



Picture: School Lake near outlet, July 30, 2007

COMFORT LAKE-FOREST LAKE WATERSHED DISTRICT 2008 WATER MONITORING REPORT

Prepared for:
Comfort Lake-Forest Lake Watershed District

Prepared By:
Washington Conservation District

April 2009

Memorandum

To: Comfort Lake-Forest Lake Watershed District Managers

From: Erik Anderson, Jessica Thiel, Wendy Griffin, and Matt Downing --Washington Conservation District

Date: April 29, 2009

Re: CLFLWD 2008 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 Greenway Avenue, Tributary to Sunrise River at Manning Trail, Tributary to Sunrise River at July Avenue

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 (Composite and Grab Samples)
- Sunrise River at Greenway Avenue (Composite and Grab Samples)
- Tributary to Sunrise River at Manning Trail (Grab Samples only)
- Tributary to Sunrise River at July Avenue (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, 2008. 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 Greenway Avenue, Birch Lake Drainage at Manning Trail, 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 22-November 3, 2008, at Sunrise River at Forest Lake Outlet from April 3-November 3, 2008, at Sunrise River at County Line Ditch from April 3-November 4, 2008, at Sunrise River at Comfort Lake Inlet from April 3-September 24, 2008 (rainfall only through November 3, 2008), at Sunrise River at Comfort Lake Outlet from May 1-November 3, 2008, at Sunrise River at Greenway Avenue from April 14-November 4, 2008, at Birch Lake Drainage at Manning Trail from April 21-November 3, 2008, and at Tributary to School Lake at July Avenue from April 17-November 3, 2008. Precipitation data was also continuously collected at each of these sites except at Sunrise River at Forest Lake Outlet, Sunrise River at Greenway Avenue, and Birch Lake Drainage at Manning Trail.

Staff gages were installed and read at each site. Field stage measurements were taken in the stream channels. Temperature, dissolved oxygen, and transparency tube measurements were also taken. If feasible, stage-discharge relationships were developed at all stream sites. When the area-velocity probe was covered with debris, erroneous velocity readings were given and the stage to discharge relationships were used to calculate discharge or a relationship of level to velocity was used to interpolate values. Flow weighted storm event composite samples and/or storm event grab samples; baseflow composite samples and/or baseflow grab samples were collected at all continuous stream monitoring sites. In addition to these samples, *E.coli* grab samples were also taken at all sites except Forest Lake Outlet. The samples were analyzed by the Metropolitan Council Environmental Services Laboratory.

ABBREVIATIONS, ACRONYMS, AND SYMBOLS

CAMP	Citizen-Assisted Lake Monitoring Program
cfs	cubic feet per second
cf	cubic feet
Cl- <i>a</i> or CLA	Chlorophyll- <i>a</i>
CLFLWD	Comfort Lake Forest Lake Watershed District
COD	Total Chemical Oxygen Demand
DO	Dissolved Oxygen
E. Coli	<i>Escherichia coli</i>
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
SRP	Soluble Reactive Phosphorus
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TP	Total Phosphorus
TSI	Trophic State Index
TSS	Total Suspended Solids
µg/L	microgram per liter
VSS	Volatile Suspended Solids
WCD	Washington Conservation District

