April 2-November 2, 2009, and at Tributary to Forest Lake at FL44 Outlet from April 22-November 2, 2009. Precipitation data was also continuously collected at Tributary to Sunrise River at Little Comfort Lake Inlet, Sunrise River at County Line Ditch, Sunrise River at Comfort Lake Inlet, Sunrise River at Comfort Lake Outlet, and at Tributary to School Lake at July Avenue.

Staff gages were installed and read at each site. Field stage measurements were taken in the stream channels. Temperature, dissolved oxygen, specific conductivity, pH, and transparency tube measurements were also taken. Stage-discharge relationships were developed at all stream sites and an area-velocity relationship was used to determine discharge during certain time periods. Storm event and baseflow grab samples were collected at all continuous stream monitoring sites, as well as snowmelt grab samples at most sites. In addition to these samples, *E. coli* grab samples were also collected at all monitoring sites except FL44. The Metropolitan Council Environmental Services Laboratory in St. Paul and Minnesota Valley Testing Laboratories, Inc. in New Ulm analyzed the samples.

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

cfs	cubic feet per second
cf	cubic feet
Cl-*a* or CLA	Chlorophyll-*a*
CLFLWD	Comfort Lake Forest Lake Watershed District
COD	Total Chemical Oxygen Demand
DO	Dissolved Oxygen
E. Coli	*Escherichia coli*
mg/L	milligram per liter
MN DNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
MPN	most probable number
OHW	Ordinary High Water level
Ortho-P	Ortho-phosphate
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TP	Total Phosphorus
TSS	Total Suspended Solids
µg/L	microgram per liter
VSS	Volatile Suspended Solids
WCD	Washington Conservation District

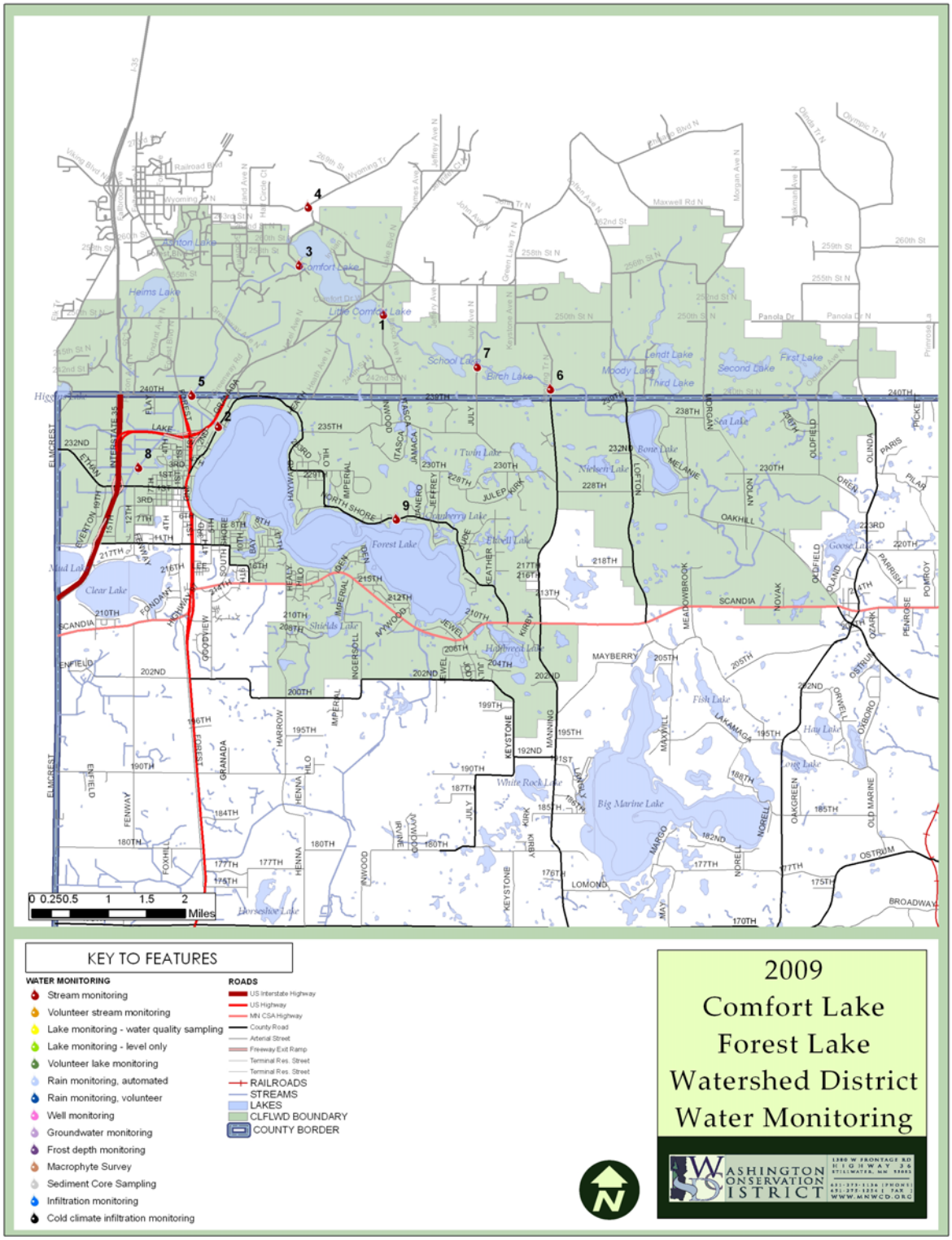


Figure 1. CLFLWD Monitoring Locations

Table 1. Monitoring Site Location and Description Summary

Site Description	Map Site ID#	Full Site Name	Summarized Site Name	General Site Location	Monitoring Site Description	Monitored Parameters
Stream Monitoring	**1**	Tributary to Sunrise River at Little Comfort Lake Inlet	Little Comfort Lake Inlet	Itasca Avenue	Flow Monitoring in Natural Cross-Section	Discharge and Water Quality Grab Samples*
Stream Monitoring	**2**	Sunrise River at Forest Lake Outlet	Forest Lake Outlet	North Shore Drive	Flow Monitoring in Natural Cross-Section	Discharge Only
Stream Monitoring	**3**	Sunrise River at Comfort Lake Inlet	Comfort Lake Inlet	West Comfort Drive	Flow Monitoring Through Culvert	Discharge and Water Quality Grab Samples*
Stream Monitoring	**4**	Sunrise River at Comfort Lake Outlet	Comfort Lake Outlet	Wyoming Trail	Flow Monitoring in Natural Cross-Section	Discharge Only
Stream Monitoring	**5**	Sunrise River at County Line Ditch	County Line Ditch	¼ Mile East of Hwy 61	Flow Monitoring in Natural Cross-Section	Discharge and Water Quality Grab Samples*
Stream Monitoring	**6**	Tributary to Sunrise River at Manning Trail	Manning Trail	Manning Trail	Flow Monitoring Through Culvert	Discharge and Water Quality Grab Samples*
Stream Monitoring	**7**	Tributary to Sunrise River at July Avenue	July Ave	July Ave	Flow Monitoring Through Culvert	Discharge and Water Quality Grab Samples*
Stream Monitoring	**8**	Sunrise River at Bixby Park	Bixby Park	Bixby Park Compost Site	Flow Monitoring in Natural Cross-Section	Discharge and Water Quality Grab Samples*
Stream Monitoring	**9**	Forest Lake FL44 Subwatershed Drainage	FL44	North Shore Trail	Flow Monitoring in Natural Cross-Section	Discharge and Water Quality Grab Samples*

*Stream Monitoring Water Quality Sample Parameters Include: Total Phosphorus, Dissolved Phosphorus, Total Kjeldahl Nitrogen, Nitrate, Nitrite, Ammonia Nitrogen, Total Suspended Solids, Volatile Suspended Solids, Total Chlorides, E. Coli Bacteria

Sections Within Report

1) Little Comfort Lake Subwatershed

- Stream Monitoring
  a. Tributary to Sunrise River at Manning Trail
  b. Tributary to Sunrise River at July Avenue
  c. Little Comfort Lake Inlet

2) Forest Lake Subwatershed

- Stream Monitoring
  a. Tributary to Forest Lake at FL44 Outlet
  b. Forest Lake Outlet

3) Comfort Lake Subwatershed

- Stream Monitoring
  a. Bixby Park
  b. County Line Ditch
  c. Comfort Lake Inlet
  d. Comfort Lake Outlet

4) Watershed Phosphorus Flow Chart

5) Historical Stream Loading, Discharge, and E. coli Summary

6) Appendices and References

1) Little Comfort Lake Subwatershed

Tributary to Sunrise River at Manning Trail

2009 was the second year that data was collected at the Manning Trail station and flow was recorded from April 2-November 2, 2009 (Figure 2). Total discharge for this period was 7,779,360 cf or 179 acre-feet. No automated rain gage was installed at this site to collect continuous rainfall data. Peak discharge of 2.797 cfs occurred on April 4th, which was caused by the remnants of the spring thaw.

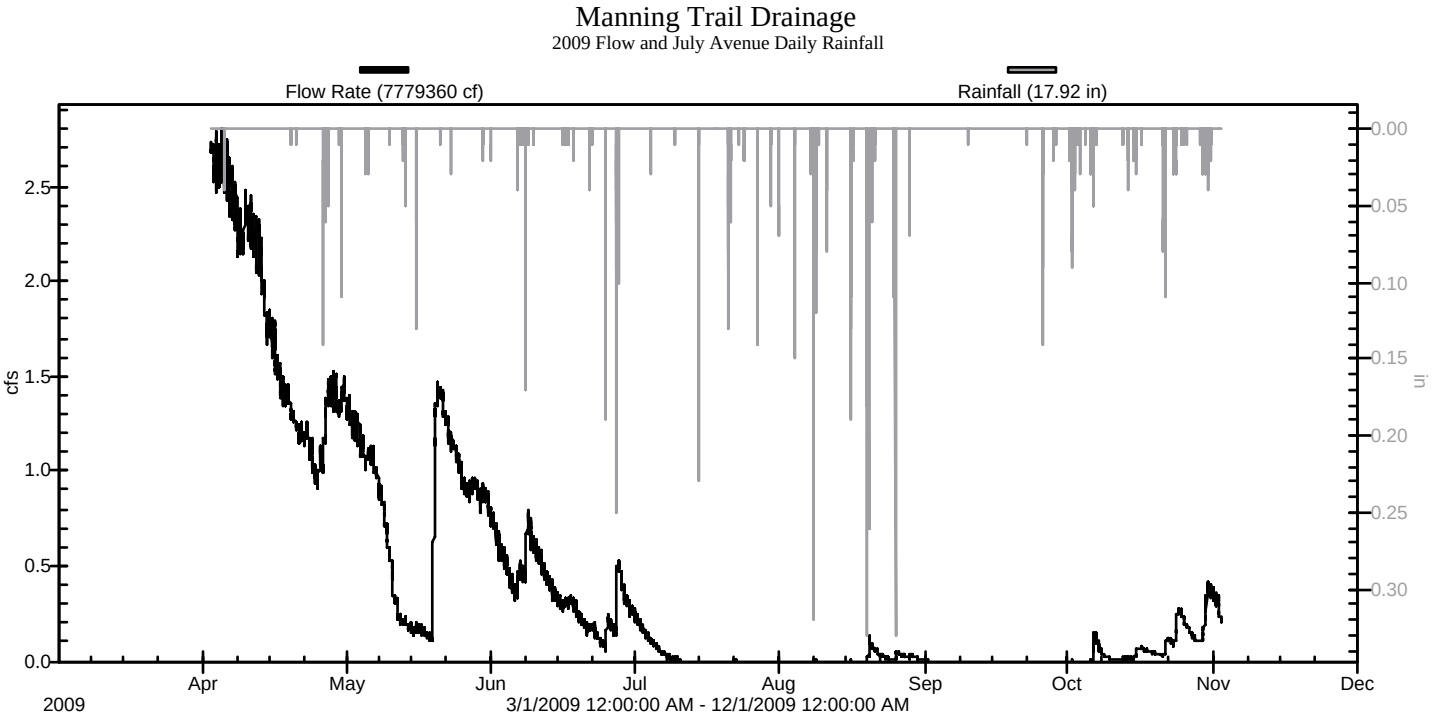


Figure 2. Manning Trail Drainage 2009 Flow and July Avenue Daily Rainfall

Grab samples were collected at the Manning Trail Drainage site in 2009. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride, and *E. coli* results from all collected samples are listed in Table 2 and field water quality measurements are listed in Table 3. The highest concentration of TKN and TP were 2 mg\L and 0.337 mg\L, respectively, from a March 17th snowmelt grab. The TSS maximum concentration of 15 mg\L was from a June 8th storm grab sample.

Table 2. Manning Trail Drainage 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved P (mg/L)	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Ammonia Nitrogen (mg/L)	E. Coli (mpn/100ml)
Snowmelt Grab	3/17/2009 12:30	3/17/2009 12:30	5	4	2	0.337	0.232	16	<0.03	0.12	0.39	
Storm Grab	3/24/2009 10:39	3/24/2009 10:39	4	4	1.4	0.089	~0.013	15	<0.03	0.12	0.38	
Base Grab	5/14/2009 11:25	5/14/2009 11:25	9	4	1.4	0.097	~0.035	20	<0.03	<0.05	0.22	
E. Coli Grab	5/28/2009 8:45	5/28/2009 8:45										58
Storm Grab	6/8/2009 8:13	6/8/2009 8:13	15	6	0.97	0.091	~0.037	16	<0.03	<0.05	~0.05	
E. Coli Grab	6/10/2009 8:10	6/10/2009 8:10										118.7
Base Grab	6/24/2009 8:23	6/24/2009 8:23	4	3	1.3	0.144	0.076	18	<0.03	<0.05	0.08	
Storm Grab	8/20/2009 9:39	8/20/2009 9:39	~2	~2	1.2	0.129	0.091	13	<0.03	<0.05	~0.04	
E. Coli Grab	8/26/2009 8:00	8/26/2009 8:00										>2419.6
Storm Grab	10/6/2009 13:44	10/6/2009 13:44	3	~2	0.94	0.234	0.165	19	<0.03	0.22	~0.02	
Storm Grab	10/22/2009 9:42	10/22/2009 9:42	<1	<1	1	~0.046	~0.048	19	<0.03	<0.05	<0.02	

Exceeds Water Quality Standard
Exceeds Chronic Standard
Exceeds Max Standard
Exceeds Final Acute Standard

Table 3. Manning Trail Drainage Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH
3/17/2009 12:24	69	0.9	9.12	230	7.4
3/24/2009 10:39	86	2.6	9.12	250	7.7
5/14/2009 11:25	75	14.4	8.24		
5/28/2009 8:50	>100	12.4	7.06		
6/8/2009 8:13	>120	12.4	7.03	270	
6/8/2009 9:42	>100	12.4	7.89	289	8.1
6/10/2009 8:11	>100	14.9	6.65		
6/17/2009 9:43	>100	18.7	7.18		
6/24/2009 8:23	>100	22.5	6.10		
8/20/2009 9:39	>100	17.0	7.03	257	7.9
8/26/2009 8:00	>100	14.0	8.40	289	8
10/6/2009 13:44	>100	9.8	9.12	272	8.4
10/22/2009 9:42	>100	6.2	9.82	307	7.8

Exceeds Water Quality Standards

Table 4. Manning Trail Drainage 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base***			*5*	*0.146*	*1/1/09 0:00*	*3/17/09 7:30*	*3,254*	*0.07*	*1.0*	*0.03*
Snowmelt Grab**	3/17/09 12:30	3/17/09 12:30	5	0.337	3/17/09 7:30	3/18/09 17:30	428,400	9.84	133.7	9.01
*Base***			*5*	*0.146*	*3/18/09 17:30*	*3/24/09 4:00*	*939,600*	*21.58*	*293.3*	*8.56*
Storm Grab**	3/24/09 10:39	3/24/09 10:39	4	0.089	3/24/09 4:00	3/25/09 4:00	302,400	6.95	75.5	1.68
*Base***			*5*	*0.146*	3/25/09 4:00	4/2/09 15:00	1,388,520	31.89	433.4	12.66
Base			*5*	*0.146*	*4/2/09 15:00*	*5/2/09 15:00*	*4,477,412*	*102.84*	*1397.5*	*40.81*
Base Grab	5/14/09 11:25	5/14/09 11:25	9	0.097	5/2/09 15:00	5/19/09 9:00	833,672	19.15	468.4	5.05
Storm			*5*	*0.146*	*5/19/09 9:00*	*5/22/09 5:00*	*303,023*	*6.96*	*94.58*	*2.76*
Base			*5*	*0.146*	*5/22/09 5:00*	*6/8/09 5:00*	*1,144,317*	*26.28*	*357.2*	*10.43*
Storm Grab	6/8/09 8:13	6/8/09 8:13	15	0.091	6/8/09 5:00	6/9/09 4:00	58,951	1.35	55.2	0.33
Base			*5*	*0.146*	*6/9/09 4:00*	*6/18/09 4:00*	*330,536*	*7.59*	*103.2*	*3.01*
Base Grab	6/24/09 8:23	6/24/09 8:23	4	0.144	6/18/09 4:00	6/25/09 5:00	109,574	2.52	27.4	0.98
Storm			*5*	*0.146*	*6/25/09 5:00*	*6/26/09 5:00*	*17,385*	*0.40*	*5.4*	*0.16*
Base			*5*	*0.146*	*6/26/09 5:00*	*6/27/09 5:00*	*14,545*	*0.33*	*4.5*	*0.13*
Storm			*5*	*0.146*	*6/27/09 5:00*	*6/28/09 2:00*	*33,231*	*0.76*	*10.4*	*0.30*
Base			*5*	*0.146*	*6/28/09 2:00*	*7/10/09 17:00*	*164,006*	*3.77*	*51.2*	*1.49*
NoFlow			*0*	*0.000*	*7/10/09 17:00*	*8/19/09 12:00*	*0*	*0.00*	*0.0*	*0.00*
Storm Grab	8/20/09 9:39	8/20/09 9:39	2	0.129	*8/19/09 12:00*	8/21/09 4:00	10,672	0.25	1.3	0.09
Base			*5*	*0.146*	*8/21/09 4:00*	*8/25/09 6:00*	*8,220*	*0.19*	*2.6*	*0.07*
Storm			*5*	*0.146*	*8/25/09 6:00*	*8/26/09 5:00*	*3,162*	*0.07*	*1.0*	*0.03*
Base			*5*	*0.146*	*8/26/09 5:00*	*8/28/09 6:00*	*4,589*	*0.11*	*1.4*	*0.04*
Storm			*5*	*0.146*	*8/28/09 6:00*	*8/29/09 0:00*	*1,823*	*0.04*	*0.6*	*0.02*
Base (Intermittent)			*5*	*0.146*	*8/29/09 0:00*	*10/6/09 4:00*	*3,002*	*0.07*	*0.9*	*0.03*
Storm Grab	10/6/09 13:44	10/6/09 13:44	3	0.234	10/6/09 4:00	10/7/09 20:00	13,523	0.31	2.5	0.20
Base			*5*	*0.146*	*10/7/09 20:00*	*10/15/09 2:00*	*11,949*	*0.27*	*3.7*	*0.11*
Storm			*5*	*0.146*	*10/15/09 2:00*	*10/17/09 9:00*	*11,849*	*0.27*	*3.7*	*0.11*
Base			*5*	*0.146*	*10/17/09 9:00*	*10/21/09 7:00*	*13,458*	*0.31*	*4.2*	*0.12*
Storm Grab	10/22/09 9:42	10/22/09 9:42	1	0.046	10/21/09 7:00	10/22/09 21:00	13,068	0.30	0.8	0.04
Base			*5*	*0.146*	*10/22/09 21:00*	*10/23/09 11:00*	*4,487*	*0.10*	*1.4*	*0.04*
Storm			*5*	*0.146*	*10/23/09 11:00*	*10/25/09 9:00*	*37,152*	*0.85*	*11.6*	*0.34*
Base			*5*	*0.146*	*10/25/09 9:00*	*10/29/09 10:00*	*50,402*	*1.16*	*15.7*	*0.46*
Storm			*5*	*0.146*	*10/29/09 10:00*	*10/31/09 22:00*	*68,249*	*1.57*	*21.3*	*0.62*
Base			*5*	*0.146*	*10/31/09 22:00*	*11/2/09 10:00*	*36,761*	*0.84*	*11.5*	*0.34*
*Base***			*5*	*0.146*	*11/2/09 10:00*	*12/2/09 10:00*	*388,800*	*8.93*	*121.4*	*3.54*
*Base***			*5*	*0.146*	*12/2/09 10:00*	*1/1/10 0:00*	*1,278*	*0.03*	*0.4*	*0.01*
Snowmelt Average			5	0.337						
Storm Average			5	0.118						
Base Average			7	0.121						
All Average			5	0.146						
Total							**11,231,268**	**258**	**3,718**	**104**
CLFLWD Major Subwatershed Total Acres							7,115			
Total Load										
Total TP/TSS (lb/ac/yr)									0.52	0.01
Total TP/TSS (kg/ha/yr)									0.59	0.02

*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/09 to 4/2/09 and 11/3/09 to 1/1/10 where estimated using logged flow conditions and site rating curve

Total phosphorus loading for Manning Trail Drainage in 2009 was estimated at 0.01 lbs/acre (104 lbs.) (Table 4). This site had very little flow for the second half of the monitoring season. This loading is substantially less than what was observed in 2008, most likely due to the overall reduction of runoff in 2009.

Tributary to Sunrise River at July Avenue

2009 was the second year that data was collected at the July Avenue station, and flow was recorded from April 2-November 2, 2009 (Figure 3). Total discharge for this period was 19,675,230 cfs or 452 ac/ft. A total of 17.92 inches of rainfall was recorded at the site and a peak flow of 6.788 cfs occurred on April 2nd, due to the remnants of the spring thaw. A second high flow of 6.648 cfs occurred on August 8th, due to a 0.86 inch rainfall event.

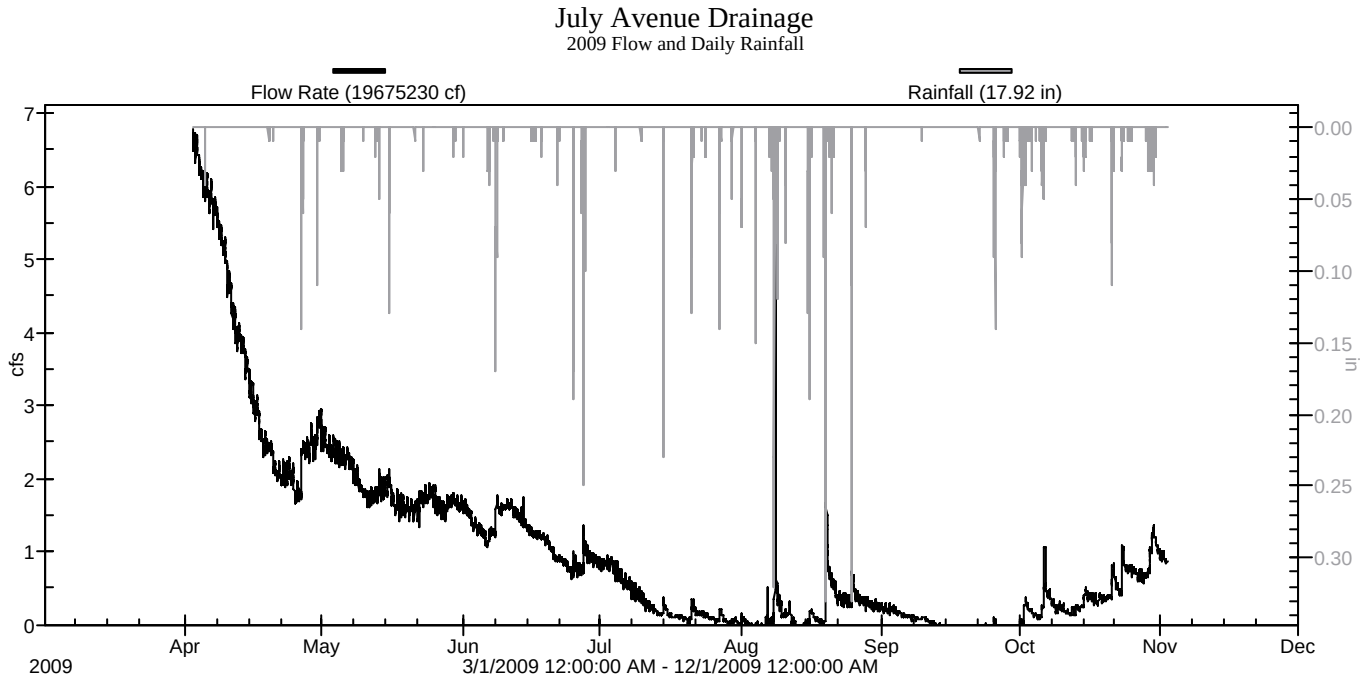


Figure 3. July Avenue Drainage 2009 Flow and Daily Rainfall

Grab samples were collected at the July Avenue site in 2009. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride, and *E. coli* results from all collected samples are listed in Table 5 and field water quality measurements are listed in Table 6. The highest concentration of TKN and TP were 1.6 mg/L (June 24th base grab) and 0.352 mg/L (March 17th snowmelt grab), respectively. The highest TSS value recorded was 14 mg/L from a storm grab sample collected on June 8th.

Table 5. July Avenue Drainage 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved TP (mg/L)	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Ammonia Nitrogen (mg/L)	E. Coli (mpn/100ml)
Snowmelt Grab	3/17/2009 12:30	3/17/2009 12:30	~2	~2	1.2	0.352	0.268	5	<0.03	0.09	0.16	
Storm Grab	3/24/2009 10:26	3/24/2009 10:26	5	5	0.93	0.077	~0.012	12	<0.03	<0.05	~0.04	
Base Grab	5/14/2009 11:09	5/14/2009 11:09	8	5	1.1	0.055	<0.010	18	<0.03	<0.05	0.06	
E. Coli Grab	5/28/2009 9:00	5/28/2009 9:00										126
Storm Grab	6/8/2009 8:25	6/8/2009 8:25	14	7	1.1	0.086	~0.040	17	<0.03	<0.05	~0.05	
E. Coli Grab	6/10/2009 8:20	6/10/2009 8:20										36.9
Base Grab	6/24/2009 8:33	6/24/2009 8:33	9	~4	1.6	0.134	0.084	18	<0.03	<0.05	0.15	
Base Grab	7/13/2009 9:10	7/13/2009 9:10	~1	~1	1.2	0.084	0.052	17	<0.03	<0.05	0.06	
E. Coli Grab	7/28/2009 8:00	7/28/2009 8:00										579.4
Storm Grab	8/20/2009 9:58	8/20/2009 9:58	4	3	1.2	0.177	0.104	9	<0.03	<0.05	~0.06	
E. Coli Grab	8/26/2009 8:11	8/26/2009 8:11										344.8
Base Grab	9/8/2009 10:21	9/8/2009 10:21	~2	~1	1	0.062	~0.019	13	<0.03	<0.05	~0.06	
Storm Grab	10/2/2009 9:31	10/2/2009 9:31	4	~2	1.1	0.221	0.158	27	<0.03	0.08	0.09	
Storm Grab	10/6/2009 13:53	10/6/2009 13:53	~2	~2	0.98	0.154	0.132	20	<0.03	<0.05	~0.05	
Storm Grab	10/22/2009 10:12	10/22/2009 10:12	~2	~2	1.1	0.083	0.072	13	<0.03	<0.05	<0.02	

Exceeds Water Quality Standard
Exceeds Chronic Standard
Exceeds Max Standard
Exceeds Final Acute Standard

Table 6. July Avenue Drainage 2009 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH
3/17/2009 12:33	94	0.8	9.51	108	6.9
3/24/2009 10:26	86	1.9	12.84	234	8
5/14/2009 11:09	>100	15.0	5.17		
5/28/2009 8:57	>100	14.3	4.95		
6/8/2009 8:25	>120	12.9	5.25	220	
6/8/2009 9:56	>100	12.4	5.08	238	7.8
6/10/2009 8:20	>100	15.7	6.14		
6/24/2009 8:33	>100	24.1	1.28		
7/13/2009 9:10	>100	16.1	2.73	239	8.2
8/20/2009 9:58	>100	17.0	1.81	207	7.6
8/26/2009 8:11	>100	15.2	1.66	241	7.3
9/8/2009 10:21	>100	16.3	2.44	240	7.06
10/2/2009 9:31	>100	9.0	5.60	282	8.3
10/6/2009 13:53	>100	9.3	6.44	250	7.9
10/22/2009 10:12	>100	6.1	7.16	244	7.4

Exceeds Water Quality Standard

Table 7. July Avenue Drainage 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base***			*5*	*0.084*	*1/1/09 0:00*	*3/17/09 5:00*	*32,490*	*0.75*	*10.1*	*0.17*
Snowmelt Grab**	3/17/09 12:30	3/17/09 12:30	2	0.352	3/17/09 5:00	3/18/09 17:00	648,000	14.88	80.9	14.24
*Base***			*5*	*0.084*	*3/18/09 17:00*	*3/24/09 4:00*	*1,980,720*	*45.49*	*618.2*	*10.39*
Storm Grab**	3/24/09 10:26	3/24/09 10:26	5	0.077	3/24/09 4:00	3/25/09 12:00	576,000	13.23	179.8	2.77
*Base***			*5*	*0.084*	*3/25/09 12:00*	*4/2/09 15:30*	*2,955,960*	*67.89*	*922.6*	*15.50*
Base			*5*	*0.084*	*4/2/09 15:30*	*4/26/09 10:30*	*7,775,086*	*178.58*	*2426.8*	*40.77*
Storm			*5*	*0.133*	*4/26/09 10:30*	*4/27/09 0:30*	*120,722*	*2.77*	*37.7*	*1.00*
Base Grab	5/14/09 11:09	5/14/09 11:09	8	0.055	4/27/09 0:30	5/16/09 0:30	3,585,154	82.35	1790.46	12.31
Base			*5*	*0.084*	*5/16/09 0:30*	*6/8/09 5:30*	*3,144,339*	*72.22*	*981.4*	*16.49*
Storm Grab	6/8/09 8:25	6/8/09 8:25	14	0.086	6/8/09 5:30	6/8/09 17:30	70,630	1.62	61.7	0.38
Base			*5*	*0.084*	*6/8/09 17:30*	*6/17/09 17:30*	*1,128,953*	*25.93*	*352.4*	*5.92*
Base Grab	6/24/09 8:33	6/24/09 8:33	9	0.134	6/17/09 17:30	6/27/09 2:30	749,184	17.21	420.9	6.27
Storm			*5*	*0.133*	*6/27/09 2:30*	*6/27/09 20:30*	*66,449*	*1.53*	20.7	0.55
Base			*5*	*0.084*	6/27/09 20:30	7/7/09 20:30	701,339	16.11	218.9	3.68
Base Grab	7/13/09 9:10	7/13/09 9:10	1	0.084	7/7/09 20:30	7/14/09 21:30	183,380	4.21	11.4	0.96
Storm			*5*	*0.133*	*7/14/09 21:30*	*7/15/09 8:30*	*10,346*	*0.24*	*3.2*	*0.09*
Base			*5*	*0.084*	*7/15/09 8:30*	*7/21/09 1:30*	*51,861*	*1.19*	*16.2*	*0.27*
Storm			*5*	*0.133*	*7/21/09 1:30*	*7/21/09 20:30*	*15,898*	*0.37*	*5.0*	*0.13*
Base			*5*	*0.084*	*7/21/09 20:30*	*7/27/09 10:30*	*50,240*	*1.15*	*15.7*	*0.26*
Storm			*5*	*0.133*	*7/27/09 10:30*	*7/27/09 23:30*	*8,131*	*0.19*	*2.5*	*0.07*
Base			*5*	*0.084*	*7/27/09 23:30*	*8/8/09 7:30*	*27,337*	*0.63*	*8.5*	*0.14*
Storm			*5*	*0.133*	*8/8/09 7:30*	*8/8/09 21:30*	*47,514*	*1.09*	*14.8*	*0.39*
Base			*5*	*0.084*	*8/8/09 21:30*	*8/11/09 11:30*	*41,793*	*0.96*	*13.0*	*0.22*
Storm			*5*	*0.133*	*8/11/09 11:30*	*8/11/09 23:30*	*8,675*	*0.20*	*2.7*	*0.07*
Base			*5*	*0.084*	*8/11/09 23:30*	*8/16/09 1:30*	*4,375*	*0.10*	*1.4*	*0.02*
Storm			*5*	*0.133*	*8/16/09 1:30*	*8/17/09 0:30*	*12,202*	*0.28*	*3.8*	*0.10*
Base			*5*	*0.084*	*8/17/09 0:30*	*8/19/09 12:30*	*8,875*	*0.20*	*2.8*	*0.05*
Storm Grab	8/20/09 9:58	8/20/09 9:58	4	0.177	8/19/09 12:30	8/20/09 17:30	89,605	2.06	22.4	0.99
Base			*5*	*0.084*	*8/20/09 17:30*	*8/25/09 6:30*	*160,812*	*3.69*	*50.2*	*0.84*
Storm			*5*	*0.133*	8/25/09 6:30	8/25/09 22:30	33,832	0.78	10.6	0.28
Base Grab	9/8/09 10:21	9/8/09 10:21	2	0.062	8/25/09 22:30	9/15/09 22:30	285,204	6.55	35.6	1.10
Base (Intermittent)			*5*	*0.084*	*9/15/09 22:30*	*10/2/09 1:30*	*2,393*	0.05	0.7	0.01
Storm Grab	10/2/09 9:31	10/2/09 9:31	4	0.221	10/2/09 1:30	10/2/09 22:30	19,308	0.44	4.8	0.27
Base			*5*	*0.084*	*10/2/09 22:30*	*10/5/09 16:30*	*34,424*	0.79	10.7	0.18
Storm Grab	10/6/09 13:53	10/6/09 13:53	2	0.154	10/5/09 16:30	10/7/09 21:30	85,891	1.97	10.7	0.83
Base			*5*	*0.084*	*10/7/09 21:30*	*10/21/09 6:30*	*322,353*	7.40	100.6	1.69
Storm Grab	10/22/09 10:12	10/22/09 10:12	2	0.083	10/21/09 6:30	10/22/09 4:30	51,400	1.18	6.4	0.27
Base			*5*	*0.084*	*10/22/09 4:30*	*10/23/09 9:30*	*50,934*	1.17	15.9	0.27
Storm			*5*	*0.133*	*10/23/09 9:30*	*10/24/09 5:30*	*57,895*	1.33	18.1	0.48
Base			*5*	*0.084*	*10/24/09 5:30*	*10/29/09 12:30*	*322,354*	7.40	100.6	1.69
Storm			*5*	*0.133*	*10/29/09 12:30*	*10/31/09 1:30*	*151,409*	3.48	47.3	1.26
Base			*5*	*0.084*	*10/31/09 1:30*	*11/2/09 10:30*	*194,164*	4.46	60.6	1.02
*Base***			*5*	*0.084*	*11/2/09 10:30*	*12/2/09 12:00*	*1,246,752*	28.64	389.1	6.54
*Base***			*5*	*0.084*	*12/2/09 12:00*	*1/1/10 0:00*	*12,744*	0.29	4.0	0.07
Snowmelt Average			2	0.352						
Storm Average			5	0.133						
Base Average			5	0.084						
All Average			5	0.135						
Total							**27,127,126**	**623**	**9,112**	**151**
CLFLWD Major Subwatershed Total Acres							7,902			
Total Load										
Total TP/TSS (lb/ac/yr)									1.15	0.02
Total TP/TSS (kg/ha/yr)									1.29	0.02

*Italics indicate estimated concentrations based on average base and storm flow concentrations, with intervals before 7/29/08 based on all samples taken before that date, and respectivly for intervals after that date

** Interval volumes from 1/1/09 to 4/2/09 and 11/2/09 to 1/1/10 where estimated based upon base and storm flow

Total phosphorous loading for July Avenue in 2009 was estimated at 0.02 lbs/acre (151 lbs) (Table 7). Compared to the Manning Trail site, the total discharge at July Ave is over double and the TP load is slightly higher. The load compared to 2008 is substantially lower. This is due in large part to the overall reduction in flow in 2009 when compared to 2008.

Little Comfort Lake Inlet

The station for the Little Comfort Lake Inlet site recorded flow between April 9-November 2, 2009 (Figure 4). Total discharge during this period was 72,160,360 cf or 1,657 acre-ft. Total rainfall recorded during the monitoring season was 17.34 inches. Peak discharge of 55.10 cfs occurred on April 17th. The cause of this high flow is unknown, but potentially could have been caused by the removal of a beaver dam upstream of the site. Another unexplained large peak that may have been the result of a beaver dam removal occurred on May 17th.

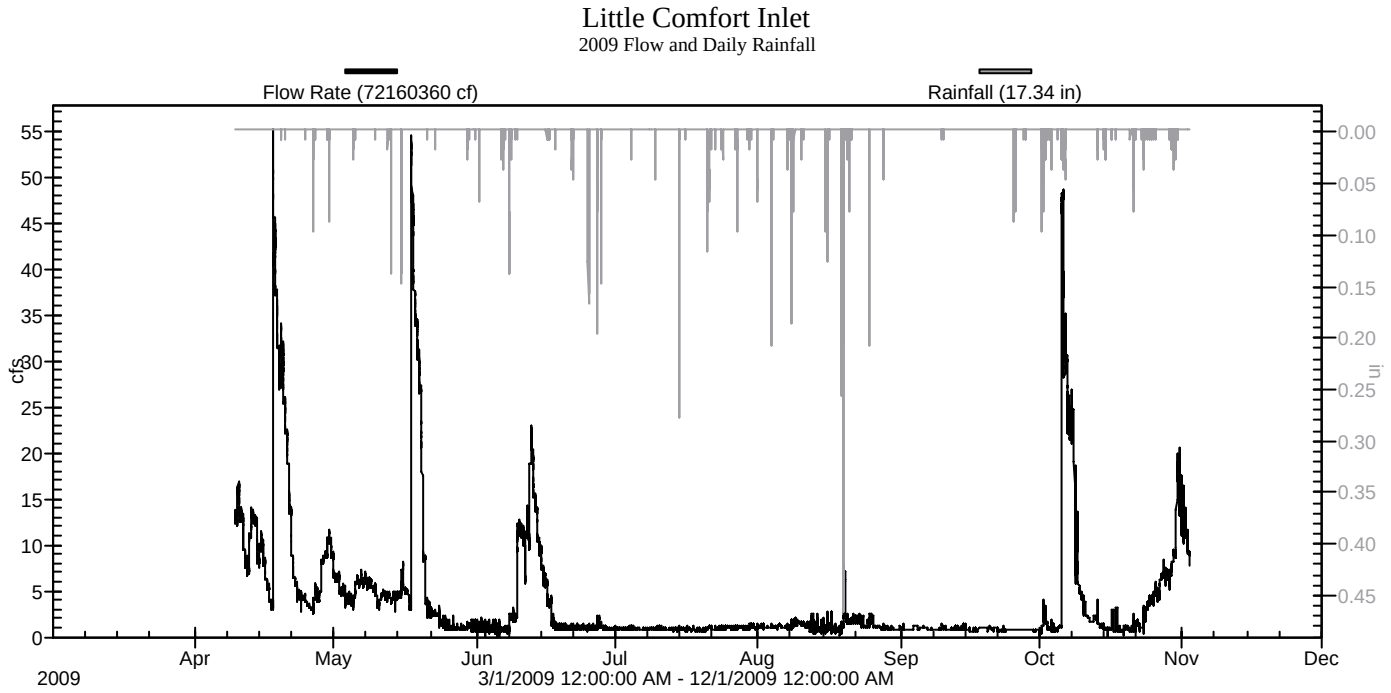


Figure 4. Little Comfort Lake Inlet 2009 Flow and Daily Rainfall

Grab samples were collected at the Little Comfort Lake Inlet site in 2009. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride, and *E. coli* results from all collected samples are listed in Table 8 and field water quality measurements are listed in Table 9. The highest concentrations of TKN and TP were 1.1 mg/L (June 8th storm grab, June 24th base grab, October 6th storm grab) and 0.159 mg/L (October 2nd storm grab). The TSS maximum concentration of 21 mg/L was from a June 8th storm grab sample.

Table 8. Little Comfort Lake Inlet 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved TP (mg/L)	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Ammonia Nitrogen (mg/L)	E. Coli (mpn/100ml)
Storm Grab	3/24/2009 10:14	3/24/2009 10:14	11	7	0.81	0.072	~0.021	8	<0.03	0.1	0.13	
Base Grab	5/14/2009 10:56	5/14/2009 10:56	4	~2	0.82	0.08	~0.014	14	<0.03	0.06	0.09	
Storm Grab	6/8/2009 8:40	6/8/2009 8:40	21	8	1.1	0.114	~0.018	9	<0.03	0.14	0.44	
E. Coli Grab	6/10/2009 8:30	6/10/2009 8:30										547.5
Base Grab	6/24/2009 8:46	6/24/2009 8:46	~2	~2	1.1	0.087	~0.049	12	0.12	0.21	0.25	
Base Grab	7/15/2009 8:30	7/15/2009 8:30	9	~3	0.52	0.059	~0.037	13	<0.03	<0.05	~0.04	
E. Coli Grab	7/28/2009 8:10	7/28/2009 8:10										201.4
Storm Grab	8/20/2009 10:18	8/20/2009 10:18	~1	~1	0.91	0.077	0.053	10	<0.03	0.06	~0.03	
Storm Grab	10/2/2009 9:46	10/2/2009 9:46	~2	~1	0.56	0.159	0.148	11	<0.03	0.12	<0.02	
Storm Grab	10/6/2009 14:04	10/6/2009 14:04	10	4	1.1	~0.026	~0.027	14	<0.03	<0.05	0.23	
Base Grab	10/22/2009 10:34	10/22/2009 10:34	~1	~1	0.8	~0.041	~0.018	10	<0.03	<0.05	~0.04	

Exceeds Water Quality Standard
Exceeds Chronic Standard
Exceeds Max Standard
Exceeds Final Acute Standard

Table 9. Little Comfort Lake Inlet 2009 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH
3/24/2009 10:14	56	4.6	13.05	266	8
4/24/2009 9:13	>100	13.7	5.54		
5/14/2009 10:56	>100	14.9	9.93		
6/8/2009 8:40	39	11.6	7.60	350	
6/10/2009 8:31	>100	15.8	6.50		
6/24/2009 8:46	>100	22.7	3.96		
7/13/2009 9:33	>100	16.4	5.49	379	8.4
7/15/2009 8:32	58	19.1	4.10	394	8.6
8/20/2009 10:18	>100	17.1	5.83	348	7.9
10/2/2009 9:46	>100	9.3	8.43	361	8.1
10/6/2009 14:04	>100	11.1	6.12	351	7.9
10/22/2009 10:34	>100	6.3	8.14	400	8

Exceeds Water Quality Standard

Table 10. Little Comfort Lake Inlet 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base***			*4*	*0.061*	*1/1/09 0:00*	*3/24/2009 5:00*	*355,140*	*8.16*	*89*	*1.4*
Storm Grab**	3/24/09 10:14	3/24/09 10:14	11	0.072	3/24/09 5:00	3/25/2009 17:00	1,425,600	32.74	979	6.4
*Base***			*4*	*0.061*	*3/25/09 17:00*	*4/9/09 15:00*	*11,599,200*	*266.42*	*2896*	*44.2*
Base Grab	5/14/09 10:56	5/14/09 10:56	4	0.080	4/9/09 15:00	5/17/09 15:00	29,053,090	667.32	7255	145.1
Base			*4*	*0.061*	*5/17/09 15:00*	*6/8/09 5:00*	*10,254,040*	*235.52*	*2560*	*39.0*
Storm Grab	6/8/09 8:40	6/8/09 8:40	21	0.114	6/8/09 5:00	6/14/09 6:00	5,371,105	123.37	7041	38.2
Base			*4*	*0.061*	*6/14/09 6:00*	*6/20/09 6:00*	*1,978,225*	*45.44*	*494*	*7.5*
Base Grab	6/24/09 8:46	6/24/09 8:46	2	0.087	6/20/09 6:00	6/25/09 5:00	391,077	8.98	49	2.1
Storm			*9*	*0.090*	*6/25/09 5:00*	*6/25/09 18:00*	*45,800*	*1.05*	*26*	*0.3*
Base			*4*	*0.061*	*6/25/09 18:00*	*6/27/09 3:00*	*108,160*	*2.48*	*27*	*0.4*
Storm			*9*	*0.090*	*6/27/09 3:00*	*6/28/09 3:00*	*113,395*	*2.60*	*64*	*0.6*
Base			*4*	*0.061*	*6/28/09 3:00*	*7/13/09 3:00*	*1,112,992*	*25.56*	*278*	*4.2*
Base Grab	7/15/09 8:30	7/15/09 8:30	9	0.059	7/13/09 3:00	7/21/09 1:00	505,856	11.62	284	1.9
Base			*4*	*0.061*	*7/21/09 1:00*	*8/8/09 6:00*	*1,541,870*	*35.41*	*385*	*5.9*
Storm			*9*	*0.090*	*8/8/09 6:00*	*8/9/09 19:00*	*193,820*	*4.45*	*109*	*1.1*
Base			*4*	*0.061*	*8/9/09 19:00*	*8/15/09 19:00*	*545,023*	*12.52*	*136*	*2.1*
Storm			*9*	*0.090*	*8/15/09 19:00*	*8/16/09 15:00*	*83,648*	*1.92*	*47*	*0.5*
Base			*4*	*0.061*	*8/16/09 15:00*	*8/19/09 3:00*	*172,079*	*3.95*	*43*	*0.7*
Storm Grab	8/20/09 10:18	8/20/09 10:18	1	0.077	8/19/09 3:00	8/20/09 20:00	373,781	8.59	23	1.8
Base			*4*	*0.061*	*8/20/09 20:00*	*8/25/09 7:00*	*627,006*	*14.40*	*157*	*2.4*
Storm			*9*	*0.090*	*8/25/09 7:00*	*8/26/09 0:00*	*133,327*	*3.06*	*75*	*0.7*
Base			*4*	*0.061*	*8/26/09 0:00*	*10/1/09 10:00*	2,568,569	59.00	641	9.8
Storm Grab	10/2/09 9:46	10/2/09 9:46	2	0.159	10/1/09 10:00	10/2/09 14:00	174,029	4.00	22	1.7
Base			*4*	*0.061*	*10/2/09 14:00*	*10/5/09 17:00*	*257,966*	*5.93*	*64*	*1.0*
Storm Grab	10/6/09 14:04	10/6/09 14:04	10	0.026	10/5/09 17:00	10/8/09 22:00	7,594,310	174.43	4741	12.3
Base			*4*	*0.061*	*10/8/09 22:00*	*10/19/09 22:00*	*1,914,027*	*43.96*	*478*	*7.3*
Base Grab	10/22/09 10:34	10/22/09 10:34	1	0.018	10/19/09 22:00	10/30/09 16:00	3,752,074	86.18	234	4.2
Storm			*9*	*0.090*	*10/30/09 16:00*	*10/31/09 20:00*	*1,631,490*	*37.47*	*917*	*9.2*
Base			*4*	*0.061*	*10/31/09 20:00*	*11/2/09 13:00*	*1,663,605*	*38.21*	*415*	*6.3*
*Base***			*4*	*0.061*	*11/2/09 13:00*	*12/2/09 13:00*	*15,552,000*	*357.21*	*3883*	*59.2*
*Base***			*4*	*0.061*	*12/2/09 13:00*	*1/1/10 0:00*	*127,260*	*2.92*	*32*	*0.5*
Storm Average			9	0.090						
Base Average			4	0.061						
All Average			7	0.077						
Total							**101,219,564**	**2,325**	**34,444**	**418**
CLFLWD Major Subwatershed Total Acres										
Total Load							10,513			
Total TP/TSS (lb/ac/yr)									3.28	0.04
Total TP/TSS (kg/ha/yr)									3.67	0.04

*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/09 to 4/9/09 and 11/2/09 to 1/1/10 where estimated based upon base flow

Total phosphorus loading for Little Comfort Lake Inlet for 2009 was estimated at 0.04 lb/ac (418 lbs) (Table 10). Compared to the July Ave. site, the higher TP load at Little Comfort Inlet is due in large part to the much higher total discharge that occurred at that site. However, the overall load is much lower when compared to 2008, again due to the reduction in total flow.

2) Forest Lake Subwatershed

Tributary to Forest Lake at FL44 Outlet

The station at the outlet of the FL44 subwatershed recorded stage from April 22 – November 2, 2009 (Figure 5). A rating curve was developed to calculate discharge. Total discharge for the recorded period was 534,969 cf or 12 acre-feet. A peak discharge of 0.244 cfs occurred on October 31st. This peak was caused by a very wet month of October, with 5.54 inches of rain falling in the area.