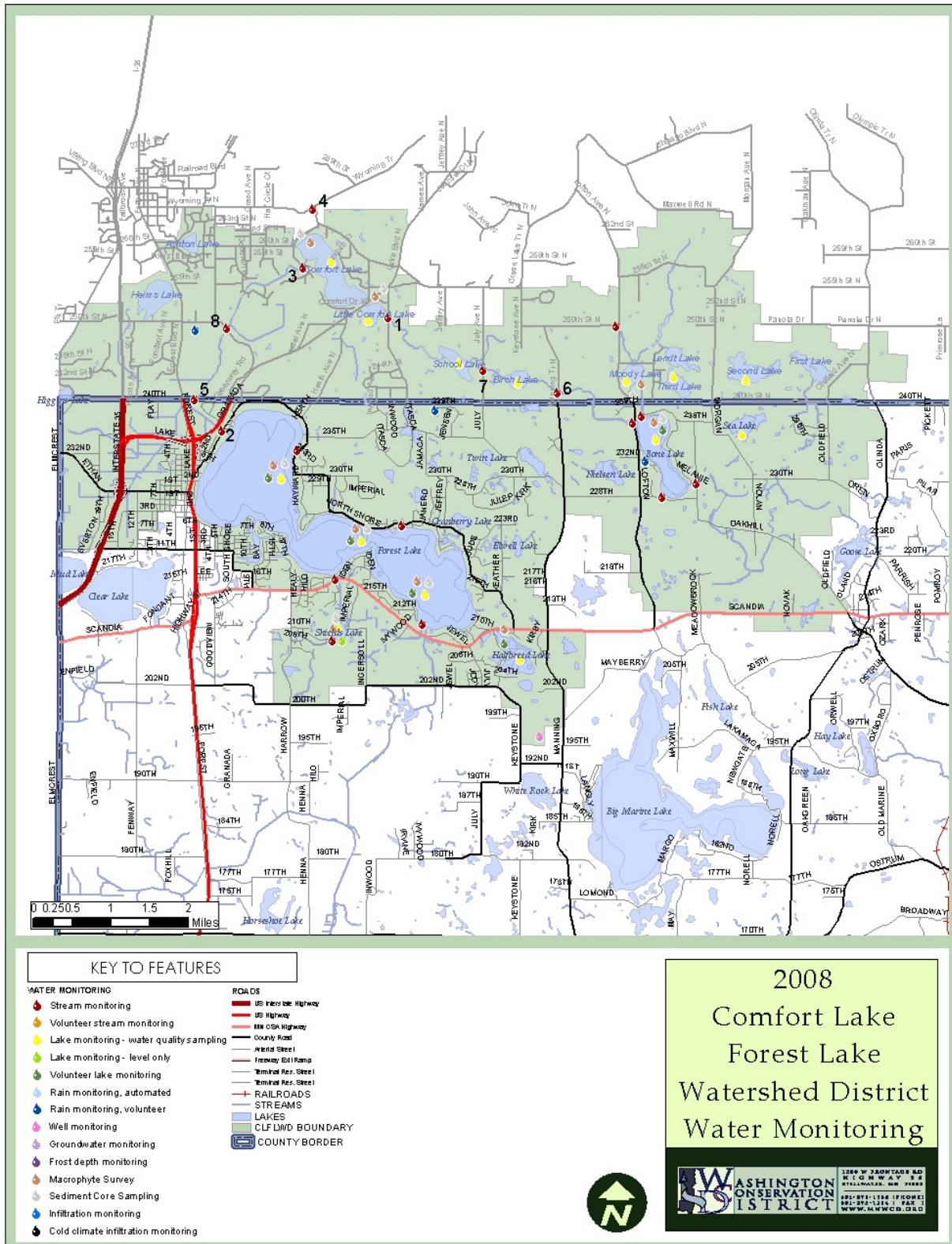


Figure 1. CLFLWD Monitoring Locations

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 Composite 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 Greenway Avenue	Greenway Ave	Greenway Ave	Flow Monitoring in Natural Cross-Section	Discharge and Water Quality Composite 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. Forest Lake Outlet

3) Comfort Lake Subwatershed

- Stream Monitoring
 - a. County Line Ditch
 - b. Greenway Avenue
 - c. Comfort Lake Inlet
 - a. Comfort Lake Outlet

4) Historical Stream Loading and Discharge Summary

5) Appendices and References

1) Little Comfort Lake Subwatershed

Tributary to Sunrise River at Manning Trail

2008 was the first year that data was collected at the Manning Trail station and flow was recorded from April 21-November 3, 2008 (Figure 2). Total discharge for this period was 37,462,320 cf or 860 acre-feet. No automated rain gage was installed at this site to collect continuous rainfall data. Peak discharge of 19.54 cfs occurred on April 22nd. This peak was caused by a combination of the remnants of the spring thaw and a period of light rain, as recorded in the area at the July Avenue site, from April 21st -22nd.