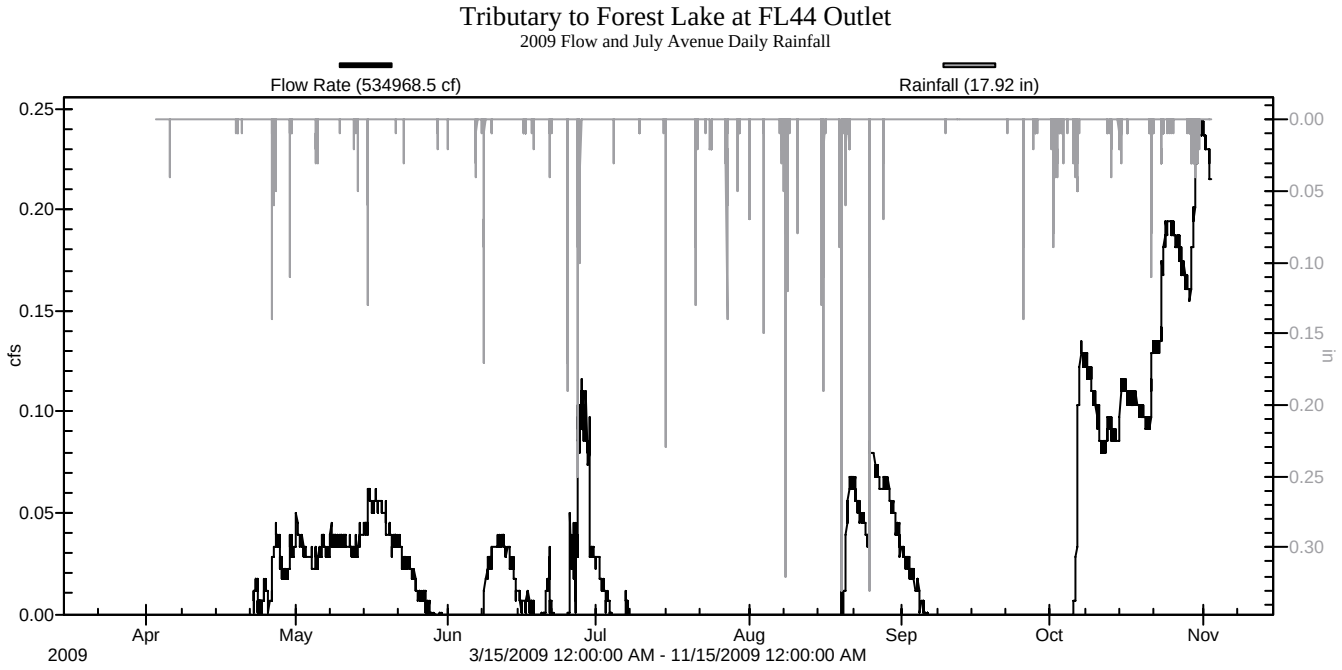


Figure 5. FL44 Outlet Flow and July Avenue Daily Rainfall

Grab samples were collected at the FL44 site in 2009. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen and Chloride results from all collected samples are listed in Table 11 and field water quality measurements are listed in Table 12. Noted in Table 11 are three samples that were taken when the outlet was not flowing. The results from these samples were much higher than normal, and therefore not included in loading estimates. The loading results for FL44 Outlet can be found in Table 13. Samples were also taken from the pond/inlet; results can be seen in Table 14 and Table 15.

Table 11. FL44 Outlet 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved TP (mg/L)	Chloride (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	Notes
Base Grab	5/1/2009 9:45	5/1/2009 9:45	3	~2	1.2	0.057	~0.022	NA	NA	NA	NA	
Base Grab	5/14/2009 9:30	5/14/2009 9:30	3	~2	1.5	0.085	~0.041	12	<0.03	<0.05	0.11	
Base Grab	5/26/2009 11:19	5/26/2009 11:19	40	24	2.6	0.389	0.167	NA	NA	NA	NA	Use data with caution, pond outlet was not flowing
Base Grab	6/12/2009 8:33	6/12/2009 8:33	~2	~2	1.3	0.083	0.052	NA	NA	NA	NA	
Base Grab	6/24/2009 14:00	6/24/2009 14:00	50	31	3.3	0.749	0.288	NA	NA	NA	NA	Use data with caution, pond outlet was not flowing
Base Grab	7/9/2009 8:45	7/9/2009 8:45	69	29	3.3	0.451	0.224	NA	NA	NA	NA	Use data with caution, pond outlet was not flowing
Storm Grab	8/25/2009 13:35	8/25/2009 13:35	5	~3	1.4	0.235	0.131	NA	NA	NA	NA	
Storm Grab	10/8/2009 10:09	10/8/2009 10:09	~2	~1	1.1	~0.020	~0.030	NA	NA	NA	NA	

Table 12. FL44 Outlet 2009 Field Water Quality Measurements

Date/Time	Transparency (cm)	Surface Water Temperature (°C)	Surface Dissolved Oxygen (mg/L)	Conductivity (µs/cm)	pH
5/14/2009 9:30	90	11.6	5.61	NA	NA
5/26/2009 11:19	66	15.6	1.66	NA	NA
6/12/2009 8:33	>100	17.8	7.33	107	7.5
6/24/2009 14:00	21	21.5	0.16	145	7.1
7/9/2009 8:45	70	18.2	2.02	134	8
8/25/2009 13:35	>100	21.0	2.69	140	8.1
10/8/2009 10:09	>100	9.5	6.55	151	7.7

Table 13. FL44 Outlet 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	Start	End	TSS (mg/L)	TP (mg/L)	Start	End	Interval Volume (cf)	Interval Volume (ac-ft)	Interval TSS (lb)	Interval TP (lb)
*Base***			*3*	*0.075*	*1/1/09 0:00*	*4/22/09 13:15*	*964*	*0.02*	*0.2*	*0.00*
Base			*3*	*0.075*	*4/22/09 13:15*	*4/30/09 13:15*	*13,010*	*0.30*	*2.4*	*0.06*
Base Grab	5/1/09 9:45	5/1/09 9:45	3	0.057	4/30/09 13:15	5/10/09 13:15	28,357	0.65	5.3	0.10
Base Grab	5/14/09 9:30	5/14/09 9:30	3	0.085	5/10/09 13:15	5/25/09 12:15	49,019	1.13	9.2	0.26
Base			*3*	*0.075*	*5/25/09 12:15*	*6/8/09 6:15*	*1,785*	*0.04*	*0.3*	*0.01*
Storm			*4*	*0.128*	*6/8/09 6:15*	*6/12/09 5:15*	*9,967*	*0.23*	*2.5*	*0.08*
Base Grab	6/12/09 8:33	6/12/09 8:33	2	0.083	6/12/09 5:15	6/25/09 6:15	9,140	0.21	*1.1*	0.05
Storm			*4*	*0.128*	*6/25/09 6:15*	*6/28/09 22:15*	*18,101*	*0.42*	*4.5*	*0.14*
Base			*3*	*0.075*	*6/28/09 22:15*	*7/14/09 12:15*	*12,265*	*0.28*	*2.3*	*0.06*
No Flow			*0*	*0.000*	*7/14/09 12:15*	*8/19/09 11:15*	*0*	*0.00*	*0.0*	*0.00*
Storm Grab	8/25/09 13:35	8/25/09 13:35	5	0.235	8/19/09 11:15	8/27/09 13:15	36,720	0.84	11.5	0.54
Base			*3*	*0.075*	*8/27/09 13:15*	*10/1/09 15:15*	*27,129*	*0.62*	*5.1*	*0.13*
Storm Grab	10/8/09 10:09	10/8/09 10:09	2	0.020	10/1/09 15:15	10/9/09 11:15	32,366	0.74	4.0	0.04
Base			*3*	*0.075*	*10/9/09 11:15*	*10/21/09 5:15*	*98,970*	*2.27*	*18.5*	*0.46*
Storm			*4*	*0.128*	*10/21/09 5:15*	*10/25/09 15:15*	*59,712*	*1.37*	*14.9*	*0.48*
Base			*3*	*0.075*	*10/25/09 15:15*	*10/29/09 10:15*	*56,577*	*1.30*	*10.6*	*0.26*
Storm			*4*	*0.128*	*10/29/09 10:15*	*11/1/09 1:15*	*48,549*	*1.12*	*12.1*	*0.39*
Base			*3*	*0.075*	*11/1/09 1:15*	*11/2/09 14:15*	*29,515*	*0.68*	*5.5*	*0.14*
*Base***			*3*	*0.075*	*11/2/09 14:15*	*12/2/09 14:15*	*259,200*	*5.95*	*48.5*	*1.21*
*Base***			*3*	*0.075*	*12/2/09 14:15*	*1/1/10 0:00*	*254*	*0.01*	*0.0*	*0.00*
Storm Average			4	0.128						
Base Average			3	0.075						
All Average			3	0.096						
Total							**791,598**	**18**	**159**	**4**
CLFLWD Major Subwatershed Total Acres							1,070			
Total TP/TSS (lb/ac/yr)									0.15	0.00
Total TP/TSS (kg/ha/yr)									0.17	0.00

*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/09 to 4/22/09 and 11/2/09 to 1/1/10 where estimated based upon base flow

Table 14. FL44 Inlet 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved TP (mg/L)
Base Grab	6/12/2009 8:50	6/12/2009 8:50	4	3	1.7	0.266	0.111
Base Grab	6/24/2009 14:26	6/24/2009 14:26	43	~37	3.1	0.319	0.055
Base Grab	7/9/2009 8:57	7/9/2009 8:57	5	4	1.6	0.078	<0.010
Storm Grab	8/25/2009 13:46	8/25/2009 13:46	~2	~1	1.90	0.458	~0.025
Storm Grab	10/8/2009 10:17	10/8/2009 10:17	~1	~1	1.3	0.051	0.057

Table 15. FL44 Inlet 2009 Field Water Quality Measurements

Date/Time	Transparency (cm)	Surface Water Temperature (°C)	Surface Dissolved Oxygen (mg/L)	Conductivity (µs/cm)	pH	Sub-Surface (1m) Water Temperature (°C)	Sub-Surface (1m) Dissolved Oxygen (mg/L)
6/12/2009 8:50	>100	16.1	1.70	126	NA	NA	NA
6/24/2009 14:26	53	27.9	8.21	96	7.4	NA	NA
7/9/2009 8:57	>100	22.7	5.75	107	7.5	NA	NA
8/25/2009 13:46	>100	21.9	8.35	116	7.6	19.6	0.24
10/8/2009 10:17	>100	11.2	1.36	122	6.4	NA	NA

Forest Lake Outlet

The station at the Forest Lake Outlet site recorded stage, velocity, and flow from April 9 - November 2, 2009 (Figure 6). Total discharge during the recorded period was 17,829,970 cf or 409 acre-ft. No automated rain gage was installed at this site to determine total seasonal rainfall. The highest discharge recorded of 9.67 cfs occurred on April 10th, 2009. This peak is a result of the remnants of the spring thaw.

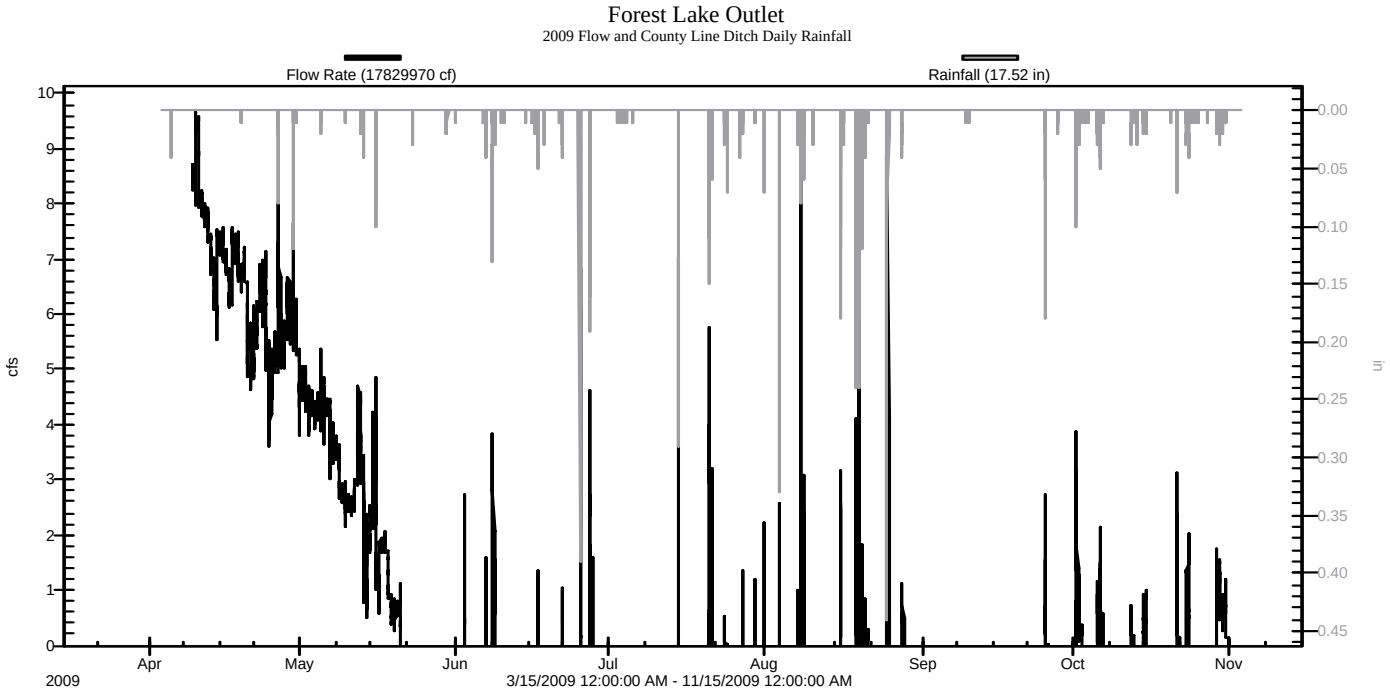


Figure 6. Forest Lake Outlet 2009 Flow and County Line Ditch Daily Rainfall

Table 16. Forest Lake Outlet 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base***			*N/A*	*0.025*	*1/1/09 0:00*	*3/25/09 0:00*	*717*	*0.0*	*N/A*	*0.0*
*Base***			*N/A*	*0.025*	*3/25/09 0:00*	*4/9/09 11:00*	*13,356,000*	*306.8*	*N/A*	*20.8*
Base Grab	4/19/09 14:00	4/19/09 14:00	N/A	0.023	4/9/09 11:00	4/25/09 8:00	9,310,253	213.8	N/A	13.4
Base Grab	5/3/09 13:00	5/3/09 13:00	N/A	0.010	4/25/09 8:00	5/5/09 8:00	4,469,220	102.7	N/A	2.8
Base Grab	5/11/09 15:00	5/11/09 15:00	N/A	0.022	5/5/09 8:00	5/14/09 8:00	2,480,687	57.0	N/A	3.4
Storm			*N/A*	*0.025*	*5/14/09 8:00*	*5/16/09 0:00*	*336,144*	*7.7*	*N/A*	*0.5*
Base Grab (Intermittent)	5/29/09 14:30	5/29/09 14:30	N/A	0.019	5/16/09 0:00	6/2/09 4:00	464,276	10.7	N/A	0.6
Base Grab (Intermittent)	6/12/09 15:00	6/12/09 15:00	N/A	0.013	6/2/09 4:00	6/22/09 4:00	70,587	1.6	N/A	0.1
Base Grab (Intermittent)	7/2/09 19:00	7/2/09 19:00	N/A	0.023	6/22/09 4:00	7/10/09 4:00	35,432	0.8	N/A	0.1
Base Grab (Intermittent)	7/13/09 15:30	7/13/09 15:30	N/A	0.025	7/10/09 4:00	7/22/09 4:00	57,705	1.3	N/A	0.1
Base Grab (Intermittent)	7/29/09 14:00	7/29/09 14:00	N/A	0.035	7/22/09 4:00	8/3/09 4:00	19,319	0.4	N/A	0.0
Base Grab (Intermittent)	8/14/09 19:15	8/14/09 19:15	N/A	0.035	8/3/09 4:00	8/19/09 4:00	72,696	1.7	N/A	0.2
Storm			*N/A*	*0.025*	*8/19/09 4:00*	*8/21/09 8:00*	*78,770*	*1.8*	*N/A*	*0.1*
Base Grab (Intermittent)	8/30/09 14:50	8/30/09 14:50	N/A	0.030	8/21/09 8:00	9/3/09 8:00	24,226	0.6	N/A	0.0
No Flow			*N/A*	*0.025*	*9/3/09 8:00*	*9/22/09 8:00*	*0*	*0.0*	*N/A*	*0.0*
Base Grab (Intermittent)	9/30/09 15:00	9/30/09 15:00	N/A	0.037	9/22/09 8:00	10/1/09 9:00	14,420	0.3	N/A	0.0
Storm			*N/A*	*0.025*	*10/1/09 9:00*	*10/2/09 18:00*	*74,589*	*1.7*	*N/A*	*0.1*
No Flow			*N/A*	*0.025*	*10/2/09 18:00*	*10/5/09 19:00*	*0*	*0.0*	*N/A*	*0.0*
Storm			*N/A*	*0.025*	*10/5/09 19:00*	*10/6/09 20:00*	*70,505*	*1.6*	*N/A*	*0.1*
No Flow			*N/A*	*0.025*	*10/6/09 20:00*	*10/12/09 6:00*	*0*	*0.0*	*N/A*	*0.0*
Storm			*N/A*	*0.025*	*10/12/09 6:00*	*10/12/09 19:00*	*17,619*	*0.4*	*N/A*	*0.0*
No Flow			*N/A*	*0.025*	*10/12/09 19:00*	*10/15/09 0:00*	*0*	*0.0*	*N/A*	*0.0*
Storm			*N/A*	*0.025*	*10/15/09 0:00*	*10/15/09 14:00*	*26,991*	*0.6*	*N/A*	*0.0*
No Flow			*N/A*	*0.025*	*10/15/09 14:00*	*10/21/09 7:00*	*0*	*0.0*	*N/A*	*0.0*
Storm			*N/A*	*0.025*	*10/21/09 7:00*	*10/21/09 22:00*	*33,607*	*0.8*	*N/A*	*0.1*
No Flow			*N/A*	*0.025*	*10/21/09 22:00*	*10/23/09 10:00*	*0*	*0.0*	*N/A*	*0.0*
Storm			*N/A*	*0.025*	*10/23/09 10:00*	*10/24/09 2:00*	*39,143*	*0.9*	*N/A*	*0.1*
Base (Intermittent)			*N/A*	*0.025*	*10/24/09 2:00*	*10/29/09 11:00*	*308*	*0.0*	*N/A*	*0.0*
Storm			*N/A*	*0.025*	*10/29/09 11:00*	*10/31/09 21:00*	*133,469*	*3.1*	*N/A*	*0.2*
*Base (Intermittent)***			*N/A*	*0.025*	*10/31/09 21:00*	*1/1/10 0:00*	*528*	*0.0*	*N/A*	*0.0*
Storm Average			N/A	N/A						
Base Average			N/A	0.025						
All Average			N/A	0.025						
Total							**31,187,212**	**716**	**N/A**	**43**
CLFLWD Major Subwatershed Total Acres							8,719			
Total TP/TSS (lb/ac/yr)									N/A	0.005
Total TP/TSS (kg/ha/yr)									N/A	0.005

*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/09 to 4/9/09 and 10/31/09 to 1/1/10 where estimated based upon base flow

Although no samples were collected at the Forest Lake Outlet site in 2009, the WCD used in-lake concentrations from samples collected by a volunteer to estimate a total phosphorus load at this location. Total phosphorus loading for Forest Lake Outlet for 2009 was estimated at 0.005 lb/ac (43 lbs.) (Table 16). This is greatly reduced from last year, due to the overall reduction in flow. Utilizing this data and the loading data from the County Line Ditch location will allow the CLFLWD to quantify the load originating from the City of Forest Lake that drains through the Bixby Park area. The monitoring station at Bixby Park that was installed in 2009 will help to verify the contribution from the city.

3) Comfort Lake Subwatershed

Bixby Park

2009 was the first year that data was collected at the Bixby Park site. The primary purpose of this site was to quantify the loads coming from the City of Forest Lake. Flow was recorded from April 13-October 20, 2009 (Figure 7). Total discharge for this period was 18,197,670 cf, or 418 acre-feet. No automated rain gage was installed at this site to record daily rainfall. A peak discharge of 40.50 cfs occurred on July 21, 2009 caused by a large precipitation event in the area. 0.93 inches of rain fell at the County Line Ditch site from July 20th-21st.

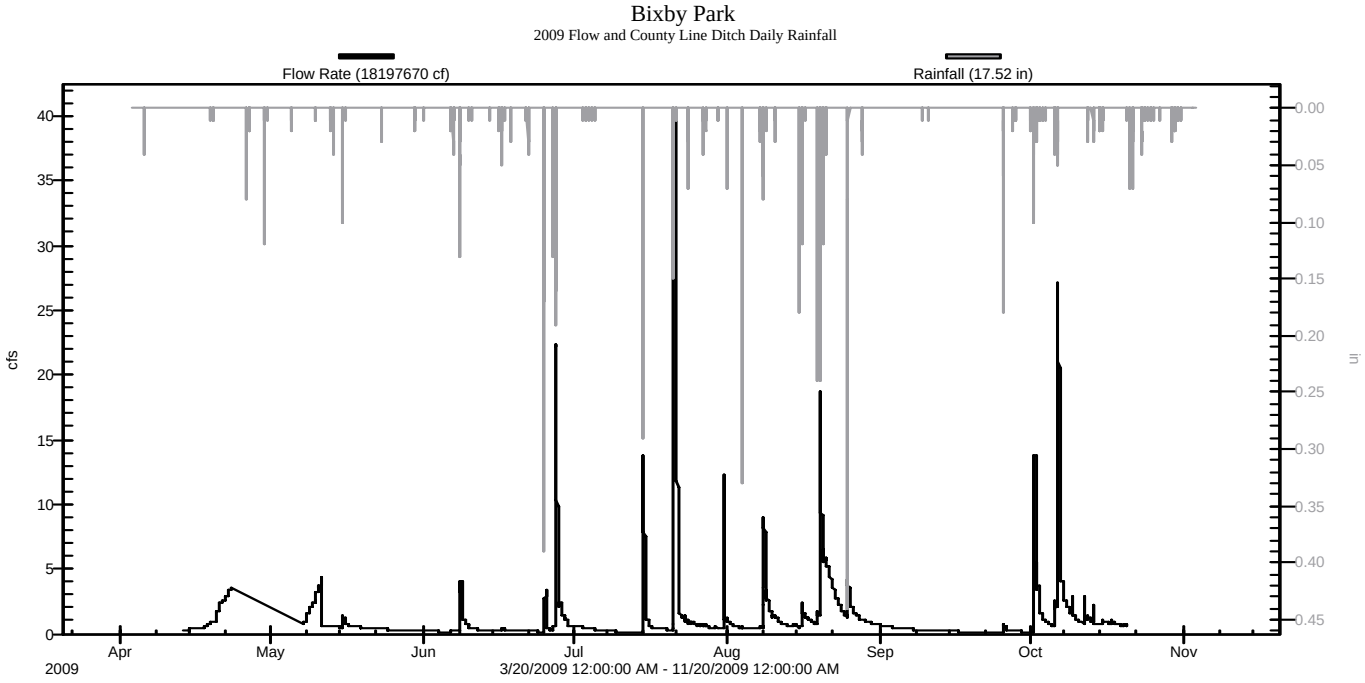


Figure 7. Bixby Park 2009 Flow and County Line Ditch Daily Rainfall

Grab samples were taken at the Bixby Park site in 2009. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride, Chlorophyll a and *E. Coli* results from all collected samples are listed in Table 17 and field water quality measurements are listed in Table 18. The highest TSS result of 19 mg\L was from a June 8th storm grab sample. The greatest TKN and TP results were from base grab samples on June 24th and July 13th, respectively, and were 5.3 mg/L and 0.227 mg/L, respectively.

Table 17. Bixby Park 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved TP (mg/L)	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Ammonia Nitrogen (mg/L)	Chlorophyll a (ug/L)	E. Coli (mpn/100ml)
Base Grab	5/14/2009 9:55	5/14/2009 9:55	7	~3	3.4	0.053	<0.010	310	<0.03	0.41	~0.06	7.8	
Storm Grab	6/8/2009 9:35	6/8/2009 9:35	19	~6	1.3	0.145	0.072	106	<0.03	0.26	0.15	8.3	
E. Coli Grab	6/16/2009 9:15	6/16/2009 9:15											7.2
E. Coli Grab	6/23/2009 8:15	6/23/2009 8:15											29.5
Base Grab	6/24/2009 9:28	6/24/2009 9:28	8	6	5.3	0.174	~0.034	279	<0.03	<0.05	0.12		
E. Coli Grab	6/30/2009 9:09	6/30/2009 9:09											62.7
Base Grab	7/13/2009 10:56	7/13/2009 10:56	7	~3	3.3	0.227	0.068	252	<0.03	<0.05	0.3		
E. Coli Grab	7/15/2009 8:54	7/15/2009 8:54											>2419.6
Storm Grab	7/21/2009 11:22	7/21/2009 11:22	6	~3	1.3	0.166	0.089	83	<0.03	0.13	0.11	15	
E. Coli Grab	7/21/2009 8:45	7/21/2009 8:45											>2419.6
E. Coli Grab	7/28/2009 8:00	7/28/2009 8:00											579.4
Storm Grab	8/10/2009 10:15	8/10/2009 10:15	11	6	3.2	0.181	0.075	137	<0.03	<0.05	0.24		
E. Coli Grab	8/11/2009 8:30	8/11/2009 8:30											42.6
E. Coli Grab	8/18/2009 8:30	8/18/2009 8:30											41.4
Storm Grab	8/20/2009 11:34	8/20/2009 11:34	5	~2	1.8	0.123	0.062	84	<0.03	0.14	~0.06	6.1	
E. Coli Grab	8/26/2009 8:34	8/26/2009 8:34											191.8
Storm Grab	10/2/2009 10:38	10/2/2009 10:38	4	~2	0.98	0.108	0.064	76	<0.03	0.22	~0.04	5.8	
Storm Grab	10/7/2009 12:46	10/7/2009 12:46	3	~2	1.7	0.064	0.095	86	<0.03	0.18	~0.04	6.8	
Storm Grab	10/22/2009 8:58	10/22/2009 8:58	3	~2	1.7	0.084	~0.029	99	<0.03	<0.05	~0.02	6.7	

Exceeds Water Quality Standard
Exceeds Chronic Standard
Exceeds Max Standard
Exceeds Final Acute Standard

Table 18. Bixby Park 2009 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH
5/14/2009 9:55	72	11.6	7.75		
6/8/2009 9:35	20	12.0	5.70	560	
6/8/2009 10:22	35	11.7	5.95	700	7.9
6/16/2009 9:13		18.8	1.87		
6/23/2009 8:15	56	22.6	1.93		
6/24/2009 9:28	69	22.8	0.96		
6/30/2009 9:09	>100	18.0	0.70		
7/13/2009 10:56	38	18.5	1.69	1180	7.6
7/15/2009 8:54	68	19.9	1.57	586	8.2
7/21/2009 8:46	53	20.1	3.89	310	8
8/10/2009 10:15	40			770	
8/18/2009 8:28	82	18.9	0.62	820	7.63
8/20/2009 11:34	68	18.4	3.24	437	7.6
8/26/2009 8:34	>100	16.7	0.77	770	7.4
10/2/2009 10:38	57	10.6	6.14	401	7.9
10/7/2009 12:46		9.1	4.75	544	7.8
10/22/2009 8:58	>100	7.6	5.87	684	7.4

Exceeds Water Quality Standard

Table 19. Bixby Park 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base**			*7*	*0.133*	*1/1/09 0:00*	*4/13/09 12:30*	*885,780*	*20.3*	*404*	*7.3*
Base			*7*	*0.133*	*4/13/09 12:30*	*4/23/09 2:45*	*963,119*	*22.1*	*439*	*8.0*
*Base**			*7*	*0.133*	*4/23/09 2:45*	*4/26/09 9:45*	*329,904*	*7.6*	*150*	*2.7*
*Storm**			*7*	*0.133*	*4/26/09 9:45*	*4/27/09 4:30*	*276,075*	*6.3*	*126*	*2.3*
*Base**			*7*	*0.133*	*4/27/09 4:30*	*5/7/09 11:30*	*1,484,964*	*34.1*	*677*	*12.3*
Base			*7*	*0.133*	*5/7/09 11:30*	*5/11/09 9:00*	*736,362*	*16.9*	*336*	*6.1*
Base Grab	5/14/2009 9:55	5/14/2009 9:55	7	0.053	5/11/09 9:00	5/15/09 17:15	194,861	4.5	85	0.6
Storm			*7*	*0.133*	*5/15/09 17:15*	*5/16/09 23:00*	*82,327*	*1.9*	*38*	*0.7*
Base			*7*	*0.133*	*5/16/09 23:00*	*6/6/09 10:30*	*539,905*	*12.4*	*246*	*4.5*
Storm			*7*	*0.133*	*6/6/09 10:30*	*6/7/09 10:30*	*19,090*	*0.4*	*9*	*0.2*
Base			*7*	*0.133*	*6/7/09 10:30*	*6/8/09 5:00*	*15,673*	*0.4*	*7*	*0.1*
Storm Grab	6/8/2009 9:35	6/8/2009 9:35	19	0.145	6/8/09 5:00	6/9/09 22:00	211,952	4.9	251	1.9
Base			*7*	*0.133*	*6/9/09 22:00*	*6/21/09 22:00*	*296,034*	*6.8*	*135*	*2.4*
Base Grab	6/24/2009 9:28	6/24/2009 9:28	8	0.174	6/21/09 22:00	6/25/09 5:30	49,263	1.1	25	0.5
Storm			*7*	*0.133*	*6/25/09 5:30*	*6/25/09 22:30*	*113,180*	*2.6*	*52*	*0.9*
Base			*7*	*0.133*	*6/25/09 22:30*	*6/27/09 2:45*	*35,267*	*0.8*	*16*	*0.3*
Storm			*7*	*0.133*	*6/27/09 2:45*	*6/29/09 0:00*	*1,017,751*	*23.4*	*464*	*8.4*
Base			*7*	*0.133*	*6/29/09 0:00*	*7/10/09 0:00*	*415,642*	*9.5*	*189*	*3.4*
Base Grab	7/13/2009 10:56	7/13/2009 10:56	7	0.227	7/10/09 0:00	7/14/09 19:45	48,903	1.1	21	0.7
Storm			*7*	*0.133*	*7/14/09 19:45*	*7/16/09 0:00*	*537,810*	*12.4*	*245*	*4.4*
Base			*7*	*0.133*	*7/16/09 0:00*	*7/20/09 19:45*	*168,160*	*3.9*	*77*	*1.4*
Storm Grab	7/21/2009 11:22	7/21/2009 11:22	6	0.166	7/20/09 19:45	7/22/09 13:00	2,405,082	55.2	901	24.9
Base			*7*	*0.133*	*7/22/09 13:00*	*8/8/09 7:15*	*966,762*	*22.2*	*441*	*8.0*
Storm Grab	8/10/2009 10:15	8/10/2009 10:15	11	0.181	8/8/09 7:15	8/10/09 15:00	538,995	12.4	370	6.1
Base			*7*	*0.133*	*8/10/09 15:00*	*8/15/09 18:30*	*328,734*	*7.6*	*150*	*2.7*
Storm			*7*	*0.133*	*8/15/09 18:30*	*8/17/09 2:00*	*168,185*	*3.9*	*77*	*1.4*
Base			*7*	*0.133*	*8/17/09 2:00*	*8/19/09 3:30*	*171,579*	*3.9*	*78*	*1.4*
Storm Grab	8/20/09 11:34	8/20/09 11:34	5	0.123	8/19/09 3:30	8/21/09 2:00	1,116,299	25.6	348	8.6
Base			*7*	*0.133*	*8/21/09 2:00*	*8/25/09 6:45*	*1,057,627*	*24.3*	*482*	*8.7*
Storm			*7*	*0.133*	*8/25/09 6:45*	*8/26/09 4:00*	*202,617*	*4.7*	*92*	*1.7*
Base			*7*	*0.133*	*8/26/09 4:00*	*9/25/09 13:15*	*1,065,813*	*24.5*	*486*	*8.8*
Storm			*7*	*0.133*	*9/25/09 13:15*	*9/27/09 1:00*	*48,511*	*1.1*	*22*	*0.4*
Base			*7*	*0.133*	*9/27/09 1:00*	*10/1/09 6:30*	*63,502*	*1.5*	*29*	*0.5*
Storm Grab	10/2/09	10:38	4	0.108	10/1/09 6:30	10/3/09 17:00	742,117	17.0	185	5.0
Base			*7*	*0.133*	*10/3/09 17:00*	*10/5/09 16:45*	*141,854*	*3.3*	*65*	*1.2*
Storm Grab	10/7/09	12:46	3	0.064	10/5/09 16:45	10/8/09 2:00	1,615,609	37.1	303	6.5
Base			*7*	*0.133*	*10/8/09 2:00*	*10/20/09 14:30*	*1,105,768*	*25.4*	*504*	*9.1*
*Base**			*7*	*0.133*	*10/20/09 14:30*	*10/21/09 13:00*	*81,000*	*1.9*	*37*	*0.7*
Storm Grab*	10/22/09	8:58	3	0.084	10/21/09 13:00	10/22/09 12:00	338,652	7.8	63	1.8
*Base**			*7*	*0.133*	*10/22/09 12:00*	*1/1/10 0:00*	*1,522,800*	*35.0*	*694*	*12.6*
Storm Average			7	0.124						
Base Average			7	0.151						
All Average			7	0.133						
Total							**22,103,528**	**508**	**9,317**	**179**
CLFLWD Major Subwatershed Total Acres							747			
Total TP/TSS (lb/ac/yr)									12.48	0.240
Total TP/TSS (kg/ha/yr)									13.98	0.269

Italics indicate estimated concentrations based on average base and storm flow concentrations

* Interval Volumes are estimated flow (cf)

Total phosphorus loading for the Bixby Park Site for 2009 was estimated at 0.240 lb/ac (179 lbs.) (Table 19). When compared to the County Line Ditch site, the TP and TSS loadings are higher at Bixby Park, possibly leading to the conclusion that the wetlands downstream of this site are acting as a sink for nutrients. Water quality monitoring should continue at this site to better assess the affect on the downstream watershed.

County Line Ditch

The station at the County Line Ditch recorded flow from April 3, 2009 to November 3, 2009 (Figure 8). Total discharge during this period was 54,246,120 cf or 1,245 acre-ft. Total rainfall for the monitoring season was 17.52 inches. A peak flow of 19.32 cfs occurred on October 6th from a cumulative rainfall of 1.50 inches that fell from October 5th – 6th. One note about this location is that due to the heavy sedimentation present within the channel, difficulty arose when flow was at a minimum. The deepest point within the channel would change frequently, thereby either burying the sensor in sediment or having the deep point (thalweg) in the channel getting rerouted around the sensor.

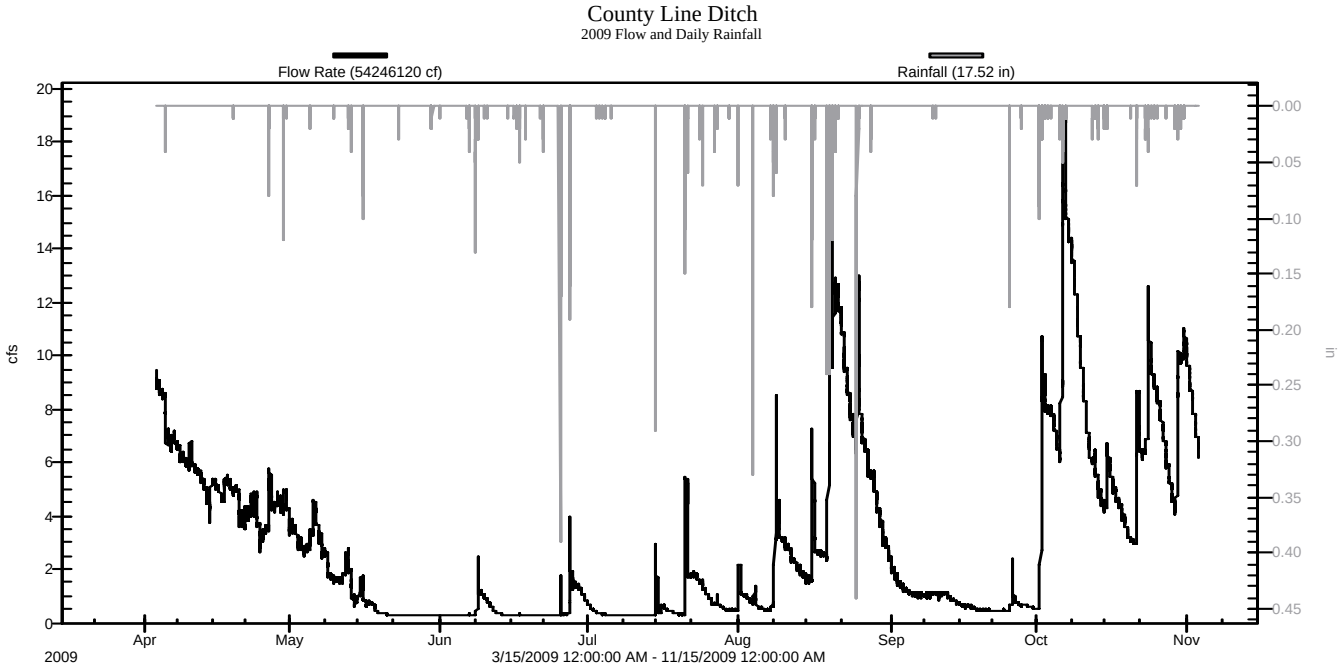


Figure 8. County Line Ditch 2009 Flow and Daily Rainfall

Grab samples were taken at the County Line Ditch site in 2009. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride and *E. Coli* results from all collected samples are listed in Table 20 and field water quality measurements are listed in Table 21. The highest TSS concentration of 40 mg/L was collected in a storm grab sample from June 6, 2009. The highest TKN concentration of 7.30 mg/L was collected in a June 25, 2009 storm grab sample. The highest TP concentration of 0.328 mg/L was also collected in the June 25 storm sample.

Table 20. County Line Ditch 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved TP (mg/L)	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Ammonia Nitrogen (mg/L)	Sulfate (mg/L)	E. Coli (mpn/100ml)
Storm Grab	3/24/2009 9:33	3/24/2009 9:33	6	3	1.4	0.086	~0.015	79	<0.03	0.2	0.26	5.14	
Base Grab	5/14/2009 10:25	5/14/2009 10:25	7	3	2.8	0.057	~0.021	187	<0.03	<0.05	0.09		
E. Coli Grab	5/28/2009 9:30	5/28/2009 9:30											1120
Storm Grab	6/8/2009 9:18	6/8/2009 9:18	44	19	3	0.198	0.076	226	<0.03	0.2	0.14		
Base Grab	6/24/2009 9:13	6/24/2009 9:13	19	~9	3.2	0.17	~0.047	235	<0.03	<0.05	~0.02		
E. Coli Grab	6/25/2009 8:30	6/25/2009 8:30											>2420
Storm Grab	6/25/2009 8:30	6/25/2009 8:30	37	17	7.3	0.328	~0.019	468	<0.03	0.44	0.72		
Base Grab	7/13/2009 10:14	7/13/2009 10:14	5	~2	2.6	0.077	~0.033	213	<0.03	<0.05	<0.02		
Storm Grab	7/21/2009 11:06	7/21/2009 11:06	4	~2	1.6	0.153	0.088	96	<0.03	0.12	~0.02		
E. Coli Grab	7/29/2009 8:37	7/29/2009 8:37											29
Base Grab	8/5/2009 11:04	8/5/2009 11:04	~1	~1	1.4	0.053	~0.036	145	<0.03	<0.05	<0.02		
Base Grab	8/10/2009 9:47	8/10/2009 9:47	~2	~2	2	0.119	0.071	102	<0.03	<0.05	~0.02		
Storm Grab	8/20/2009 11:00	8/20/2009 11:00	3	~2	1.6	0.122	0.077	90	<0.03	<0.05	~0.03		
E. Coli Grab	8/27/2009 10:15	8/27/2009 10:15											68
Base Grab	9/8/2009 9:22	9/8/2009 9:22	4	~2	2.5	0.071	~0.043	139	<0.03	<0.05	~0.05		
Base Grab	9/28/2009 15:04	9/28/2009 15:04	11	5	2.5	0.061	<0.010	167	<0.03	<0.05	~0.03		
E. Coli Grab	9/30/2009 8:56	9/30/2009 8:56											44
Storm Grab	10/2/2009 10:20	10/2/2009 10:20	3	~2	1.6	0.099	0.054	136	<0.03	0.16	~0.02		
Storm Grab	10/6/2009 14:32	10/6/2009 14:32	5	~2	0.93	0.089	0.061	93	<0.03	0.07	~0.03		

Exceeds Water Quality Standard
Exceeds Chronic Standard
Exceeds Max Standard
Exceeds Final Acute Standard

Table 21. County Line Ditch 2009 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH
3/24/2009 9:33	85	2.8	12.81	452	8.4
5/14/2009 10:25	>120	12.3	11.34		
5/28/2009 9:29	84	11.7	8.92		
6/8/2009 9:18	24	11.7	5.83	880	
6/8/2009 10:57	41	11.6	7.10	1032	7.8
6/24/2009 9:13	57	24.3	8.13		
6/25/2009 8:32	44	20.6	3.57	850	
7/13/2009 10:14	>100	19.9	9.04	1034	8.2
7/21/2009 11:06	71	19.4	5.27	477	8
7/29/2009 8:37	>120	16.5	5.80		
8/5/2009 11:04	>100	18.9	7.90	832	7.8
8/10/2009 9:47	>100			600	
8/20/2009 11:00		18.3	1.54	496	7.4
9/8/2009 9:22	>100	17.9	1.37	880	7.3
9/28/2009 15:04		13.6	7.15	1020	8.1
10/2/2009 10:20	>100	10.0	4.81	860	7.7
10/6/2009 14:32	83	9.9	7.47	489	7.8

Exceeds Water Quality Standard

Table 22. County Line Ditch 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base***					*1/1/09 0:00*	*3/24/09 4:00*	*354,960*	*8.2*	*0*	*0.0*
Storm Grab**	3/24/09 9:33	3/24/09 9:33	6	0.086	3/24/09 4:00	3/25/09 16:00	1,296,000	29.8	485	7.0
*Base***					*3/25/09 16:00*	*4/3/09 10:30*	*5,140,800*	*118.1*	*0*	*0.0*
Base					*4/3/09 10:30*	*5/3/09 10:30*	*13,340,130*	*306.4*	*0*	*0.0*
Base Grab	5/14/09 10:25	5/14/09 10:25	7	0.057	5/3/09 10:30	6/6/09 18:30	3,032,069	69.6	1,325	10.8
Storm Grab	6/8/09 9:18	6/8/09 9:18	44	0.198	6/6/09 18:30	6/9/09 16:30	191,554	4.4	526	2.4
Base					*6/9/09 16:30*	*6/18/09 16:30*	*316,411*	*7.3*	*0*	*0.0*
Base Grab	6/24/09 9:13	6/24/09 9:13	19	0.170	6/18/09 16:30	6/25/09 3:30	150,188	3.4	178	1.6
Storm Grab	6/25/09 8:30	6/25/09 8:30	37	0.328	6/25/09 3:30	6/25/09 18:30	39,827	0.9	92	0.8
Base					*6/25/09 18:30*	*6/27/09 2:30*	*37,202*	*0.9*	*0*	*0.0*
Storm					*6/27/09 2:30*	*6/28/09 4:30*	*154,694*	*3.6*	*0*	*0.0*
Base Grab	7/13/09 10:14	7/13/09 10:14	5	0.077	6/28/09 4:30	7/14/09 21:30	663,243	15.2	207	3.2
Storm					*7/14/09 21:30*	*7/15/09 16:30*	*65,208*	*1.5*	*0*	*0.0*
Base					*7/15/09 16:30*	*7/21/09 0:30*	*192,803*	*4.4*	*0*	*0.0*
Storm Grab	7/21/09 11:06	7/21/09 11:06	4	0.088	7/21/09 0:30	7/21/09 23:30	251,145	5.8	63	1.4
Base					*7/21/09 23:30*	*7/31/09 21:30*	*821,552*	*18.9*	*0*	*0.0*
Storm					*7/31/09 21:30*	*8/1/09 14:30*	*79,075*	*1.8*	*0*	*0.0*
Base					*8/1/09 14:30*	*8/3/09 22:30*	*183,827*	*4.2*	*0*	*0.0*
Storm					*8/3/09 22:30*	*8/4/09 17:30*	*63,075*	*1.4*	*0*	*0.0*
Base Grab	8/5/09 11:04	8/5/09 11:04	1	0.053	8/4/09 17:30	8/7/09 18:30	137,722	3.2	9	0.5
Storm					*8/7/09 18:30*	*8/9/09 6:30*	*424,392*	*9.7*	*0*	*0.0*
Base Grab	8/10/09 9:47	8/10/09 9:47	2	0.119	8/9/09 6:30	8/15/09 18:30	1,314,885	30.2	164	9.8
Storm					*8/15/09 18:30*	*8/16/09 13:30*	*282,294*	*6.5*	*0*	*0.0*
Base					*8/16/09 13:30*	*8/19/09 3:30*	*578,958*	*13.3*	*0*	*0.0*
Storm Grab	8/20/09 11:00	8/20/09 11:00	3	0.122	8/19/09 3:30	8/20/09 16:30	1,351,544	31.0	253	10.3
Base					*8/20/09 16:30*	*8/25/09 7:30*	*3,836,884*	*88.1*	*0*	*0.0*
Storm					*8/25/09 7:30*	*8/26/09 0:30*	*594,919*	*13.7*	*0*	*0.0*
Base Grab	9/8/09 9:22	9/8/09 9:22	4	0.071	8/26/09 0:30	9/10/09 0:30	3,493,664	80.2	872	15.5
Base					*9/10/09 0:30*	*9/25/09 13:30*	*891,726*	*20.5*	*0*	*0.0*
Storm					*9/25/09 13:30*	*9/26/09 12:30*	*107,673*	*2.5*	*0*	*0.0*
Base Grab	9/28/09 15:04	9/28/09 15:04	11	0.061	9/26/09 12:30	10/1/09 15:30	277,518	6.4	191	1.1
Storm Grab	10/2/09 10:20	10/2/09 10:20	3	0.099	10/1/09 15:30	10/2/09 18:30	743,173	17.1	139	4.6
Base					*10/2/09 18:30*	*10/5/09 21:30*	*2,014,178*	*46.3*	*0*	*0.0*
Storm Grab	10/6/09 14:32	10/6/09 14:32	5	0.089	10/5/09 21:30	10/8/09 6:30	2,878,312	66.1	898	16.0
Base					*10/8/09 6:30*	*10/15/09 0:30*	*4,615,126*	*106.0*	*0*	*0.0*
Storm					*10/15/09 0:30*	*10/16/09 7:30*	*628,840*	*14.4*	*0*	*0.0*
Base					*10/16/09 7:30*	*10/21/09 7:30*	*1,722,308*	*39.6*	*0*	*0.0*
Storm					*10/21/09 7:30*	*10/22/09 4:30*	*481,445*	*11.1*	*0*	*0.0*
Base					*10/22/09 4:30*	*10/23/09 13:30*	*764,409*	*17.6*	*0*	*0.0*
Storm					*10/23/09 13:30*	*10/25/09 0:30*	*1,265,751*	*29.1*	*0*	*0.0*
Base					*10/25/09 0:30*	*10/29/09 14:30*	*2,642,670*	*60.7*	*0*	*0.0*
Storm					*10/29/09 14:30*	*11/1/09 1:30*	*2,020,246*	*46.4*	*0*	*0.0*
Base					*11/1/09 1:30*	*11/3/09 9:30*	*1,595,487*	*36.6*	*0*	*0.0*
*Base***					*11/3/09 9:30*	*12/2/09 9:30*	*10,022,400*	*230.2*	*0*	*0.0*
*Base***					*12/2/09 9:30*	*1/1/10 0:00*	*127,890*	*2.9*	*0*	*0.0*
Storm Average			15	0.144						
Base Average			7	0.087						
All Average			11	0.116						
Total							**71,188,173**	**1,635**	**5,403**	**85**
CLFLWD Major Subwatershed Total Acres							9,806			
Total TP/TSS (lb/ac/yr)									0.55	0.009
Total TP/TSS (kg/ha/yr)									0.62	0.010

*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/09 to 4/3/08 and 11/3/08 to 1/1/10 where estimated based upon base flow

Total phosphorus loading for the County Line Ditch Site for 2009 was estimated at 0.009 lb/ac (85 lbs.) (Table 22). This load is substantially lower than the estimate from 2008. The likely cause of this is the overall reduction of flow at this site in 2009, which was less than half of the discharge observed in 2008. When compared to the Bixby Park site, the TP and TSS loadings are lower at County Line Ditch, possibly leading to the conclusion that the wetland complex between these two sites is acting as a sink for nutrients. Another cause of this nutrient reduction may be from dilution by the lower nutrient concentrations from Forest Lake, when the lake was flowing over the outlet.

Comfort Lake Inlet

The station for the Comfort Lake Inlet site recorded flow between April 3-November 2, 2009 (Figure 9). Total discharge during this period was 76,945,270 cf or 1,766 acre-ft. Total rainfall for the monitoring season was 17.80 inches. A peak flow of 31.16 cfs occurred on April 3, 2009 due to the remnants of the spring thaw.