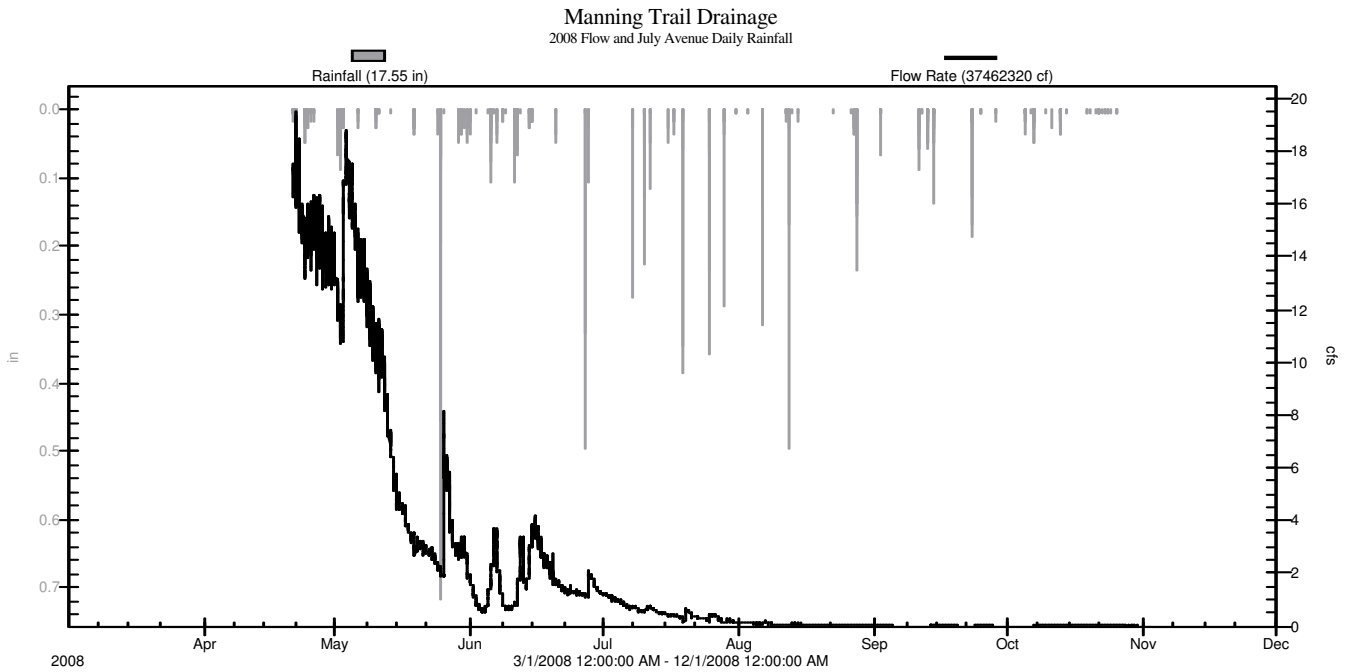


Figure 2. Manning Trail Drainage 2008 Flow and Daily Rainfall

Grab samples were collected at the Manning Trail Drainage site in 2008. 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 1.6 mg/L (April 2nd snowmelt grab) and 2.690 mg/L (May 21st base grab), respectively. The TP value is very high and considered an outlier, and the next highest TP value was 0.162 mg/L from the April 2nd snowmelt sample. The TSS maximum concentration of 9 mg/L was from an August 6th storm grab sample.

Table 2. Manning Trail Drainage 2008 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 N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	E. Coli (#/100ml)
Snowmelt Grab	4/2/08 14:33	4/2/08 14:33	3	3	1.6	0.162	-0.027	14	<0.03	0.18	-0.04	
Storm Grab	4/22/08 14:08	4/22/08 14:08	~1	~1	0.89	0.053	-0.031	13	<0.03	<0.05	<0.02	
Storm Grab	4/25/08 10:34	4/25/08 10:34	~1	~1	1.1	-0.046	-0.034	14	<0.03	<0.05	<0.02	
Storm Grab	5/5/08 11:30	5/5/08 11:30	<1	<1	0.77	-0.027	-0.026	15	<0.03	<0.05	<0.02	
Base Grab	5/21/08 9:21	5/21/08 9:21	~1	~1	0.8	2.690	2.48	15	<0.03	<0.05	0.11	
E. Coli Grab	6/5/08 9:15	6/5/08 9:15										249
Storm Grab	6/6/08 9:22	6/6/08 9:22	5	~2	0.98	0.070	-0.030	13	<0.03	<0.05	<0.02	
Storm Grab	6/12/08 9:52	6/12/08 9:52	3	~2	1	0.062	-0.046	14	<0.03	<0.05	-0.05	
E. Coli Grab	6/12/08 9:52	6/12/08 9:52										417
E. Coli Grab	6/19/08 9:35	6/19/08 9:35										71
Base Grab	6/23/08 10:45	6/23/08 10:45	4	3	1	0.104	0.054	15	<0.03	<0.05	<0.02	
E. Coli Grab	6/26/08 9:15	6/26/08 9:15										41
E. Coli Grab	6/30/08 10:08	6/30/08 10:08										26
E. Coli Grab	7/7/08 8:50	7/7/08 8:50										102
E. Coli Grab	7/14/08 10:03	7/14/08 10:03										118
E. Coli Grab	7/17/08 8:21	7/17/08 8:21										214
E. Coli Grab	7/24/08 9:16	7/24/08 9:16										115
Base Grab	7/31/08 8:30	7/31/08 8:30	<1	~1	0.83	0.059	-0.043	15	<0.03	0.07	-0.03	
E. Coli Grab	7/31/08 8:30	7/31/08 8:30										272
E. Coli Grab	8/4/08 8:30	8/4/08 8:30										88
Storm Grab	8/6/08 15:20	8/6/08 15:20	9	4	1.1	0.144	0.095	16	<0.03	0.18	0.11	
E. Coli Grab	8/7/08 9:30	8/7/08 9:30										195
E. Coli Grab	8/14/08 9:47	8/14/08 9:47										205
E. Coli Grab	8/21/08 8:30	8/21/08 8:30										248
E. Coli Grab	8/27/08 8:50	8/27/08 8:50										>2420

Exceeds Water Quality Standards

Table 3. Manning Trail Drainage Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)
4/22/08 14:08	>120	11.6	8.81
4/25/08 10:34	>120	7.8	4.10
5/5/08 11:30	>120	10.9	6.71
5/21/08 9:21	>120	12.0	5.49
6/6/08 8:37	>100	17.6	2.51
6/12/08 9:52	120	17.3	3.42
6/19/08 9:35	>120	19.3	4.03
6/23/08 10:45	>120	21.3	4.41
6/26/08 9:12		22.0	3.20
6/30/08 10:08	>120	20.8	5.22
7/2/08 9:13	>120	22.5	4.15
7/7/08 8:55	>100	22.7	3.52
7/14/08 10:30	>120	20.9	5.45
7/17/08 8:21	>120	23.2	4.26
7/24/08 9:16	>120	22.7	5.63
7/31/08 8:30	>100	21.7	4.06
8/4/08 8:30	>120	21.0	5.32
8/7/08 9:30	100	18.7	6.24
8/14/08 9:47	>120	19.9	4.98
8/21/08 8:24	>120	19.9	4.05
8/27/08 8:50	>100	15.8	5.09