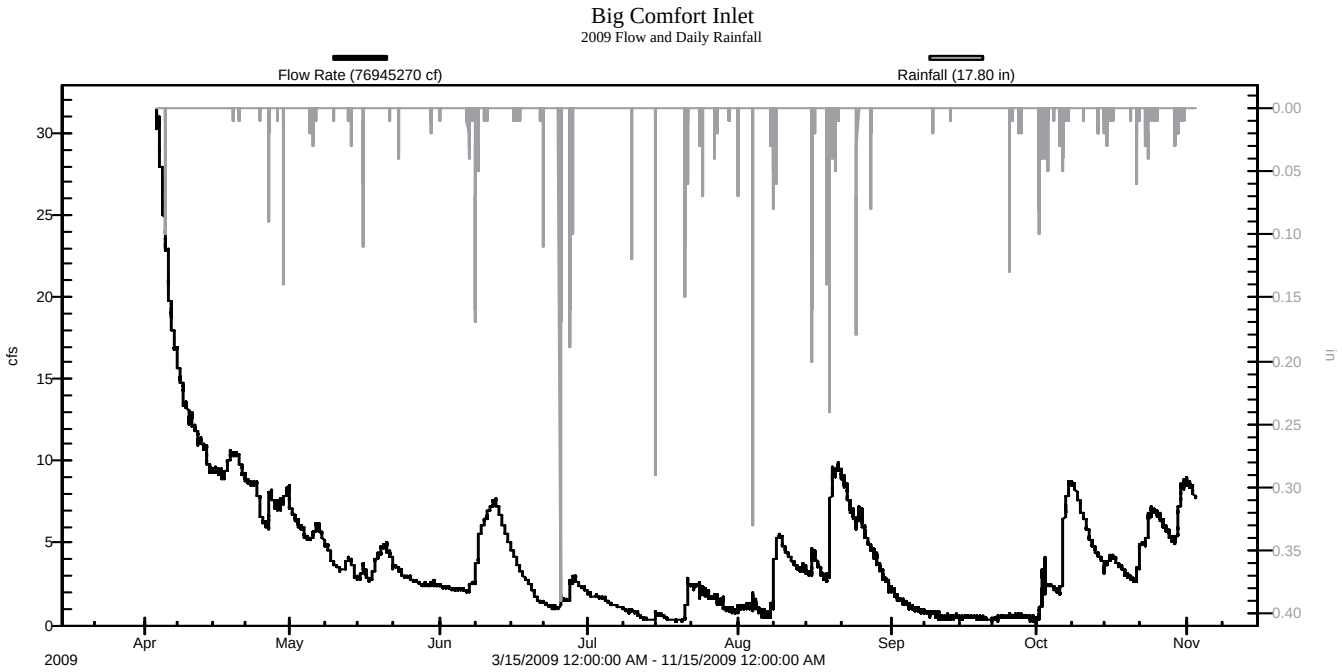


Figure 9. Comfort Lake Inlet 2009 Flow and Daily Rainfall

Grab samples were taken at the Comfort Lake Inlet site in 2009. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride and *E. Coli* results from all collected samples are listed in Table 23 and field water quality measurements are listed in Table 24. The highest TKN and TP concentrations were 2.9 mg/L (June 8th storm grab) and 0.154 mg/L (August 5th base grab), respectively. The highest TSS concentration observed was 7 mg/L from a July 21st storm grab.

Table 23. Comfort Lake Inlet 2009 Sample Chemistry Results

Sample Type	Start	End	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Dissolved TP (mg/L)	Chloride (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Ammonia Nitrogen (mg/L)	Sulfate (mg/L)	E. Coli (mpn/100ml)
Storm Grab	3/24/2009 9:55	3/24/2009 9:55	4	3	1.8	0.122	~0.030	72	<0.03	0.27	0.38	5.81	
Base Grab	5/14/2009 10:41	5/14/2009 10:41	4	~2	1.7	~0.040	<0.010	90	<0.03	0.16	~0.03		
E. Coli Grab	5/28/2009 9:15	5/28/2009 9:15											41
Storm Grab	6/8/2009 9:00	6/8/2009 9:00	5	3	2.9	0.097	~0.023	106	0.04	0.58	0.22		
Base Grab	6/24/2009 8:58	6/24/2009 8:58	3	~2	2.1	0.124	0.062	67	0.1	0.7	0.55		
E. Coli Grab	6/25/2009 9:00	6/25/2009 9:00											>2420
Storm Grab	7/21/2009 10:48	7/21/2009 10:48	7	~2	1.3	0.082	0.068	79	0.05	0.77	0.15		
E. Coli Grab	7/29/2009 8:54	7/29/2009 8:54											118
Base Grab	8/5/2009 10:39	8/5/2009 10:39	~2	~1	1.7	0.154	0.053	103	0.04	0.57	0.15		
Storm Grab	8/10/2009 9:15	8/10/2009 9:15	~2	~2	2.2	0.094	0.065	109	<0.03	0.19	0.1		
Storm Grab	8/20/2009 10:38	8/20/2009 10:38	5	~2	1.3	0.1	0.078	63	<0.03	<0.05	~0.04		
E. Coli Grab	8/27/2009 10:25	8/27/2009 10:25											84
Base Grab	9/8/2009 9:49	9/8/2009 9:49	~2	~1	1.8	0.063	~0.037	95	0.04	0.83	0.16		
Base Grab	9/28/2009 14:43	9/28/2009 14:43	~2	~1	1.3	~0.047	~0.019	76	<0.03	0.64	<0.02		
E. Coli Grab	9/30/2009 9:13	9/30/2009 9:13											152
Storm Grab	10/2/2009 10:01	10/2/2009 10:01	3	~2	1	~0.041	~0.012	63	<0.03	0.67	<0.02		
Storm Grab	10/6/2009 14:15	10/6/2009 14:15	3	~2	1.4	~0.011	0.085	83	<0.03	0.08	<0.02		

Exceeds Water Quality Standard
Exceeds Chronic Standard
Exceeds Max Standard
Exceeds Final Acute Standard

Table 24. Comfort Lake Inlet 2009 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH
3/24/2009 9:55	72	3.2	12.21	447	8
4/24/2009 9:42	>100	14.4	7.53		
5/14/2009 10:41	>120	11.9	10.00		
5/28/2009 9:13	>100	10.5	2.01		
6/8/2009 9:00	90	11.5	5.02	760	
6/8/2009 11:23	75	11.2	6.25	750	8.1
6/24/2009 8:58	>100	21.8	1.30		
6/25/2009 9:01	79.5	20.0	1.73	760	
7/13/2009 9:54	>100	16.0	2.92	735	7.9
7/21/2009 10:48	50	17.7	4.81	567	8.1
7/29/2009 8:54	>120	16.6	3.32		
8/5/2009 10:39	>100	16.8	3.53	729	8.1
8/10/2009 9:15	>100			690	
8/20/2009 10:38	>100	18.0	3.99	404	7.7
9/8/2009 9:49	>100	17.1	3.67	720	7.68
9/28/2009 14:43		12.7	3.65	730	8
10/2/2009 10:01	>100	9.3	7.48	581	7.9
10/6/2009 14:15	>100	9.3	8.52	581	8.1

Exceeds Water Quality Standard

Table 25. Comfort Lake Inlet 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base***			*3*	*0.086*	*1/1/09 0:00*	*3/24/09 4:00*	*3,549,600*	*81.5*	*665*	*19.1*
Storm Grab**	3/24/09 9:55	3/24/09 9:55	4	0.122	3/24/09 4:00	3/25/09 16:00	3,240,000	74.4	809	24.7
*Base***			*3*	*0.086*	*3/25/09 16:00*	*4/3/09 11:30*	*12,182,400*	*279.8*	*2,282*	*65.4*
Base			*3*	*0.086*	*4/3/09 11:30*	*5/3/09 11:30*	*29,621,230*	*680.4*	*5,547*	*159.0*
Base Grab	5/14/09 10:41	5/14/09 10:41	4	0.040	5/3/09 11:30	6/8/09 3:30	10,542,290	242.1	2,632	26.3
Storm Grab	6/8/09 9:00	6/8/09 9:00	5	0.097	6/8/09 3:30	6/13/09 7:30	2,892,609	66.4	903	17.5
Base Grab	6/24/09 8:58	6/24/09 8:58	3	0.124	6/13/09 7:30	6/25/09 5:30	2,869,398	65.9	537	22.2
Storm			*4*	*0.078*	*6/25/09 5:30*	*6/25/09 22:30*	*100,541*	*2.3*	*25*	*0.5*
Base			*3*	*0.086*	*6/25/09 22:30*	*6/27/09 3:30*	*157,532*	*3.6*	*30*	*0.8*
Storm			*4*	*0.078*	*6/27/09 3:30*	*6/29/09 2:30*	*460,245*	*10.6*	*115*	*2.2*
Base			*3*	*0.086*	*6/29/09 2:30*	*7/21/09 1:30*	*1,864,717*	*42.8*	*349*	*10.0*
Storm Grab	7/21/09 10:48	7/21/09 10:48	7	0.082	7/21/09 1:30	7/22/09 0:30	168,450	3.9	74	0.9
Base			*3*	*0.086*	*7/22/09 0:30*	*7/31/09 0:30*	*1,305,568*	*30.0*	*245*	*7.0*
Base Grab	8/5/09 10:39	8/5/09 10:39	2	0.154	7/31/09 0:30	8/8/09 7:30	696,243	16.0	87	6.7
Storm Grab	8/10/09 9:15	8/10/09 9:15	2	0.094	8/8/09 7:30	8/10/09 15:30	994,417	22.8	124	5.8
Base			*3*	*0.086*	*8/10/09 15:30*	*8/15/09 18:30*	*1,603,693*	*36.8*	*300*	*8.6*
Storm			*4*	*0.078*	*8/15/09 18:30*	*8/17/09 2:30*	*473,033*	*10.9*	*118*	*2.3*
Base			*3*	*0.086*	*8/17/09 2:30*	*8/19/09 10:30*	*622,516*	*14.3*	*117*	*3.3*
Storm Grab	8/20/09 10:38	8/20/09 10:38	5	0.100	8/19/09 10:30	8/22/09 6:30	2,101,753	48.3	656	13.1
Base			*3*	*0.086*	*8/22/09 6:30*	*8/25/09 6:30*	*1,922,515*	*44.2*	*360*	*10.3*
Storm			*4*	*0.078*	*8/25/09 6:30*	*8/26/09 18:30*	*842,132*	*19.3*	*210*	*4.1*
Base Grab	9/8/09 9:49	9/8/09 9:49	2	0.063	8/26/09 18:30	9/10/09 18:30	2,719,081	62.5	339	10.7
Base Grab	9/28/09 14:43	9/28/09 14:43	2	0.047	9/10/09 18:30	10/1/09 15:30	830,347	19.1	104	2.4
Storm Grab	10/2/09 10:01	10/2/09 10:01	3	0.041	10/1/09 15:30	10/3/09 16:30	384,297	8.8	72	1.0
Base			*3*	*0.086*	*10/3/09 16:30*	*10/5/09 20:30*	*403,654*	*9.3*	*76*	*2.2*
Storm Grab	10/6/09 14:15	10/6/09 14:15	3	0.011	10/5/09 20:30	10/9/09 22:30	2,518,683	57.9	472	1.7
Base			*3*	*0.086*	*10/9/09 22:30*	*10/21/09 8:30*	*4,151,876*	*95.4*	*778*	*22.3*
Storm			*4*	*0.078*	*10/21/09 8:30*	*10/25/09 19:30*	*2,142,062*	*49.2*	*535*	*10.4*
Base			*3*	*0.086*	*10/25/09 19:30*	*10/29/09 10:30*	*1,828,192*	*42.0*	*342*	*9.8*
Storm			*4*	*0.078*	*10/29/09 10:30*	*10/31/09 21:30*	*1,603,548*	*36.8*	*400*	*7.8*
Base			*3*	*0.086*	*10/31/09 21:30*	*11/2/09 10:30*	*1,110,574*	*25.5*	*208*	*6.0*
*Base***			*3*	*0.086*	*11/2/09 10:30*	*12/2/09 10:30*	*10,368,000*	*238.1*	*1,942*	*55.7*
*Base***			*3*	*0.086*	*12/2/09 10:30*	*1/1/10 0:00*	*1,277,100*	*29.3*	*239*	*6.9*
Storm Average			4	0.078						
Base Average			3	0.086						
All Average			4	0.081						
Total							**107,548,295**	**2,047**	**21,691**	**547**
CLFLWD Major Subwatershed Total Acres							13,732			
Total TP/TSS (lb/ac/yr)									1.58	0.04
Total TP/TSS (kg/ha/yr)									1.77	0.04

*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/09 to 4/3/09 and 11/2/09 to 1/1/10 where estimated based upon base flow

Total phosphorus loading at the Comfort Lake Inlet for 2009 was estimated at 0.04 lb/ac (1,153 lbs.) (Table 25). Compared to the County Line Ditch site, the higher TP load at Big Comfort Inlet is due in large part to the much higher total discharge that occurred at that site and is less likely from nutrient concentrations. However, the overall load is much lower when compared to 2008, again due to the reduction in total flow between the two years.

Comfort Lake Outlet

The station for the Comfort Lake Outlet site recorded flow from April 22-November 2, 2009 (Figure 10). Total flow for this period was 39,131,550 cf or 898 acre/ft. A rain gage was installed at this site in 2009, however it was plugged for the majority of the year. On June 13, 2009, the highest flow was recorded for the monitoring season at 8.57 cfs. The cause of this high flow was not entirely clear. No water quality data was collected at the Comfort Outlet site in 2009 by the WCD, but lake water quality samples were utilized to develop a loading estimate.

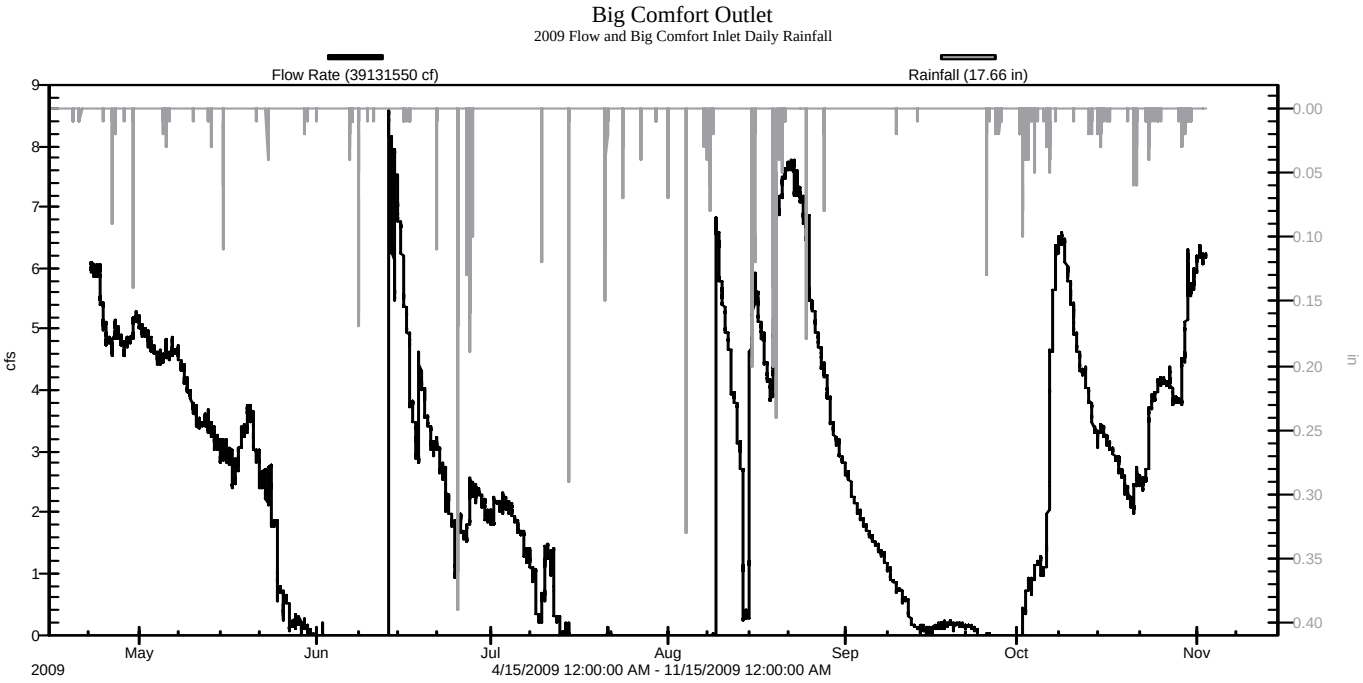


Figure 10. Comfort Lake Outlet 2009 Flow and Big Comfort Inlet Daily Rainfall

Table 26. Comfort Lake Outlet 2009 Total Phosphorus and Total Suspended Solids Loading

	Sample Collection Time				Loading Interval					
Sample Type	**Start**	**End**	**TSS (mg/L)**	**TP (mg/L)**	**Start**	**End**	**Interval Volume (cf)**	**Interval Volume (ac-ft)**	**Interval TSS (lb)**	**Interval TP (lb)**
*Base***			*N/A*	*0.031*	*1/1/09 0:00*	*4/2/09 0:00*	*3,931,200*	*90.30*	*N/A*	*7.61*
Base Grab**	4/17/09 10:00	4/17/09 10:00	N/A	0.049	4/2/09 0:00	4/22/09 12:15	11,518,650	264.57	N/A	35.23
Base Grab	4/30/09 15:00	4/30/09 15:00	N/A	0.039	4/22/09 12:15	5/5/09 12:15	5,618,137	129.04	N/A	13.68
Base Grab	5/15/09 15:40	5/15/09 15:40	N/A	0.029	5/5/09 12:15	5/25/09 12:15	5,707,787	131.10	N/A	10.33
Base Grab	5/31/09 18:40	5/31/09 18:40	N/A	0.012	5/25/09 12:15	6/5/09 12:15	116,503	2.68	N/A	0.09
Base Grab	6/13/09 16:05	6/13/09 16:05	N/A	0.053	6/5/09 12:15	6/25/09 12:15	4,103,284	94.25	N/A	13.58
Base Grab	6/28/09 16:40	6/28/09 16:40	N/A	0.029	6/25/09 12:15	7/5/09 12:15	1,777,059	40.82	N/A	3.22
Base Grab	7/9/09 16:10	7/9/09 16:10	N/A	0.031	7/5/09 12:15	7/20/09 12:15	675,189	15.51	N/A	1.31
Base Grab	7/22/09 19:20	7/22/09 19:20	N/A	0.026	7/20/09 12:15	8/5/09 12:15	2,889	0.07	N/A	0.00
Base Grab	8/8/09 12:30	8/8/09 12:30	N/A	0.028	8/5/09 12:15	8/14/09 23:15	1,844,207	42.36	N/A	3.22
Storm			*N/A*	*0.031*	*8/14/09 23:15*	*8/17/09 3:15*	*818,757*	*18.81*	*N/A*	*1.58*
Base			*N/A*	*0.031*	*8/17/09 3:15*	*8/19/09 11:15*	*889,495*	*20.43*	*N/A*	*1.72*
Storm Grab	8/23/09 16:05	8/23/09 16:05	N/A	0.019	8/19/09 11:15	8/24/09 19:15	3,332,534	76.54	N/A	3.95
Base Grab	9/4/09 15:00	9/4/09 15:00	N/A	0.021	8/24/09 19:15	9/15/09 19:15	4,080,711	93.73	N/A	5.35
Base Grab	9/18/09 16:50	9/18/09 16:50	N/A	0.028	9/15/09 19:15	10/1/09 16:15	95,587	2.20	N/A	0.17
Storm Grab	10/5/09 15:30	10/5/09 15:30	N/A	0.042	10/1/09 16:15	10/9/09 18:15	2,101,464	48.27	N/A	5.51
Base			*N/A*	*0.031*	*10/9/09 18:15*	*11/2/09 12:15*	*7,967,953*	*183.01*	*N/A*	*15.42*
*Base***			*N/A*	*0.031*	*11/2/09 12:15*	*12/2/09 12:15*	*5,184,000*	*119.07*	*N/A*	*10.03*
*Base***			*N/A*	*0.031*	*12/2/09 12:15*	*1/1/10 0:00*	*1,273,950*	*29.26*	*N/A*	*2.47*
Storm Average			N/A	0.031						
Base Average			N/A	0.031						
All Average			N/A	0.031						
Total							**61,039,355**	**1,402**	**N/A**	**134**
CLFLWD Major Subwatershed Total Acres							24,558			
Total TP/TSS (lb/ac/yr)									N/A	0.005
Total TP/TSS (kg/ha/yr)									N/A	0.006

*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/09 to 4/22/09 and 11/2/09 to 1/1/10 where estimated based upon base flow

Although no samples were collected at the Comfort Lake Outlet site in 2009, the WCD used in-lake concentrations from samples collected by a volunteer to estimate a total phosphorus load at this location. Total phosphorus loading at the Comfort Lake Outlet site and the entire Comfort Lake Forest Lake Watershed was estimated at 0.005 lbs./acre (134 lbs.) (Table 26). TP and TSS are captured in Big Comfort Lake and Little Comfort Lake resulting in lower load amounts leaving the watershed.

4) Watershed Phosphorus Flow Chart

2009 Total Phosphorus Loads and In-Lake Concentrations at Monitored Waters

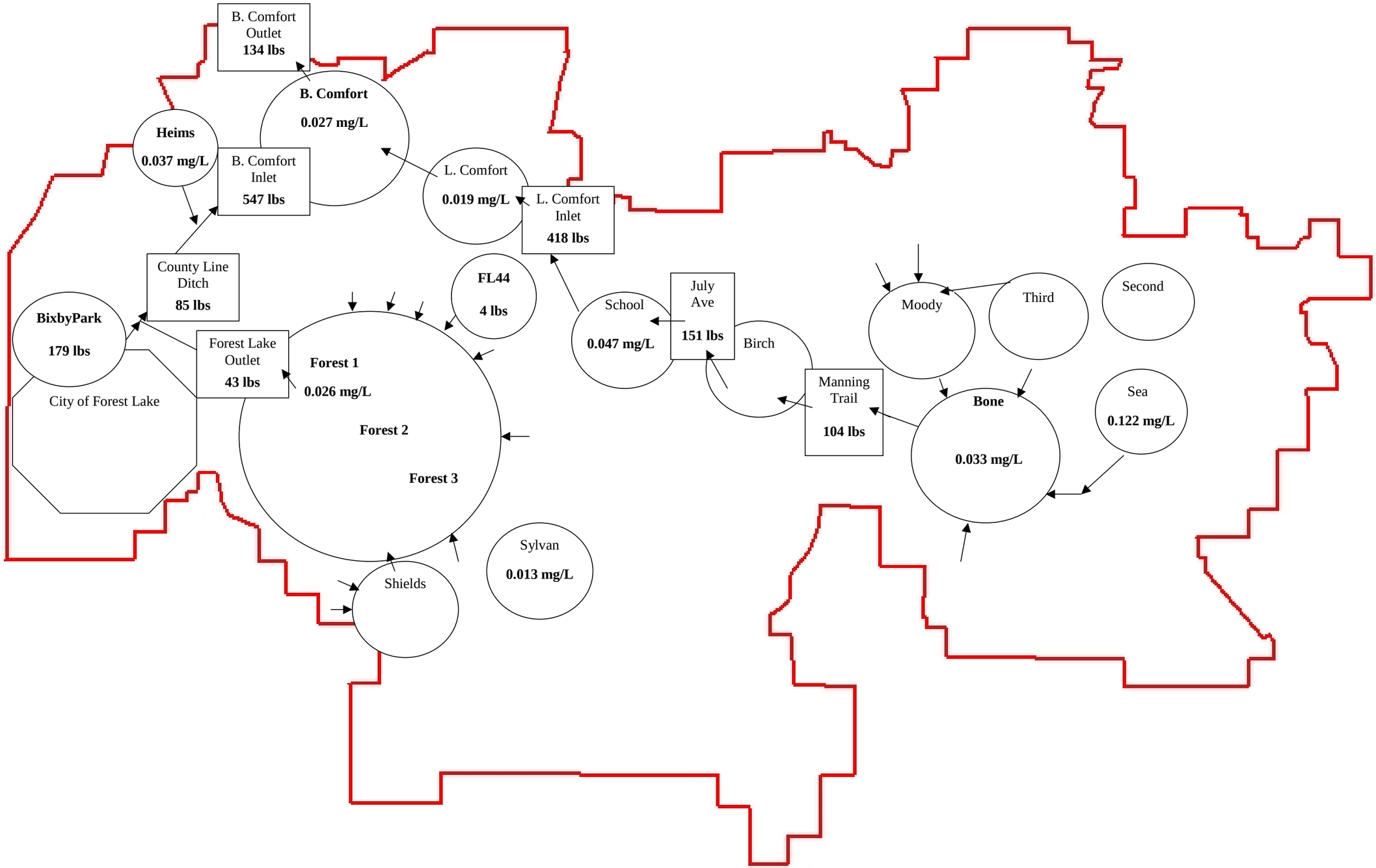


Figure 11. 2009 Watershed Summer Average Lake Phosphorus Concentrations and Total Phosphorus Load Water Quality Flow Chart

5) Historical Stream Loading, Discharge, and E. coli Summary

Table 27. CLFLWD Historical Stream Discharge and Rainfall Summary

			Total Monitored Discharge		Growing Season (June 1-Sept 30) Discharge*		Yearly Estimated Discharge		
Site	Year	Monitoring Season	Cubic Feet	Acre Feet	Cubic Feet	Acre Feet	Cubic Feet	Acre Feet	Monitored Rainfall (inches)
Tributary to Sunrise River at Bone Lake North Inlet	2003	5/27/03-10/30/03	24,899,320	572	23,012,779	528	NA	NA	12.73
Tributary to Sunrise River at Bone Lake North Inlet	2005	3/29/05-11/1/05	10,010,637	230	3,370,684	77	14,075,577	323	20.73
Tributary to Sunrise River at Bone Lake North Inlet	2006	5/1/06-10/25/06	3,384,957	78	1,892,891	43	9,625,678	221	15.67
Tributary to Sunrise River at Bone Lake Outlet	2003	5/27/03-10/30/03	50,260,434	1,154	45,627,921	1,047	NA	NA	12.35
Tributary to Sunrise River at Bone Lake Outlet	2004	3/24/04-11/2/04	59,146,211	1,358	27,081,226	622	66,316,511	1,522	18.03
Tributary to Sunrise River at Bone Lake Outlet	2005	3/29/05-11/1/05	20,545,175	472	7,753,089	178	26,115,815	600	18.27
Tributary to Sunrise River at Bone Lake Outlet	2006	5/1/06-10/30/06	11,915,009	274	6,821,497	157	23,460,532	539	14.08
Tributary to Sunrise River at Bone Lake South Inlet	2005	4/5/05-11/1/05	13,281,086	305	4,581,651	105	23,004,776	528	No Data Available at Site
Tributary to Sunrise River at Bone Lake South Inlet	2006	5/1/06-10/30/06	5,506,279	126	2,278,834	52	15,794,923	363	No Data Available at Site
Tributary to Sunrise River at Shields Outlet/Forest Inlet	2005	4/20/05-11/1/05	17,656,788	405	11,446,896	263	27,638,328	634	19.63
Tributary to Sunrise River at Shields Outlet/Forest Inlet	2006	5/2/06-10/30/06	8,168,305	188	4,119,142	95	17,784,049	408	13.18
Sunrise River at Forest Lake Outlet	2003	5/29/03-10/11/03	139,734,323	3,208	134,712,756	3,093	NA	NA	No Data Available at Site
Sunrise River at Forest Lake Outlet	2004	3/31/04-11/2/04	170,016,264	3,903	93,716,849	2,151	233,100,967	5,351	No Data Available at Site
Sunrise River at Forest Lake Outlet	2005	3/24/05-11/2/05	136,280,894	3,129	59,097,451	1,357	187,748,294	4,310	No Data Available at Site
Sunrise River at Forest Lake Outlet	2006	5/2/06-10/25/06	47,205,184	1,084	21,006,901	482	92,349,949	2,120	No Data Available at Site
Sunrise River at Forest Lake Outlet	2007	3/26/07-10/29/07	95,341,217	2,189	5,378,189	123	128,950,817	2,960	No Data Available at Site
Sunrise River at Forest Lake Outlet	2008	4/3/08-11/3/08	143,048,300	3,284	41,809,187	960	159,233,702	3,656	No Data Available at Site
Sunrise River at Forest Lake Outlet	2009	4/9/09-11/2/09	17,829,967	409	373,155	9	31,187,212	716	No Data Available at Site
Sunrise River at Bixby Park	2009	5/7/09-10/20/09	17,184,353	395	11,602,336	266	22,103,528	507	No Data Available at Site
Sunrise River at County Line Ditch	2007	3/27/07-10/29/07	132,890,500	3,051	13,265,950	305	168,125,270	3,860	20.65
Sunrise River at County Line Ditch	2008	4/3/08-11/4/08	160,415,200	3,683	46,128,347	1,059	167,318,507	3,841	16.85
Sunrise River at County Line Ditch	2009	4/3/09-11/3/09	54,246,123	1,245	15,225,062	350	71,188,173	1,634	17.52
Sunrise River at Greenway Avenue	2008	4/14/08-11/4/08	196,117,700	4,502	64,476,470	1,480	231,516,014	5,315	No Data Available at Site
Tributary to Sunrise River at Manning Trail	2008	4/21/08-11/3/08	37,462,320	860	7,613,182	175	63,196,487	1,451	No Data Available at Site
Tributary to Sunrise River at Manning Trail	2009	4/2/09-11/2/09	7,779,016	179	759,696	17	11,231,268	258	No Data Available at Site
Tributary to Sunrise River at July Avenue	2008	4/17/08-11/3/08	62,892,460	1,444	22,886,998	525	80,937,662	1,858	17.25
Tributary to Sunrise River at July Avenue	2009	4/2/09-11/2/09	19,674,460	452	3,759,027	86	27,127,126	623	17.92
Tributary to Sunrise River at Little Comfort Lake Inlet	2004	5/4/04-11/2/04	102,844,258	2,361	79,549,516	1,826	172,272,256	3,955	19.59
Tributary to Sunrise River at Little Comfort Lake Inlet	2005	3/29/05-11/2/05	113,288,933	2,601	56,782,372	1,304	149,011,733	3,421	21.99
Tributary to Sunrise River at Little Comfort Lake Inlet	2006	5/4/06-10/30/06	68,248,790	1,567	42,677,774	980	131,946,491	3,029	16.89
Tributary to Sunrise River at Little Comfort Lake Inlet	2007	4/26/07-10/30/07	129,682,053	2,977	54,709,030	1,256	173,218,653	3,977	23.65
Tributary to Sunrise River at Little Comfort Lake Inlet	2008	4/22/08-11/3/08	248,125,200	5,696	93,791,250	2,153	360,171,837	8,268	16.35
Tributary to Sunrise River at Little Comfort Lake Inlet	2009	4/9/09-11/2/09	72,160,364	1,657	26,119,773	600	101,219,564	2,324	17.34
Sunrise River at Comfort Lake Inlet	2004	4/5/04-11/2/04	267,300,025	6,136	147,834,005	3,394	422,272,825	9,694	20.97
Sunrise River at Comfort Lake Inlet	2005	3/29/05-11/2/05	200,161,344	4,595	93,498,873	2,146	284,332,944	6,527	22.48
Sunrise River at Comfort Lake Inlet	2006	5/2/06-10/30/06	73,915,488	1,697	40,363,884	927	163,858,477	3,762	18.27
Sunrise River at Comfort Lake Inlet	2007	3/26/07-10/30/07	188,797,829	4,334	39,591,680	909	247,038,494	5,671	22.42
Sunrise River at Comfort Lake Inlet	2008	4/3/08-9/24/08	267,964,800	6,152	109,097,724	2,505	284,321,095	6,527	18.24
Sunrise River at Comfort Lake Inlet	2009	4/3/09-11/2/09	76,931,195	1,766	33,167,079	761	107,548,295	2,469	17.80
Sunrise River at Comfort Lake Outlet	2003	5/29/03-11/3/03	422,830,532	9,707	361,495,072	8,299	NA	NA	13.09
Sunrise River at Comfort Lake Outlet	2004	3/22/04-11/2/04	449,268,511	10,314	249,741,973	5,733	673,985,011	15,473	21.68
Sunrise River at Comfort Lake Outlet	2005	3/24/05-11/2/05	170,267,154	3,909	85,981,864	1,974	201,840,954	4,634	22.32
Sunrise River at Comfort Lake Outlet	2006	5/2/06-10/30/06	98,954,975	2,272	51,812,383	1,189	183,293,248	4,208	18.32
Sunrise River at Comfort Lake Outlet	2007	3/26/07-7/12/07	56,286,780	1,292	NA	NA	NA	NA	21.42
Sunrise River at Comfort Lake Outlet	2008	5/1/08-11/3/08	229,578,200	5,270	73,273,609	1,682	254,442,469	5,841	16.53
Sunrise River at Comfort Lake Outlet	2009	4/22/09-11/2/09	39,131,555	898	17,619,711	404	61,039,355	1,401	No Data Available at Site

*Growing season discharge and loads are estimated using quantities just previous to and including June 1, and just post and including Sept 30.

Table 28. CLFLWD Historical Loading and Rainfall Summary

			Total Monitored Load		Growing Season (June 1-Sept 30) Load*		Total Yearly Estimated Load		
Site	Year	Monitoring Season	TP (lbs.)	TSS (lbs.)	TP (lbs.)	TSS (lbs.)	TP (lbs.)	TSS (lbs.)	Monitored Rainfall (inches)
Tributary to Sunrise River at Bone Lake North Inlet	2003	5/27/03-10/30/03	724	127,509	654	129,443	NA	NA	12.73
Tributary to Sunrise River at Bone Lake North Inlet	2005	3/29/05-11/1/05	174	23,675	89	14,745	226	24,817	20.73
Tributary to Sunrise River at Bone Lake North Inlet	2006	5/1/06-10/25/06	133	1,913	74	1,085	315	5,225	15.67
Tributary to Sunrise River at Bone Lake Outlet	2003	5/27/03-10/30/03	323	72,438	297	66,763	NA	NA	12.35
Tributary to Sunrise River at Bone Lake Outlet	2004	3/24/04-11/2/04	311	32,963	146	14,138	339	35,283	18.03
Tributary to Sunrise River at Bone Lake Outlet	2005	3/29/05-11/1/05	80	36,608	36	30,343	97	38,776	18.27
Tributary to Sunrise River at Bone Lake Outlet	2006	5/1/06-10/30/06	25	1,716	14	1,018	49	3,158	14.08
Tributary to Sunrise River at Bone Lake South Inlet	2005	4/5/05-11/1/05	186	39,562	117	34,695	231	41,383	No Data Available at Site
Tributary to Sunrise River at Bone Lake South Inlet	2006	5/1/06-10/30/06	142	8,223	71	4,734	229	14,324	No Data Available at Site
Tributary to Sunrise River at Shields Outlet/Forest Inlet	2005	4/20/05-11/1/05	420	79,186	237	19,188	420	79,186	19.63
Tributary to Sunrise River at Shields Outlet/Forest Inlet	2006	5/2/06-10/30/06	161	6,218	92	3,372	332	8,620	13.18
Sunrise River at Forest Lake Outlet	2003	5/29/03-10/11/03	553	209,842	551	209,614	NA	NA	No Data Available at Site
Sunrise River at Forest Lake Outlet	2004	3/31/04-11/2/04	1,050	152,505	598	107,761	1,235	167,533	No Data Available at Site
Sunrise River at Forest Lake Outlet	2005	3/24/05-11/2/05	346	66,240	141	27,981	457	83,383	No Data Available at Site
Sunrise River at Forest Lake Outlet	2006	5/2/06-10/25/06	98	12,992	41	5,738	173	24,263	No Data Available at Site
Sunrise River at Forest Lake Outlet	2007	3/26/07-10/29/07	132	NA	8	NA	253	NA	No Data Available at Site
Sunrise River at Forest Lake Outlet	2008	4/3/08-11/3/08	315	NA	81	NA	341	NA	No Data Available at Site
Sunrise River at Forest Lake Outlet	2009	4/9/09-11/2/09	22	NA	1	NA	43	NA	No Data Available at Site
Sunrise River at Bixby Park	2009	5/7/09-10/20/09	140	7,166	103	5,212	179	9,317	No Data Available at Site
Sunrise River at County Line Ditch	2007	3/27/07-10/29/07	1,131	105,867	420	35,317	1,212	109,981	20.65
Sunrise River at County Line Ditch	2008	4/3/08-11/4/08	626	141,709	216	67,304	650	144,481	16.85
Sunrise River at County Line Ditch	2009	4/3/09-11/3/09	78	4,917	45	2,364	85	5,403	17.52
Sunrise River at Greenway Avenue	2008	4/14/08-11/4/08	1,352	676,044	499	233,541	1,505	696,004	No Data Available at Site
Tributary to Sunrise River at Manning Trail	2008	4/21/08-11/3/08	355	4,159	41	1,232	508	7,421	No Data Available at Site
Tributary to Sunrise River at Manning Trail	2009	4/2/09-11/2/09	68	2,659	7	265	104	3,718	No Data Available at Site
Tributary to Sunrise River at July Avenue	2008	4/17/08-11/3/08	297	9,556	146	5,316	431	14,137	17.25
Tributary to Sunrise River at July Avenue	2009	4/2/09-11/2/09	101	6,907	23	1,295	151	9,112	17.92
Tributary to Sunrise River at Little Comfort Lake Inlet	2004	5/4/04-11/2/04	785	499,570	584	474,947	1,283	1,220,397	19.59
Tributary to Sunrise River at Little Comfort Lake Inlet	2005	3/29/05-11/2/05	748	365,776	461	211,373	1,023	697,890	21.99
Tributary to Sunrise River at Little Comfort Lake Inlet	2006	5/4/06-10/30/06	1,079	517,829	834	411,398	1,551	643,540	16.89
Tributary to Sunrise River at Little Comfort Lake Inlet	2007	4/26/07-10/30/07	527	35,733	202	13,620	676	43,113	23.65
Tributary to Sunrise River at Little Comfort Lake Inlet	2008	4/22/08-11/3/08	743	72,821	256	23,369	1,127	94,344	16.35
Tributary to Sunrise River at Little Comfort Lake Inlet	2009	4/9/09-11/2/09	306	26,565	119	12,439	418	34,444	17.34
Sunrise River at Comfort Lake Inlet	2004	4/5/04-11/2/04	1,414	353,891	899	255,626	1,963	403,759	20.97
Sunrise River at Comfort Lake Inlet	2005	3/29/05-11/2/05	900	111,027	392	33,117	1,119	125,039	22.48
Sunrise River at Comfort Lake Inlet	2006	5/2/06-10/30/06	1,443	105,433	913	52,781	1,887	175,089	18.27
Sunrise River at Comfort Lake Inlet	2007	3/26/07-10/30/07	782	53,763	242	15,064	997	63,755	22.42
Sunrise River at Comfort Lake Inlet	2008	4/3/08-9/24/08	1,105	189,523	482	85,171	1,153	196,267	18.24
Sunrise River at Comfort Lake Inlet	2009	4/3/09-11/2/09	375	15,755	155	7,325	547	21,691	17.80
Sunrise River at Comfort Lake Outlet	2003	5/29/03-11/3/03	1,445	301,964	1,308	285,063	NA	NA	13.09
Sunrise River at Comfort Lake Outlet	2004	3/22/04-11/2/04	1,736	535,972	1,076	401,584	2,065	566,195	21.68
Sunrise River at Comfort Lake Outlet	2005	3/24/05-11/2/05	603	243,997	326	153,936	670	251,622	22.32
Sunrise River at Comfort Lake Outlet	2006	5/2/06-10/30/06	246	32,873	122	16,097	563	60,519	18.32
Sunrise River at Comfort Lake Outlet	2007	3/26/07-7/12/07	NA	NA	NA	NA	NA	NA	21.42
Sunrise River at Comfort Lake Outlet	2008	5/1/08-11/3/08	267	56,806	99	21,762	291	62,469	16.53
Sunrise River at Comfort Lake Outlet	2009	4/22/09-11/2/09	79	NA	34	NA	134	NA	No Data Available at Site

*Growing season discharge and loads include quantities estimated from just previous to and including June 1, and just post and including Sept 30.

E. coli

The Minnesota Pollution Control Agency has set water quality standards for Class 2 Waters of the State for aquatic life and recreation (https://www.revisor.mn.gov/rules/?id=7050.0222). The following is the description for the Escherichia (E.) coli standard:

> "Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31."

Monthly Geometric Means for E. coli (#/100 mL)

Site	April	May	June	July	August	September	October
Bone Lake North Inlet	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Bone Lake South Inlet	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Bone Lake Outlet	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Shields Outlet/Forest Inlet	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Forest Lake Outlet	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Bixby Park	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
County Line Ditch	Insufficient Data	Insufficient Data	110	129	228	Insufficient Data	Insufficient Data
Greenway Avenue	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Manning Trail	Insufficient Data	Insufficient Data	99	152	415	Insufficient Data	Insufficient Data
July Avenue	Insufficient Data	Insufficient Data	21	56	208	Insufficient Data	Insufficient Data
Little Comfort Inlet	Insufficient Data	Insufficient Data	67	160	236	Insufficient Data	Insufficient Data
Big Comfort Lake Inlet	Insufficient Data	Insufficient Data	176	150	252	Insufficient Data	Insufficient Data
Big Comfort Lake Outlet	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data

Exceeds geometric mean of 126 #/100mL from not less than 5 samples in a calendar month

10% of samples taken in a calendar month exceed 1260 #/100mL (Doesn't necessarily exceed geometric mean standard)

Site	Date	Fecal Coliform (#/100ml)	E. Coli (#/100ml)
Bone Lake North Inlet	7/22/2003 9:40	110	69
	9/11/2003 8:45	2600	1638
	10/7/2003 10:15	70	44
	10/28/2003 8:25	45	28
	5/5/2005 8:15	42	26
	7/13/2005 10:30	610	384
	10/19/2005 11:00	60	38
	6/14/2006 10:20		32
	8/10/2006 8:45		411
	9/6/2006 8:45		238
Bone Lake South Inlet	5/5/2005 8:30	20	13
	7/13/2005 10:45	900	567
	10/19/2005 10:45	150	95
	6/14/2006 10:30		345
	8/10/2006 8:30		96
	9/6/2006 8:15		250
	10/10/2006 10:00		115
Bone Lake Outlet	7/22/2003 9:20	<1	<1
	9/11/2003 8:55	420	265
	6/8/2004 10:00	5	3
	7/15/2004 10:00	3	2
	8/12/2004 9:15	220	139
	5/5/2005 8:15	2	1
	7/13/2005 10:30	<1	<1
	10/19/2005 11:00	3	2
	6/14/2006 10:25		1
	7/24/2006 10:30		727
	8/10/2006 8:50		26
	9/6/2006 8:30		33
Shields Outlet/Forest Inle	5/5/2005 8:15	43	27
	7/13/2005 9:15	190	120
	10/19/2005 9:30	22	14
	6/14/2006 9:15		66
	10/10/2006 9:00		59
Forest Lake Outlet	7/22/2003 10:25	20	13
	6/8/2004 8:45	5	3
	7/15/2004 8:45	29	18
	5/5/2005 8:30	93	59
	7/13/2005 9:30	200	126
	10/19/2005 9:45	30	19
	6/14/2006 9:30		10
	8/10/2006 9:15		44
	9/6/2006 9:30		13

Site	Date	Fecal Coliform (#/100ml)	E. Coli (#/100ml)
County Line Ditch	5/2/2007 10:45		22
	6/13/2007 10:02		186
	7/16/2007 10:37		>2420
	10/18/2007 10:23		328
	6/5/2008 9:55		20
	6/12/2008 8:46		1300
	6/19/2008 8:50		28
	6/26/2008 10:15		18
	6/30/2008 9:07		34
	7/7/2008 9:45		66
	7/14/2008 9:45		45
	7/17/2008 7:22		162
	7/24/2008 8:25		140
	7/31/2008 10:00		129
	8/4/2008 9:20		131
	8/7/2008 8:30		142
	8/14/2008 8:43		218
	8/21/2008 9:25		210
	8/27/2008 9:50		>2420
	5/28/2009 9:30		1120
	6/25/2009 8:30		>2420
	7/29/2009 8:37		29
	8/27/2009 10:15		68
	9/30/2009 8:56		44
Greenway Avenue	6/5/2008 9:50		31
	6/26/2008 10:00		126
	7/17/2008 7:38		147
	8/7/2008 8:45		326
	8/27/2008 9:40		104
Manning Trail	6/5/2008 9:15		249
	6/12/2008 9:52		417
	6/19/2008 9:35		71
	6/26/2008 9:15		41
	6/30/2008 10:08		26
	7/7/2008 8:50		102
	7/14/2008 10:03		118
	7/17/2008 8:21		214
	7/24/2008 9:16		115
	7/31/2008 8:30		272
	8/4/2008 8:30		88
	8/7/2008 9:30		195
	8/14/2008 9:47		205
	8/21/2008 8:30		248
	8/27/2008 8:50		>2420
	5/28/2009 8:45		58
	6/10/2009 8:10		119
	8/26/2009 8:00		>2420
July Avenue	6/5/2008 9:18		23
	6/12/2008 9:37		52
	6/19/2008 9:25		10
	6/26/2008 9:20		15
	6/30/2008 9:56		12
	7/7/2008 9:05		11
	7/14/2008 9:10		19
	7/17/2008 8:12		125
	7/24/2008 9:04		56
	7/31/2008 9:00		38
	8/4/2008 8:45		46
	8/7/2008 9:20		88
	8/14/2008 9:36		144
	8/21/2008 8:45		411
	8/27/2008 9:00		980
	5/28/2009 9:00		126
	6/10/2009 8:20		37
	7/28/2009 8:00		579
	8/26/2009 8:11		345

Site	Date	Fecal Coliform (#/100ml)	E. Coli (#/100ml)
Little Comfort Inlet	6/8/2004 9:45	26	16
	7/15/2004 9:45	26	16
	8/12/2004 9:00	310	195
	9/27/2004 10:00	200	126
	5/5/2005 9:00	7	4
	7/13/2005 10:00	110	69
	10/19/2005 10:30	33	21
	6/14/2006 10:05		108
	7/24/2006 10:15		214
	8/10/2006 8:45		461
	9/6/2006 9:00		166
	10/10/2006 9:40		101
	5/2/2007 11:10		30
	6/13/2007 9:28		109
	7/16/2007 10:10		147
	10/18/2007 9:32		41
	6/5/2008 9:30		38
	6/12/2008 9:27		148
	6/19/2008 9:15		31
	6/26/2008 9:35		63
	6/30/2008 9:45		23
	7/7/2008 9:20		72
	7/14/2008 9:20		225
	7/17/2008 8:01		1733
	7/24/2008 8:53		365
	7/31/2008 9:15		145
	8/4/2008 9:00		261
	8/7/2008 9:10		687
	8/14/2008 9:22		172
	8/21/2008 9:00		56
	8/27/2008 9:15		261
	6/10/2009 8:30		548
	7/28/2009 8:10		201
Big Comfort Lake Inlet	6/8/2004 9:00	30	19
	7/15/2004 9:15	80	50
	8/12/2004 8:30	280	176
	9/27/2004 9:30	35	22
	5/5/2005 8:45	480	302
	7/13/2005 9:45	250	158
	8/25/2005 8:45	690	435
	10/19/2005 10:00	50	32
	6/14/2006 9:45		128
	7/24/2006 9:45		387
	8/10/2006 9:00		291
	9/6/2006 10:00		261
	5/2/2007 11:00		31
	6/13/2007 9:43		115
	7/16/2007 10:23		127
	10/18/2007 9:48		649
	6/5/2008 10:35		86
	6/12/2008 9:07		365
	6/19/2008 9:00		150
	6/26/2008 9:45		249
	6/30/2008 9:28		206
	7/7/2009 9:30		115
	7/14/2008 10:00		160
	7/17/2008 7:50		238
	7/24/2008 8:40		172
	7/31/2008 9:30		167
	8/7/2008 9:00		649
	8/11/2008 9:30		179
	8/14/2008 9:08		387
	8/21/2008 9:10		150
	8/27/2008 9:25		326
	5/28/2009 9:15		41
	6/25/2009 9:00		>2420
	7/29/2009 8:54		118
	8/27/2009 10:25		84
	9/30/2009 9:13		152
Big Comfort Lake Outlet	7/22/2003 10:00	4	3
	9/11/2003 8:25	54	34
	10/7/2003 10:00	20	13
	10/28/2003 8:10	4	3
	6/8/2004 9:15	10	6
	7/15/2004 9:30	10	6
	8/12/2004 8:45	51	32
	9/27/2004 9:45	22	14
	5/5/2005 8:45	4	3
	7/13/2005 10:00	22	14
	10/19/2005 10:15	10	6
	6/14/2006 9:55		42
	7/24/2006 10:00		111
	8/10/2006 9:00		17
	9/6/2006 9:15		18
	10/10/2006 9:20		10

Site	Date	Fecal Coliform (#/100ml)	E. Coli (#/100ml)
Bixy Park	6/16/2009 9:15		7
	6/23/2009 8:15		30
	6/30/2009 9:09		63
	7/15/2009 8:54		>2420
	7/21/2009 8:45		>2420
	7/28/2009 8:00		579
	8/11/2009 8:30		43
	8/18/2009 8:30		41
	8/26/2009 8:34		192

Note: When fecal coliform samples were collected, results were converted to equivalent E. coli values.