Exceeds Water Quality Standards

Table 4. Manning Trail Drainage 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		Loading Interval		Interval Volume (cf)	Interval Volume (ac-ft)	Interval TSS (lb)	Interval TP (lb)		
	Start	End	TSS (mg/L)	TP (mg/L)					Start	End
Base**			<i>1.83</i>	<i>0.082</i>	<i>1/1/08 0:00</i>	<i>4/2/08 13:45</i>	<i>3,999</i>	<i>0.09</i>	<i>0.5</i>	<i>0.02</i>
Snowmelt Grab	4/2/08 14:33	4/2/08 14:33	3.00	0.162	4/2/08 13:45	4/5/08 14:45	4,286,268	98.45	802.7	43.35
Base**			<i>1.83</i>	<i>0.082</i>	<i>4/5/08 14:45</i>	<i>4/21/08 15:45</i>	<i>21,483,000</i>	<i>493.44</i>	<i>2458.2</i>	<i>109.30</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>4/21/08 15:45</i>	<i>4/22/08 8:45</i>	<i>1,071,968</i>	<i>24.62</i>	<i>122.7</i>	<i>5.49</i>
Storm Grab	4/22/08 14:08	4/22/08 14:08	1.00	0.053	4/22/08 8:45	4/22/08 22:45	877,525	20.16	54.8	2.90
Base			<i>1.83</i>	<i>0.082</i>	<i>4/22/08 22:45</i>	<i>4/24/08 16:45</i>	<i>2,241,106</i>	<i>51.48</i>	<i>256.4</i>	<i>11.47</i>
Storm Grab	4/25/08 10:34	4/25/08 10:34	1.00	0.046	4/24/08 16:45	4/25/08 10:45	992,421	22.79	62.0	2.85
Base			<i>1.83</i>	<i>0.082</i>	<i>4/25/08 10:45</i>	<i>5/2/08 13:45</i>	<i>8,711,669</i>	<i>200.10</i>	<i>996.85</i>	<i>44.59</i>
Storm Grab	5/5/08 11:30	5/5/08 11:30	0.50	0.027	5/2/08 13:45	5/5/08 11:45	4,082,410	93.77	127.4	6.88
Base			<i>1.83</i>	<i>0.082</i>	<i>5/5/08 11:45</i>	<i>5/20/08 11:45</i>	<i>10,609,290</i>	<i>243.68</i>	<i>1214.0</i>	<i>54.31</i>
Base Grab	5/21/08 9:21	5/21/08 9:21	1.00	2.690	5/20/08 11:45	5/25/08 16:45	1,104,246	25.36	68.9	185.43
Storm			<i>3.25</i>	<i>0.067</i>	<i>5/25/08 16:45</i>	<i>5/25/08 21:45</i>	<i>115,134</i>	<i>2.64</i>	<i>23.4</i>	<i>0.48</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>5/25/08 21:45</i>	<i>6/4/08 9:45</i>	<i>2,065,578</i>	<i>47.44</i>	<i>236.4</i>	<i>10.57</i>
Storm Grab	6/6/08 9:22	6/6/08 9:22	5.00	0.070	6/4/08 9:45	6/6/08 15:45	358,030	8.22	111.8	1.56
Base			<i>1.83</i>	<i>0.082</i>	<i>6/6/08 15:45</i>	<i>6/11/08 10:45</i>	<i>447,107</i>	<i>10.27</i>	<i>51.2</i>	<i>2.29</i>
Storm Grab	6/12/08 9:52	6/12/08 9:52	3.00	0.062	6/11/08 10:45	6/12/08 20:45	286,753	6.59	53.7	1.11
Base Grab	6/23/08 10:45	6/23/08 10:45	4.00	0.104	6/12/08 20:45	6/23/08 10:45	2,072,162	47.60	517.4	13.45
Base			<i>1.83</i>	<i>0.082</i>	<i>6/23/08 10:45</i>	<i>7/19/08 8:45</i>	<i>1,957,574</i>	<i>44.96</i>	<i>224.0</i>	<i>9.96</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>7/19/08 8:45</i>	<i>7/19/08 18:45</i>	<i>10,029</i>	<i>0.23</i>	<i>2.0</i>	<i>0.04</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>7/19/08 18:45</i>	<i>7/25/08 9:45</i>	<i>167,763</i>	<i>3.85</i>	<i>19.2</i>	<i>0.85</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>7/25/08 9:45</i>	<i>7/25/08 13:45</i>	<i>4,376</i>	<i>0.10</i>	<i>0.9</i>	<i>0.02</i>