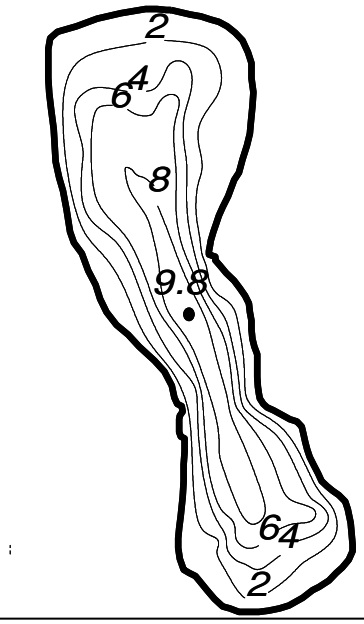
6) Appendices and References

Appendix A – Individual Lake Summaries
References

Bone Lake

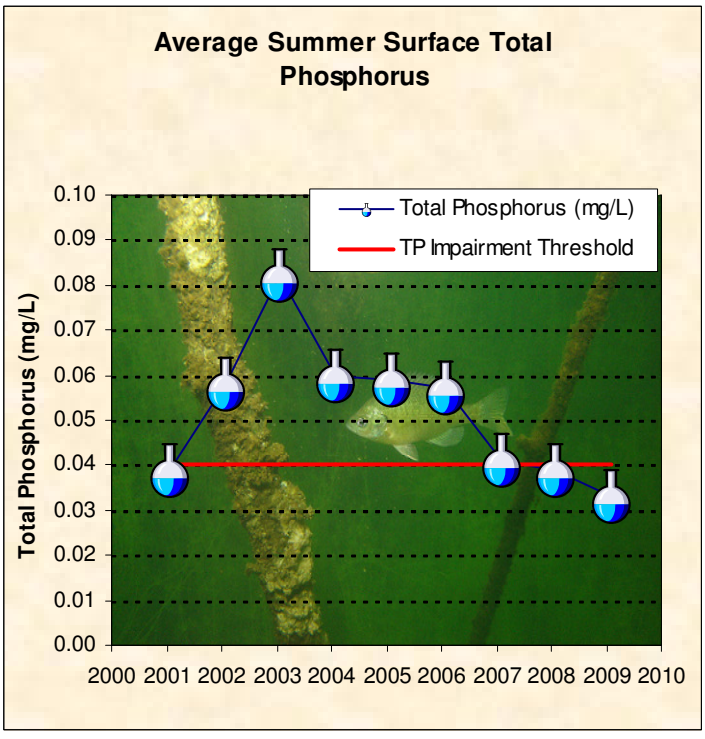
2009 Lake Grade: C+

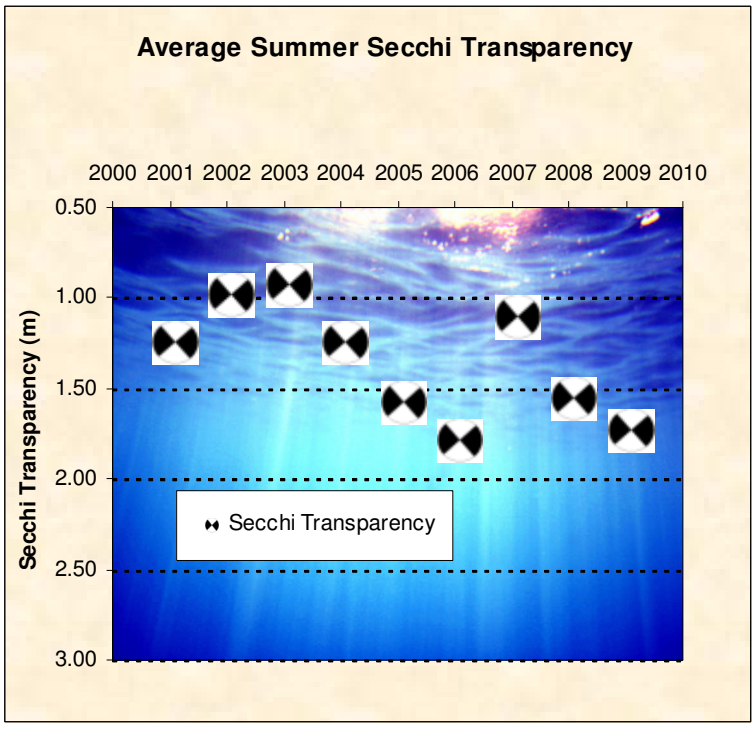
- DNR ID #: 820054
- Municipality: City of Scandia
- Location: Section 5 T32N-R20W
- Lake Size: 210 Acres
- Maximum Depth: 32 ft
- Ordinary High Water Mark: 909.1 ft
- 58% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.



Summary Points

- Bone Lake was considered a eutrophic lake in 2009, based on the Carlson Trophic State Index (similar to 2006-2008).
- Bone Lake's summer phosphorus mean was lower than that experienced in 2003-2008.
- **Bone Lake is listed on the MPCA's Impaired Waters List for excessive nutrients.**
- **Eurasian Milfoil and Curly leaf pondweed (invasive aquatic plants) are extensive in this lake.**
- The major land use is rural/agricultural.
- The lake does stratify throughout the summer months.





Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
5/11/09	0.097	6.3	1.4	2.4
5/18/09	0.044	14	1.3	2
5/28/09	0.031	27	1.2	1.7
6/9/09	0.04	10	1.5	1.8
6/15/09	0.033	7.7	1.2	2
6/20/09	0.036	5.4	1.2	2.1
7/1/09	0.031	8.2	1.3	3.5
7/19/09	0.031	14	0.96	1.2
8/2/09	0.036	17	0.98	1.2
9/6/09	0.036	73	1.4	1.1
9/15/09	0.03	11	1.3	1.3
9/26/09	0.028	6.4	0.96	1.4
2009 Summer Average	0.033	16.967	1.200	1.733

Water Quality threshold is 0.04 mg/L TP or higher*

Shallow Lake water quality threshold is 0.06 mg/L or higher*

	High	High Date	Low	Low Date	Average
2009 Elevation (ft)	NA	NA	NA	NA	NA

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP, chlorophyll-a, and Secchi disk data and provide a basis for evaluating their interrelationships and hence the trophic status of the lake."

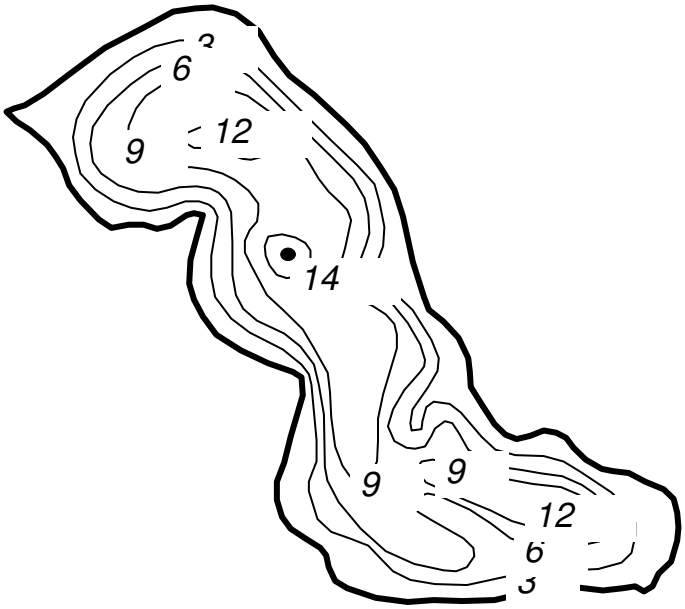
Lake Water Quality Summary

	Trophic Status	Lake Grades									
	2009	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Eutrophic	C	C	C	C	C	C	D	C	C	C
Chlorophyll-*a* (ug/l)	Eutrophic	B	B	B	B	C+	C	C	C	C	C
Secchi depth (ft)	Eutrophic	C	C	C	C	C	C	C	C	B	C
Overall	Eutrophic	C+	C+	C+	C+	C	C	C-	C	C+	C

Comfort Lake

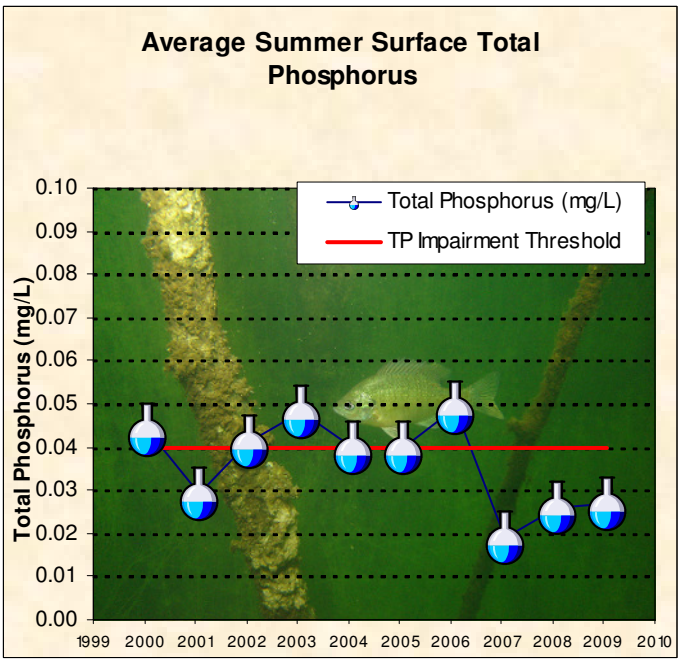
2009 Lake Grade: B

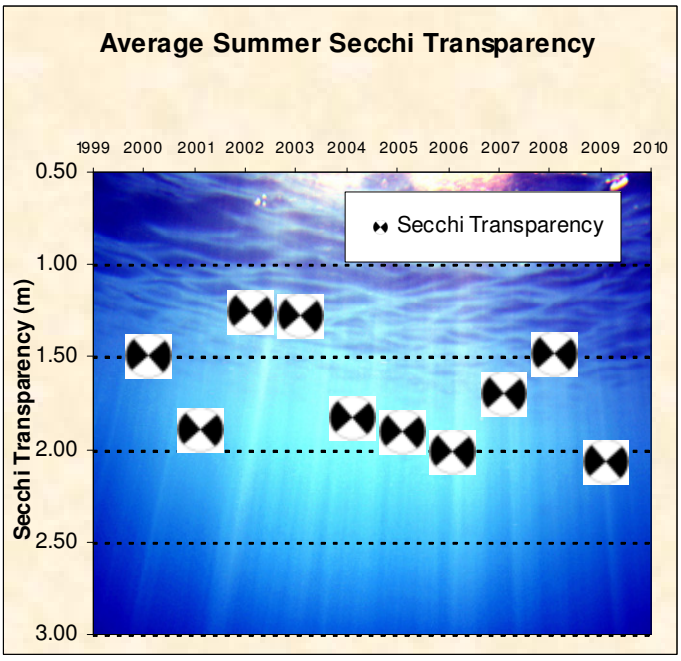
- DNR ID #: 130053
- Municipality: City of Wyoming
- Location: Section 27 T33N-R21W
- Lake Size: 218 Acres
- Maximum Depth: 47 ft
- Ordinary High Water Mark: 887.2 ft
- 41% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.



Summary Points

- Comfort Lake was considered a mesotrophic lake in 2009, based on the Carlson Trophic State Index (similar to that experienced in 2007-2008 and better than 2002-2006).
- **Comfort Lake is listed on the MPCA's Impaired Waters List for excessive nutrients.**
- **Curly leaf pondweed (an invasive aquatic plant) is extensive in this lake.**
- Comfort Lake experienced its 3rd best monitored overall water quality to date.
- The major land use is a mix of semi-urban, rural, and agricultural.
- The lake does stratify throughout the summer months.





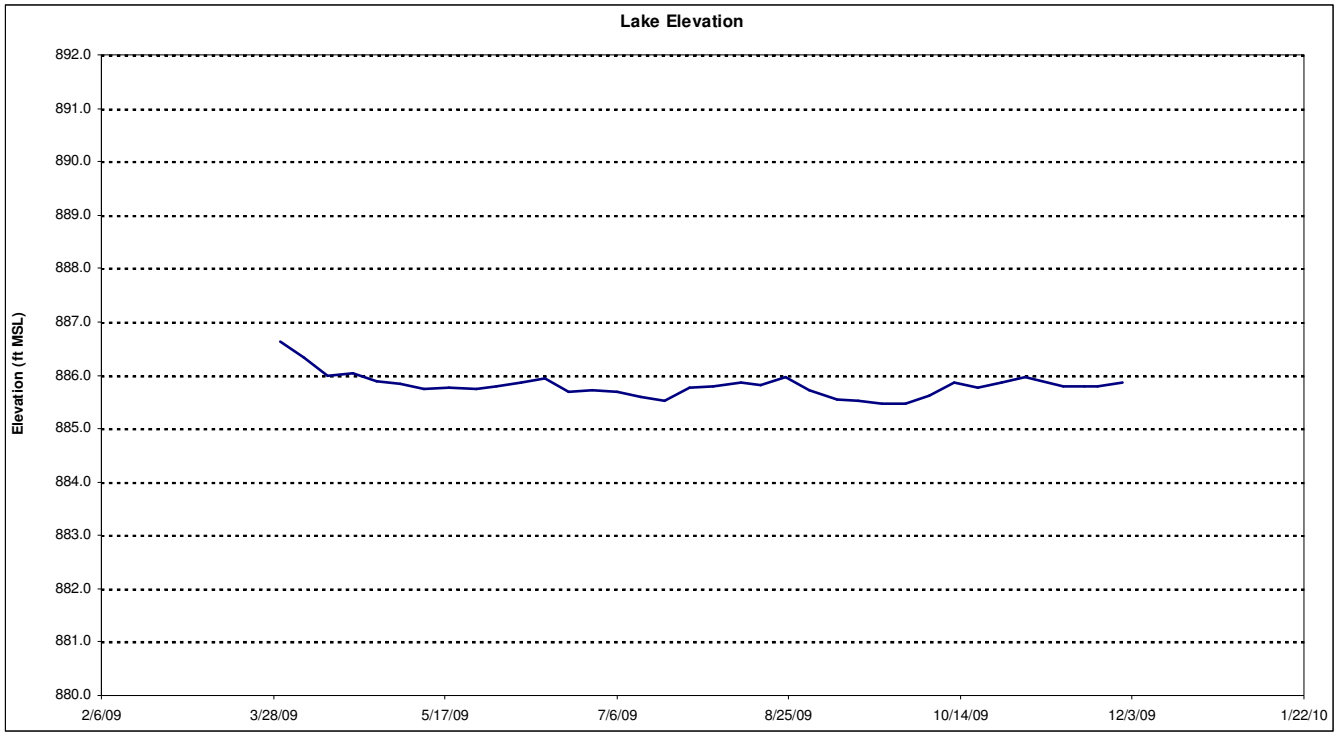
Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
4/17/09	0.049	26	1.3	1.3
4/30/09	0.039	10	1.3	1.7
5/15/09	0.029	11	1.1	2.2
5/31/09	0.012	3.9	0.72	2.2
6/13/09	0.053	11	1.4	2.3
6/28/09	0.029	8.3	0.97	2.3
7/9/09	0.031	8	0.82	1.9
7/22/09	0.026	5.5	0.91	2.5
8/8/09	0.028	18	0.68	2.35
8/23/09	0.019	16	0.92	
9/4/09	0.021	21	1	1.5
9/18/09	0.028	15	1.1	1.5
10/5/09	0.042	17	1.4	1.7
2009 Summer Average	0.027	11.856	0.947	2.069

Water Quality threshold is 0.04 mg/L TP or higher*

Shallow Lake water quality threshold is 0.06 mg/L or higher*

	High	High Date	Low	Low Date	Average
2009 Elevation (ft)	886.34	4/6/2009	885.47	9/28/2009	885.78

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP, chlorophyll-a, and Secchi disk data and provide a basis for evaluating their interrelationships and hence the trophic status of the lake."



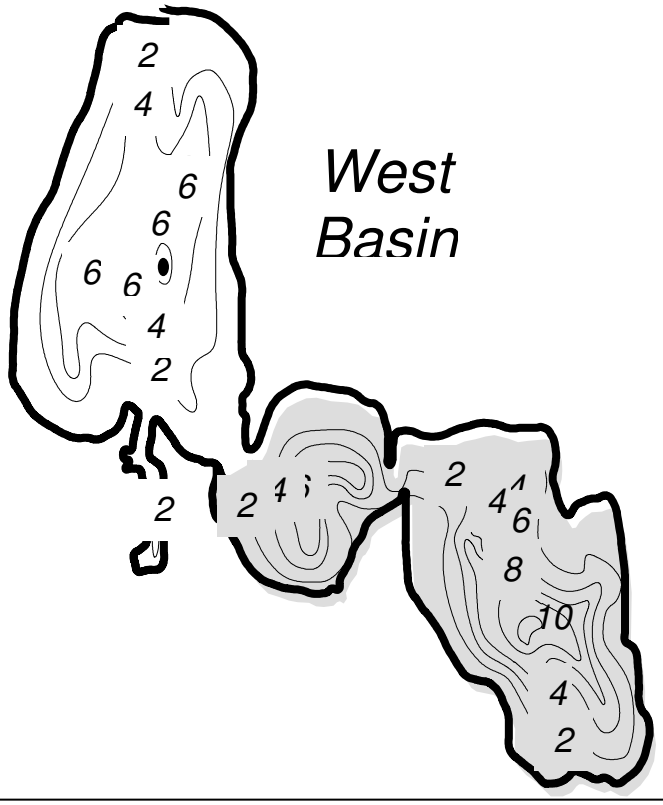
Lake Water Quality Summary

	Trophic Status	Lake Grades									
	2009	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Mesotrophic	B	B	A	C	C	C	C	C	B	C
Chlorophyll-*a* (ug/l)	Eutrophic	B	A	A	B	B	B	C	C	B	C
Secchi depth (ft)	Mesotrophic	C	C	C	C	C	C	C	C	C	C
Overall	Mesotrophic	B	B	B+	C+	C+	C+	C	C	B	C

Forest Lake- Western Basin

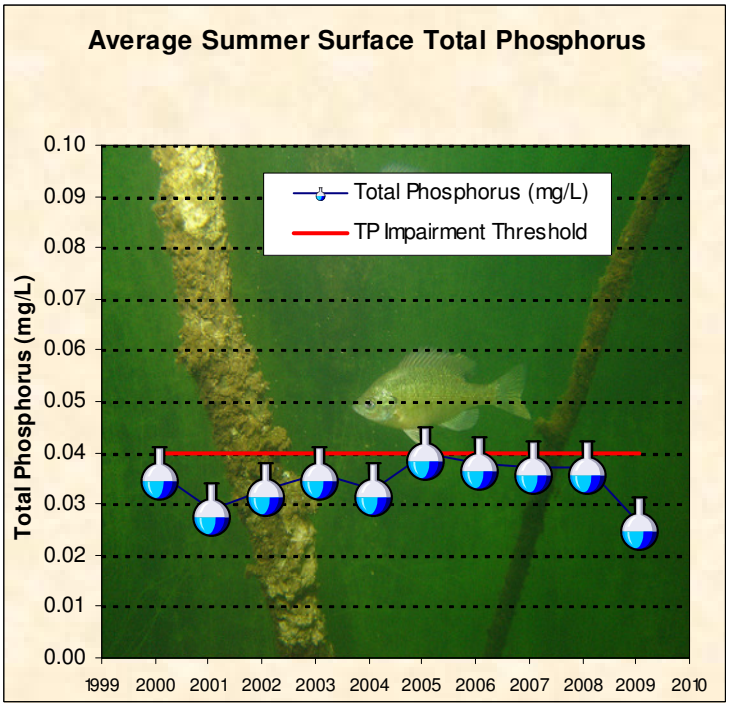
2009 Lake Grade: B

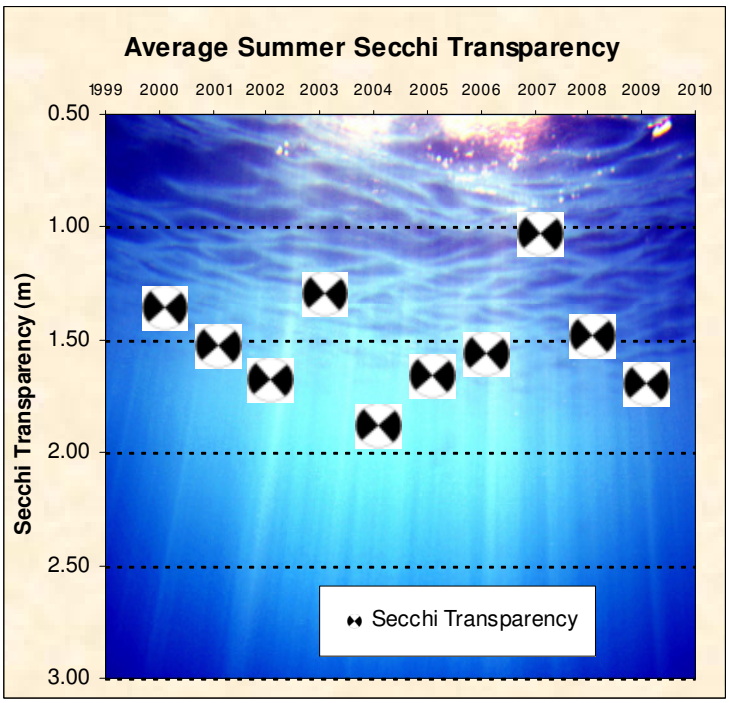
- DNR ID #: 820159
- Municipality: City of Forest Lake
- Location: Section 9 T32N-R21W
- Lake Size: 2,251 Acres
- Maximum Depth: 37 ft
- Ordinary High Water Mark: 901.8 ft
- 67% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.



Summary Points

- Forest Lake was considered a mesotrophic lake in 2009, based on the Carlson Trophic State Index.
- Forest Lake is not listed as impaired for excessive nutrients.
- **Curly leaf pondweed (an invasive aquatic plant) is present in this lake.**
- Forest Lake has a healthy diverse aquatic plant population.
- The major land use is semi-urban and rural/agricultural.
- The lake does stratify throughout the summer months.
- The 2009 Secchi transparency summer means for the middle and eastern basns of Forest Lake were 2.5 and 2.2 meters, respectively





Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
4/19/09	0.023	3	0.63	2.7
5/3/09	0.01	3.4	0.62	3
5/11/09	0.022	2.9	0.57	3
5/31/09	0.019	3.4	0.58	3
6/12/09	0.013	3.8	0.7	2.4
7/2/09	0.023	9.1	0.71	1.3
7/13/09	0.025	8.1	0.91	1.4
7/29/09	0.035	9.7	0.92	1.6
8/14/09	0.035	17	0.84	1.6
8/30/09	0.03	20	0.82	1.5
9/9/09	0.022	9.8	0.79	1.6
9/20/09	0.023	12	0.84	1.5
9/30/09	0.037	19	0.86	1
10/11/09	0.018	12	0.63	1.8
2009 Summer Average	0.026	11.190	0.797	1.690

Water Quality threshold is 0.04 mg/L TP or higher*

Shallow Lake water quality threshold is 0.06 mg/L or higher*

	High	High Date	Low	Low Date	Average
2009 Elevation (ft)	901.68	4/23/2008	900.83	9/13/2008	901.3

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP,

Lake Water Quality Summary

	Trophic Status	Lake Grades									
	2009	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Mesotrophic	B	C	C	C	C	C+	B	C	B	C
Chlorophyll-*a* (ug/l)	Mesotrophic	B+	B	C	B	C+	A-	B	B	B	B
Secchi depth (ft)	Eutrophic	C	C	C	C	C	B	C	C	C	C
Overall	Mesotrophic	B	C+	C	C+	C	B	B-	C+	B-	C+

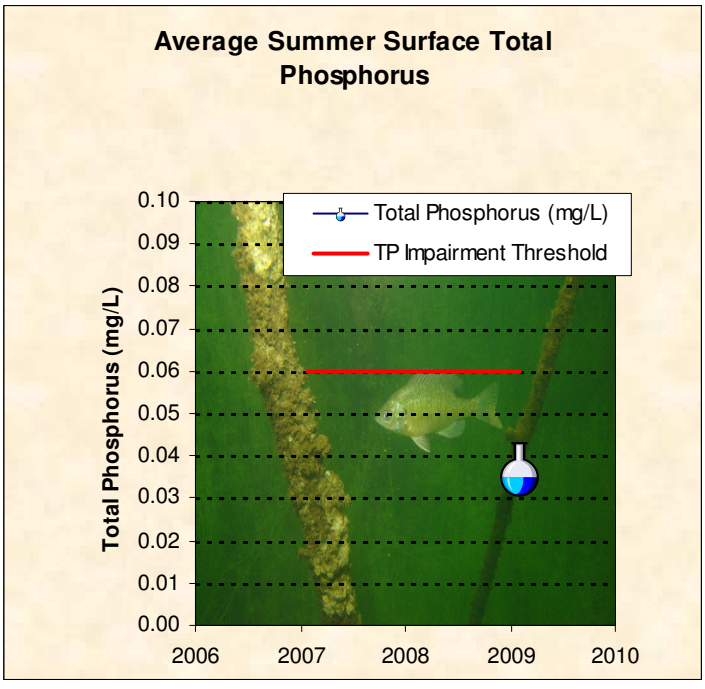
Heims Lake

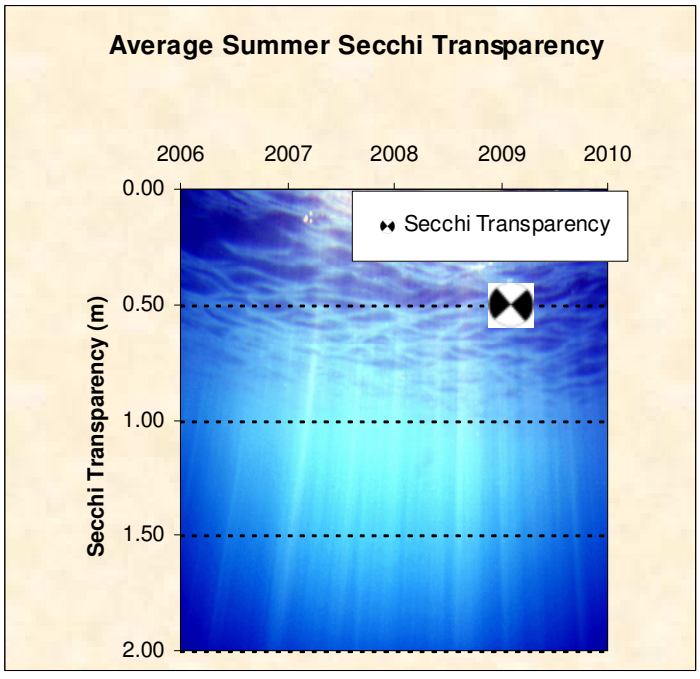
2009 Lake Grade: C

- DNR ID #: 130056
- Municipality: City of Wyoming
- Location: Section 29 T33N-R21W
- Lake Size: 90 Acres
- Maximum Depth: < 15 ft
- 100% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.