Base Grab	7/31/08 8:30	7/31/08 8:30	0.50	0.059	7/25/08 13:45	8/6/08 13:45	175,102	4.02	5.5	0.64
Storm Grab	8/6/08 15:20	8/6/08 15:20	9.00	0.144	8/6/08 13:45	8/6/08 23:45	4,532	0.10	2.5	0.04
Base			<i>1.83</i>	<i>0.082</i>	<i>8/6/08 23:45</i>	<i>8/12/08 19:45</i>	<i>29,657</i>	<i>0.68</i>	<i>3.4</i>	<i>0.15</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>8/12/08 19:45</i>	<i>8/13/08 3:45</i>	<i>2,447</i>	<i>0.06</i>	<i>0.5</i>	<i>0.01</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>8/13/08 3:45</i>	<i>8/27/08 5:45</i>	<i>25,264</i>	<i>0.58</i>	<i>2.9</i>	<i>0.13</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>8/27/08 5:45</i>	<i>8/28/08 3:45</i>	<i>1,059</i>	<i>0.02</i>	<i>0.2</i>	<i>0.00</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>8/28/08 3:45</i>	<i>9/2/08 11:45</i>	<i>3,851</i>	<i>0.09</i>	<i>0.4</i>	<i>0.02</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>9/2/08 11:45</i>	<i>9/2/08 16:45</i>	<i>32</i>	<i>0.00</i>	<i>0.0</i>	<i>0.00</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>9/2/08 16:45</i>	<i>9/13/08 21:45</i>	<i>122</i>	<i>0.00</i>	<i>0.0</i>	<i>0.00</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>9/13/08 21:45</i>	<i>9/15/08 0:00</i>	<i>597</i>	<i>0.01</i>	<i>0.1</i>	<i>0.00</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>9/15/08 0:00</i>	<i>9/23/08 16:45</i>	<i>607</i>	<i>0.01</i>	<i>0.1</i>	<i>0.00</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>9/23/08 16:45</i>	<i>9/24/08 3:45</i>	<i>150</i>	<i>0.00</i>	<i>0.0</i>	<i>0.00</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>9/24/08 3:45</i>	<i>10/7/08 18:45</i>	<i>392</i>	<i>0.01</i>	<i>0.0</i>	<i>0.00</i>
Storm			<i>3.25</i>	<i>0.067</i>	<i>10/7/08 18:45</i>	<i>10/8/08 0:45</i>	<i>116</i>	<i>0.00</i>	<i>0.0</i>	<i>0.00</i>
Base			<i>1.83</i>	<i>0.082</i>	<i>10/8/08 0:45</i>	<i>11/3/08 9:45</i>	<i>1,622</i>	<i>0.04</i>	<i>0.2</i>	<i>0.01</i>
Base**			<i>1.83</i>	<i>0.082</i>	<i>11/3/08 9:45</i>	<i>1/1/09 0:00</i>	<i>2,531</i>	<i>0.06</i>	<i>0.3</i>	<i>0.01</i>
Snowmelt Average			3.00	0.162						
Storm Average			3.25	0.067						
Base Average			1.83	0.082						
All Average			2.80	0.081						
Total							63,196,487	1,452	7,421	508
CLFLWD Major Subwatershed Total Acres							7,115			
Total Load										
Total TP/TSS (lb/ac/yr)									1.04	0.07
Total TP/TSS (kg/ha/yr)									1.17	0.08

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

** Interval volumes from 1/1/08 to 4/2/08 and 11/3/08 to 1/1/09 where estimated based upon base flow

Total phosphorus loading for Manning Trail Drainage in 2008 was estimated at 0.07 lbs/acre (508 lbs.) (Table 4). This site had very little flow for the second half of the monitoring season. Future years of monitoring will help to understand what's flowing into Birch Lake and give a better representation of the overall trends present in the drainage.

Tributary to Sunrise River at July Avenue

2008 was the first year that data was collected at the July Avenue station, and flow was recorded from April 17- November 3, 2008 (Figure 3). Total discharge for this period was 62,892,460 cfs or 1,444 ac/ft. A total of 17.25 inches of rainfall was recorded at the site and a peak flow of 15.34 cfs occurred on May 3rd. A combination of the remnants of the spring thaw emptying from Birch Lake and the wetland upstream, and a total rainfall of 0.95 inches caused the high flow rate from May 2nd-3rd.

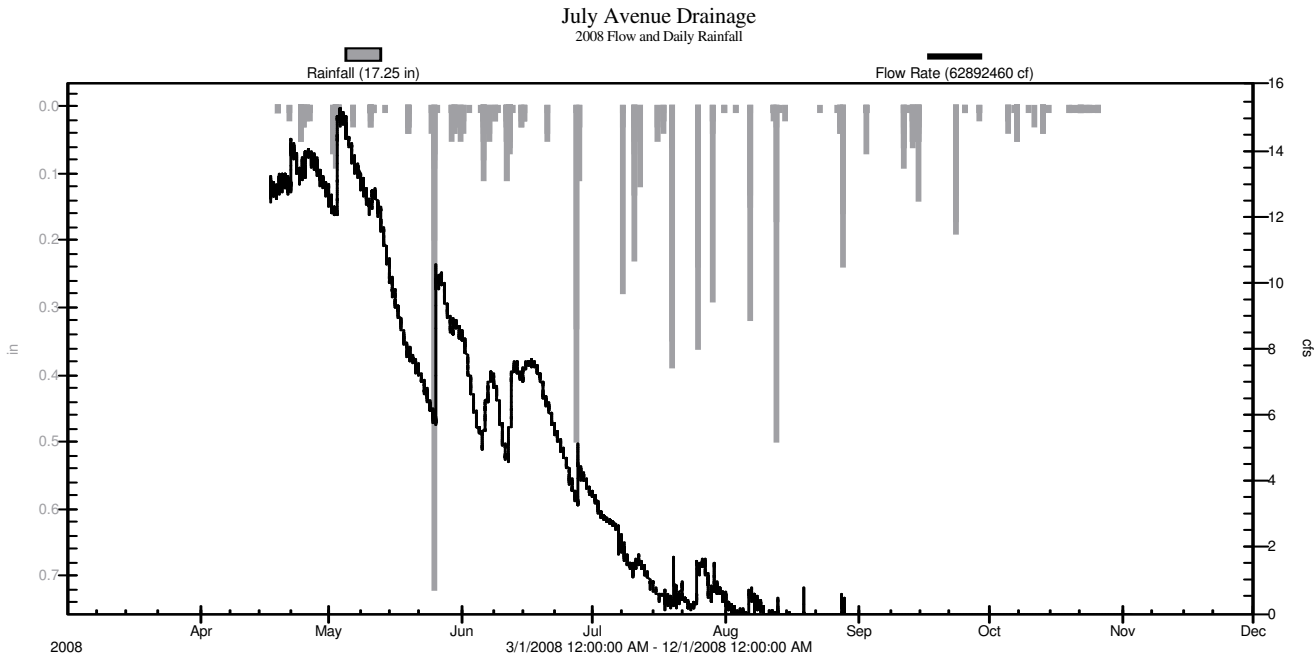


Figure 3. July Avenue Drainage 2008 Flow and Daily Rainfall

Grab samples were collected at the July Avenue site in 2008. 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 2.7 mg/L and 0.282 mg/L, respectively, from an April 2nd snowmelt grab. The highest TSS value recorded was 23 mg/L from a base grab sample collected on September 9th.