Summary Points

- 2009 was the first year in which Heims Lake has been monitored
- Heims Lake was considered a eutrophic lake in 2009, based on the Carlson Trophic State Index.
- The lake's Secchi transparency grade was limited by the shallowness of the lake rather than algae or suspended sediments. Readings were often inhibited by weeds.
- The major land use is rural/agricultural.
- The lake does not stay stratified throughout the summer months.





Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
5/27/09	0.082	22	2.1	0.4
6/10/09	0.044	13	1.8	0.3
6/27/09	0.057	82	1.9	0.4
7/12/09	0.034	3.4	1.5	0.45
7/16/09	0.029	5.1	1.5	0.5
7/24/09	0.032	3	1.8	0.5
8/9/09	0.06	26	2.1	0.6
8/23/09	0.024	4.8	1.2	0.7
9/2/09	0.026	4.9	1	0.6
9/20/09	0.026	4.8	1.2	0.5
2009 Summer Average	0.037	16.333	1.556	0.506
Water Quality threshold is 0.04 mg/L TP or higher*				
Shallow Lake water quality threshold is 0.06 mg/L or higher*				

	High	High Date	Low	Low Date	Average
2009 Elevation (ft)	NA	NA	NA	NA	NA

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP, chlorophyll-a, and Secchi disk data and provide a basis for evaluating their interrelationships and hence the trophic status of the lake."

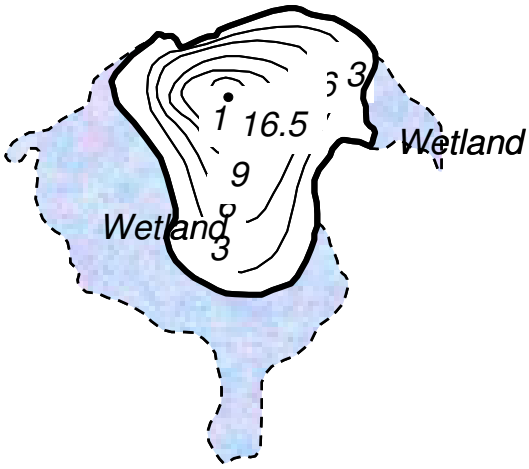
Lake Water Quality Summary

	Trophic Status	Lake Grades									
	2008	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Eutrophic	C									
Chlorophyll-*a* (ug/l)	Eutrophic	B									
Secchi depth (ft)	Hypereutrophic	F									
Overall	Eutrophic	C									

Little Comfort Lake

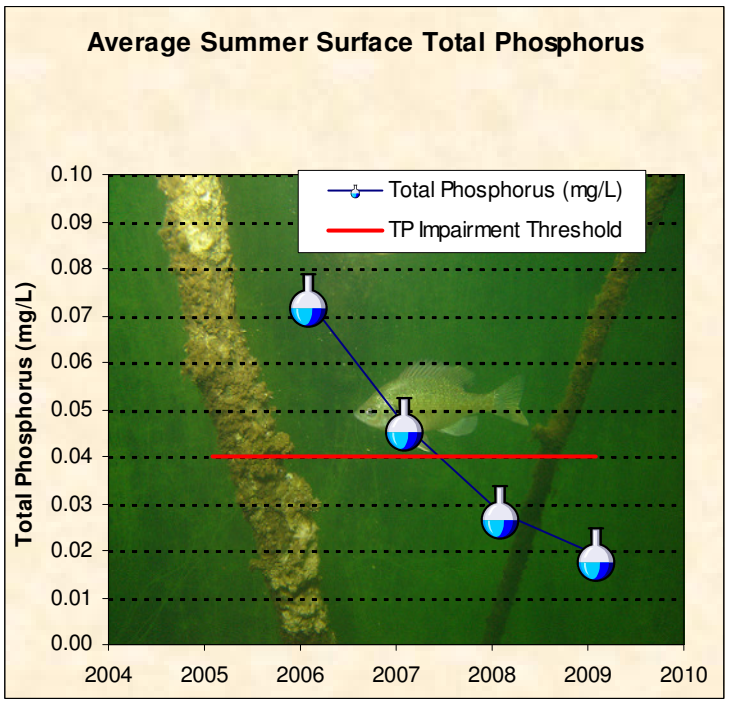
2009 Lake Grade: B+

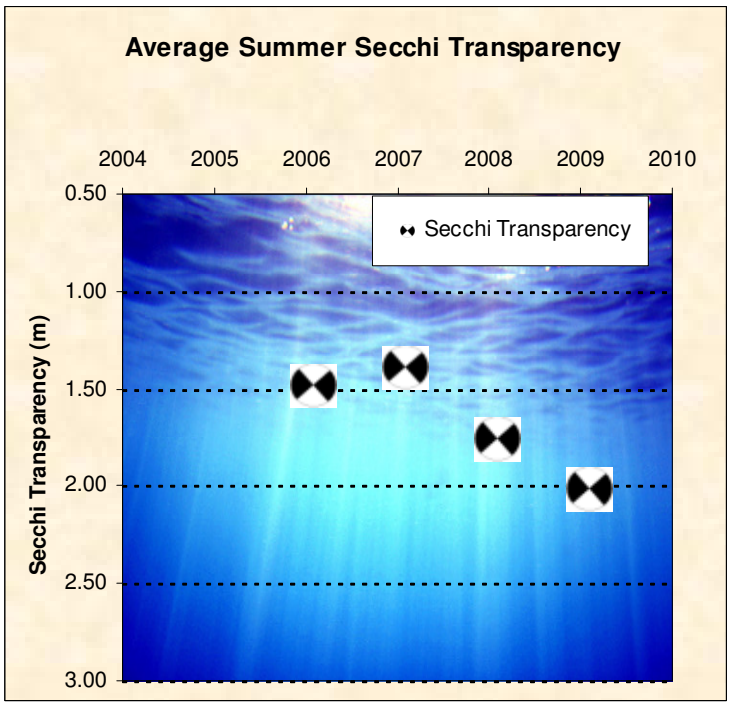
- DNR ID #: 130054
- Municipality: Chisago City
- Location: Section 27 T33N-R21W
- Lake Size: 36 Acres
- Maximum Depth: 56 ft
- Ordinary High Water Mark: 887.2 ft
- 49% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.



Summary Points

- Little Comfort Lake was considered a mesotrophic lake in 2009, based on the Carlson Trophic State Index.
- 2009 represents the best monitored water quality for Little Comfort Lake to date.
- **Curly leaf pondweed (invasive aquatic plants) are extensive in this lake.**
- The major land use is rural/agricultural.
- The lake does stratify throughout the summer months.





Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
4/16/09	0.052	24	1.1	0.8
5/1/09	0.024	11	0.84	1
5/13/09	0.03	7.3	0.92	1.4
6/1/09	0.017	3.5	0.74	2.4
6/10/09	0.018	3.6	0.81	3
6/22/09	0.014	6.6	0.85	2.2
7/12/09	0.017	9.8	0.75	1.7
7/27/09	0.016	10	0.82	1.6
8/23/09	0.022	10	0.78	1.9
9/5/09	0.019	7.8	0.86	1.7
9/16/09	0.029	11	0.87	1.6
10/4/09	0.031	5.8	0.87	1.5
2009 Summer Average	0.019	7.788	0.810	2.013
Water Quality threshold is 0.04 mg/L TP or higher*				
Shallow Lake water quality threshold is 0.06 mg/L or higher*				

	High	High Date	Low	Low Date	Average
2009 Elevation (ft)	NA	NA	NA	NA	NA

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP, chlorophyll-a, and Secchi disk data and provide a basis for evaluating their interrelationships and hence the trophic status of the lake."

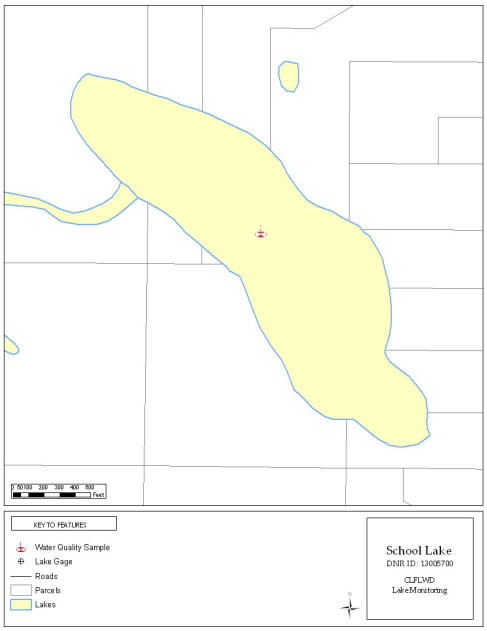
Lake Water Quality Summary

	Trophic Status	Lake Grades									
	2009	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Mesotrophic	A	B	C	D						
Chlorophyll-*a* (ug/l)	Mesotrophic	A	C	A	C						
Secchi depth (ft)	Mesotrophic	C	C	C	C						
Overall	Mesotrophic	B+	B-	B-	C						

School Lake

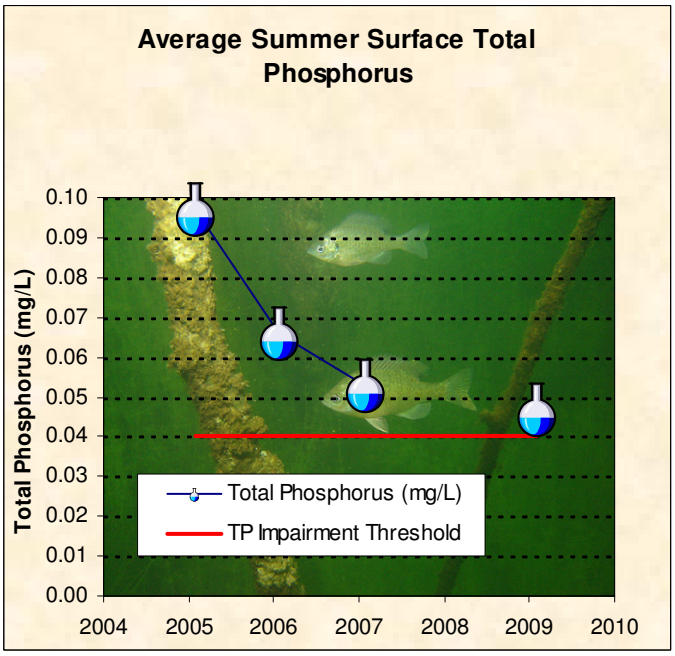
2009 Lake Grade: C+

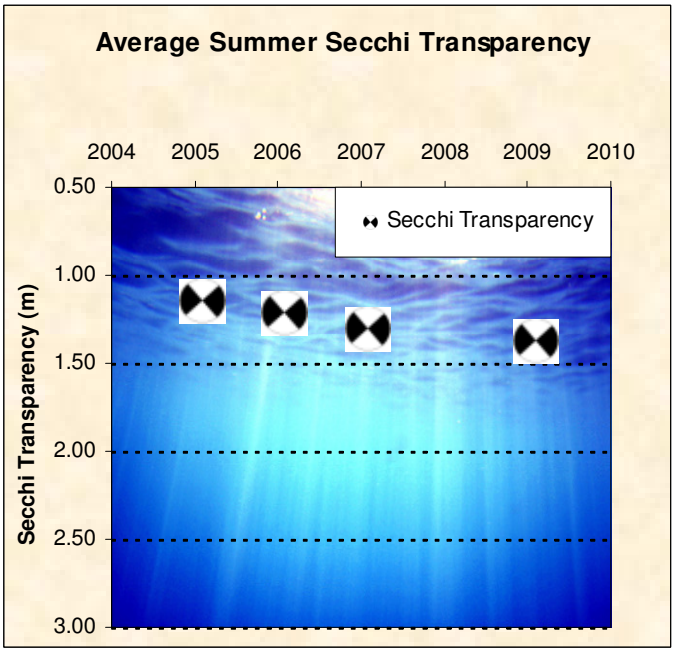
- DNR ID #: 130057
- Municipality: Chisago City
- Location: SE$^{1/4}$ Section 36 T33N-R21W
- Lake Size: 47 Acres
- Maximum Depth: 26 ft
- Ordinary High Water Mark: N/A
- 66% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.



Summary Points

- School Lake was considered a eutrophic lake in 2009, based on the Carlson Trophic State Index.
- **A limited amount of Curly Leaf Pondweed (An invasive aquatic plant) is present.**
- **School Lake is listed on the MPCA's Impaired Waters List for excessive nutrients.**
- At this time, there are not enough years of data to determine a statistically significant trend in overall water quality but the water quality appears to be improving slightly.
- The major land use is rural/agricultural.
- The lake does stratify throughout the summer months.





Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
5/24/09	0.052	29	0.95	1.5
6/13/09	0.047	30	0.82	1.7
6/28/09	0.047	29	0.87	1.4
7/10/09	0.049	30	0.95	1.2
7/25/09	0.046	28	0.84	1.1
8/11/09	0.044	30	0.98	1.5
2009 Summer Average	0.047	29.400	0.892	1.380
Water Quality threshold is 0.04 mg/L TP or higher*				
Shallow Lake water quality threshold is 0.06 mg/L or higher*				

	High	High Date	Low	Low Date	Average
2009 Elevation (ft)	NA	NA	NA	NA	NA

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP, chlorophyll-a, and Secchi disk data and provide a basis for evaluating their interrelationships and hence the trophic status of the lake."

Lake Water Quality Summary

	Trophic Status	Lake Grades									
	2009	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Eutrophic	C		C	C	D					
Chlorophyll-*a* (ug/l)	Eutrophic	B		C	C	C					
Secchi depth (ft)	Eutrophic	C		C	C	C-					
Overall	Eutrophic	C+		C	C	C-					

Sea Lake

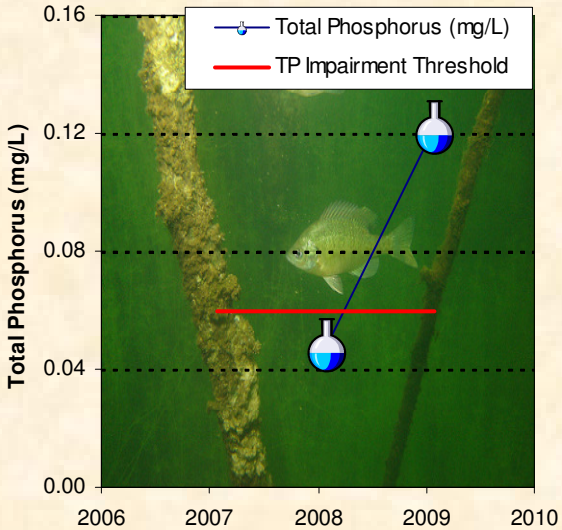
2009 Lake Grade: D

- DNR ID #: 820053
- Municipality: City of Scandia
- Location: Section 4 T32N-R20W
- Lake Size: 50 Acres
- Maximum Depth: 15 ft
- 100% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.

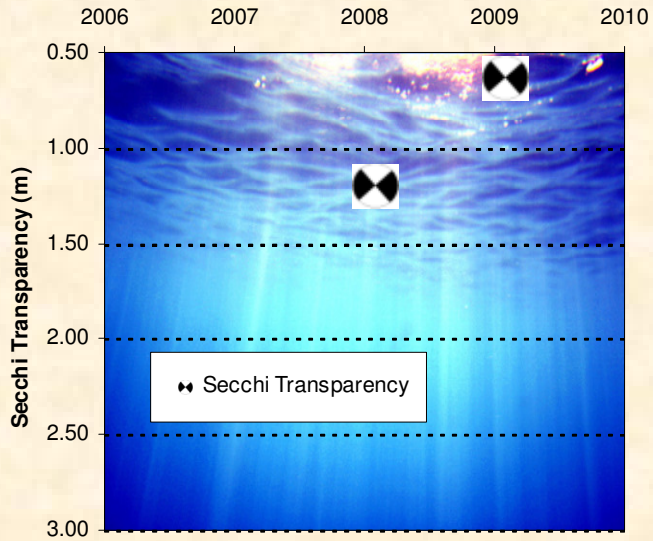
Summary Points

- 2009 was only the second year in which Sea Lake has been monitored
- Sea Lake was considered a hypereutrophic lake in 2009, based on the Carlson Trophic State Index.
- The lake's 2009 water quality was worse than that recorded in 2008
- The major land use is rural/agricultural.
- The lake does not stay stratified throughout the summer months.

Average Summer Surface Total Phosphorus



Average Summer Secchi Transparency



Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
6/11/09	0.097	32	1.7	0.7
6/25/09	0.143	24	1.6	0.8
7/7/09	0.073	32	1.7	0.7
7/23/09	0.074	28	1.6	0.7
8/16/09	0.23	100	2.1	0.5
9/1/09	0.131	64	1.8	0.5
9/14/09	0.105	41	1.6	0.6
2009 Summer Average	0.122	45.857	1.729	0.643
Water Quality threshold is 0.04 mg/L TP or higher*				
Shallow Lake water quality threshold is 0.06 mg/L or higher*				

	High	High Date	Low	Low Date	
2008 Elevation (ft)	NA	NA	NA	NA	NA

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP, chlorophyll-a, and Secchi disk data and provide a basis for evaluating their interrelationships and hence the trophic status of the lake."

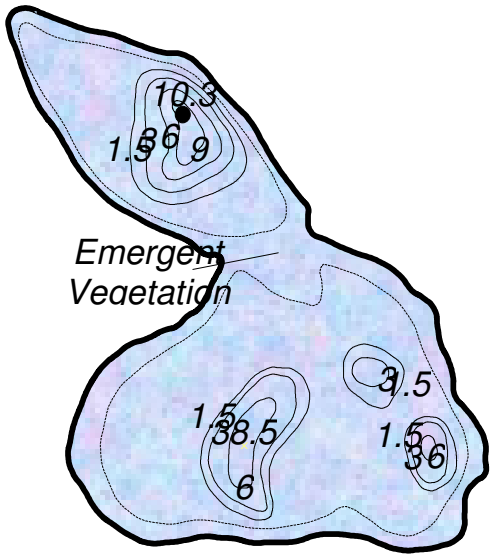
Lake Water Quality Summary

	Trophic Status	Lake Grades									
	2009	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Hyperutrophic	D	C								
Chlorophyll-*a* (ug/l)	Hyperutrophic	C	B								
Secchi depth (ft)	Hyperutrophic	F	C								
Overall	Hyperutrophic	D	C+								

Sylvan Lake

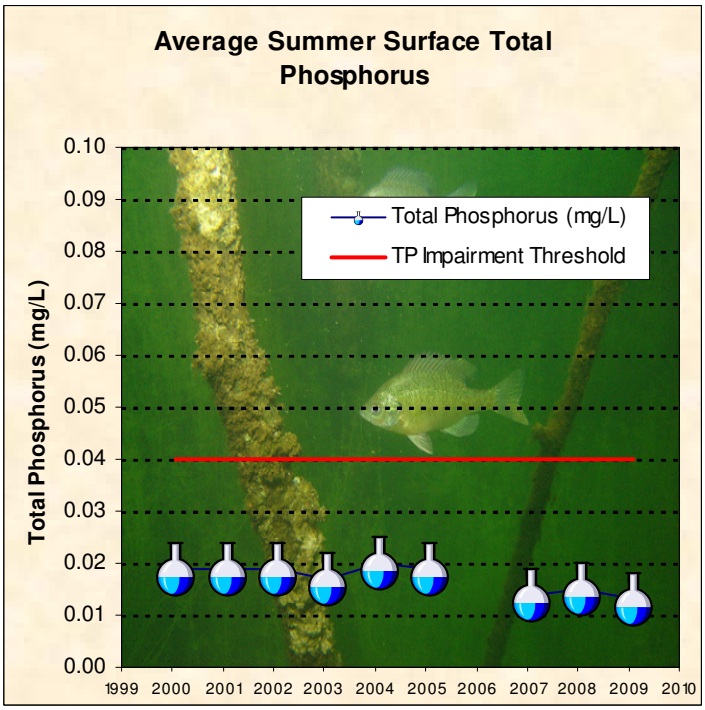
2009 Lake Grade: A

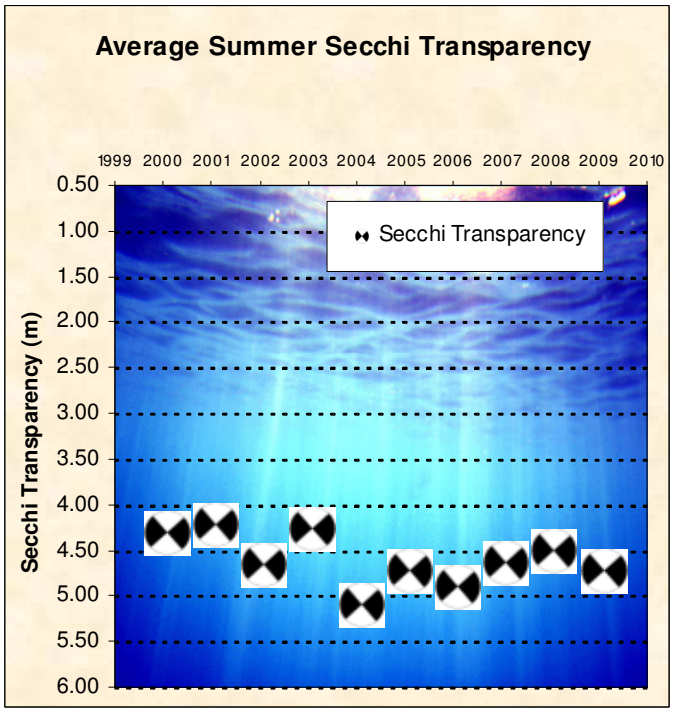
- DNR ID #: 820080
- Municipality: City of Forest Lake
- Location: Section 24 T32N-R21W
- Lake Size: 84 Acres
- Maximum Depth: 35 ft
- Ordinary High Water Mark: 937.1 ft
- 68% Littoral
  Note: Littoral area is the portion of the lake <15 ft and dominated by aquatic vegetation.



Summary Points

- Sylvan Lake was considered a mesotrophic lake again in 2009, based on the Carlson Trophic State Index.
- The water quality of Sylvan Lake ranks among the top ten percent in the Twin Cities Metro Area.
- **Curly leaf pondweed (an invasive aquatic plant) is present in this lake.**
- Sylvan Lake has a healthy diverse aquatic plant population.
- The major land use is semi-urban and rural/agricultural.
- The lake does stratify throughout the summer months.





Date	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Total Kjeldahl Nitrogen (mg/L)	Secchi Disk Depth (m)
4/27/09	0.011	2.2	0.54	4.5
5/4/09	0.022	1.7	0.55	5.3
5/18/09	0.023	1.8	0.58	5.4
5/22/09	0.013	2.6	0.6	5.5
6/22/09	0.01	2.3	0.64	4.6
7/7/09	0.013	2.7	0.69	4.4
7/21/09	0.017	3.5	0.81	4.2
8/10/09	0.007	3	0.62	5
9/10/09	0.017	3.6	0.6	5.4
2009 Summer Average	0.013	3.020	0.672	4.720
Water Quality threshold is 0.04 mg/L TP or higher*				
Shallow Lake water quality threshold is 0.06 mg/L or higher*				

	High	High Date	Low	Low Date	Average
2009 Elevation (ft)	NA	NA	NA	NA	NA

*MPCA description of Impaired Lake's Listing criteria: "At a minimum, a decision that a given lake is impaired for the 303(d) list due to excessive nutrients will be supported by data for both causal and response factors. Data requirements for 303(d) listing consist of 12 or more TP measurements collected from June through September over the most recent 10-year period. Ideally this should represent 12 separate visits to the lake over the course of two summers; however it might also reflect four monthly samples over the course of three years (a typical sampling regimen for many lake monitoring programs). In addition to exceeding the TP guideline thresholds, lakes to be considered for 303(d) listing should have at least 12 Secchi measurements and 12 chlorophyll-a measurements. This amount of data will allow for at least one season (preferably more) of paired TP, chlorophyll-a, and Secchi disk data and provide a basis for evaluating their interrelationships and hence the trophic status of the lake."

Lake Water Quality Summary											
	Trophic Status			Lake Grades							
	2008	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Total Phosphorus (mg/l)	Mesotrophic	A	A	A	A	A	A	A	A	A	A
Chlorophyll-a (ug/l)	Oligitrophic	A	A	A	A	A	A	A	A	A	A
Secchi depth (ft)	Mesotrophic	A	A	A	A	A	A	A	A	A	A
Overall	Mesotrophic	A	A	A	A	A	A	A	A	A	A

References

Carlson, R.E. 1977. A trophic state index for lakes. *Limnology and Oceanography* 22:361-369.

Carlson, R.E. 1992. Expanding the trophic state concept to identify non-nutrient limited lakes and reservoirs. Pages 59-71 *In Enhancing the State's Lake Management Programs: Proceedings of a conference*, Chicago, 1991. North American Lake Management Society, Madison, WI.

After Moore, 1. And K. Thornton, [Ed.] 1988. *Lake and Reservoir Restoration Guidance Manual*. USEPA>EPA 440/5-88-002