Table 5. July Avenue Drainage 2008 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)	E. Coli (#/100ml)
Snowmelt Grab	4/2/08 14:24	4/2/08 14:24	9	-5	2.7	0.282	0.091	22	<0.03	<0.05	0.79	
Storm Grab	4/22/08 14:24	4/22/08 14:24	~2	~2	0.99	0.118	0.07	13	<0.03	<0.05	~0.04	
Storm Grab	4/25/08 10:57	4/25/08 10:57	~2	~2	1	0.056	<0.010	13	<0.03	<0.05	~0.05	
Storm Grab	5/5/08 11:12	5/5/08 11:12	~1	~1	0.84	~0.036	~0.043	15	<0.03	<0.05	<0.02	
Base Grab	5/21/08 9:28	5/21/08 9:28	~1	~2	0.82	~0.042	~0.021	15	<0.03	<0.05	<0.02	
Storm Grab	5/27/08 12:21	5/27/08 12:21	~2	~2	0.98	0.061	~0.038	13	<0.03	<0.05	~0.04	
E. Coli Grab	6/5/08 9:18	6/5/08 9:18										23
Storm Grab	6/6/08 8:50	6/6/08 8:50	4	~2	1.1	0.112	0.051	13	<0.03	<0.05	~0.05	
Storm Grab	6/12/08 9:37	6/12/08 9:37	3	~2	0.95	0.114	0.056	11	<0.03	0.08	0.1	
E. Coli Grab	6/12/08 9:37	6/12/08 9:37										52
E. Coli Grab	6/19/08 9:25	6/19/08 9:25										10
Base Grab	6/23/08 10:32	6/23/08 10:32	4	3	1.1	0.114	0.052	12	<0.03	<0.05	~0.06	
E. Coli Grab	6/26/08 9:20	6/26/08 9:20										15
E. Coli Grab	6/30/08 9:56	6/30/08 9:56										12
E. Coli Grab	7/7/08 9:05	7/7/2008 9:05										11
E. Coli Grab	7/14/08 9:10	7/14/08 9:10										19
E. Coli Grab	7/17/08 8:12	7/17/08 8:12										125
E. Coli Grab	7/24/08 9:04	7/24/08 9:04										56
Base Grab	7/31/08 9:00	7/31/08 9:00	12	8	1.7	0.229	0.066	13	<0.03	<0.05	0.46	
E. Coli Grab	7/31/08 9:00	7/31/08 9:00										38
E. Coli Grab	8/4/08 8:45	8/4/08 8:45										46
Storm Grab	8/6/08 15:30	8/6/08 15:30	15	9	1.9	0.250	0.069	14	<0.03	0.07	0.42	
E. Coli Grab	8/7/08 9:20	8/7/08 9:20										88
E. Coli Grab	8/14/08 9:36	8/14/08 9:36										144
E. Coli Grab	8/21/08 8:45	8/21/08 8:45										411
E. Coli Grab	8/27/08 9:00	8/27/08 9:00										980
Base Grab	9/8/2008 15:00	9/8/2008 15:00	23	15	1.5	0.136	~0.025	13	<0.03	<0.05	0.12	
Base Grab	10/22/2008 14:47	10/22/2008 14:47	8	4	0.94	~0.049	~0.021	16	<0.03	0.1	~0.03	
Exceeds Water Quality Standard												

Table 6. July Avenue Drainage 2008 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)
4/22/08 14:24	>120	9.9	7.00
4/25/08 10:57	>120	9.9	4.94
5/5/08 11:12	>120	10.9	8.11
5/14/08 15:58		16.1	5.86
5/21/08 9:28	>120	13.0	4.06
6/6/08 8:50	>100	18.3	1.57
6/12/08 9:37	>120	18.1	2.66
6/19/08 9:25	>120	21.2	2.74
6/23/08 10:32	101	22.7	1.97
6/26/08 9:22		24.3	0.93
6/30/08 9:56	>120	22.1	1.37
7/2/08 9:28	>120	24.1	1.31
7/7/08 9:09	>100	24.8	1.32
7/14/08 9:10	>120	20.2	1.30
7/17/08 8:12	39	24.9	0.24
7/24/08 9:04	67	24.0	0.18
7/31/08 9:00	>100	24.4	0.38
8/4/08 8:45	>120	22.3	0.35
8/7/08 9:20	100	21.5	0.70
8/14/08 9:36	>120	21.3	0.59
8/21/08 8:40	111	21.5	0.59
8/27/08 9:00	73	17.5	1.10
Exceeds Water Quality Standard			

Table 7. July Avenue Drainage 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		Loading Interval		Interval Volume (cf)	Interval Volume (ac-ft)	Interval TSS (lb)	Interval TP (lb)		
	Start	End	TSS (mg/L)	TP (mg/L)					Start	End
<i>Base**</i>			2.40	0.082	<i>1/1/08 0:00</i>	<i>4/2/08 14:45</i>	128,304	2.95	19.2	0.66
Snowmelt Grab	4/2/08 14:24	4/2/08 14:24	9.00	0.282	4/2/08 14:45	4/5/08 14:45	3,405,888	78.23	1913.5	59.96
<i>Base**</i>			2.40	0.082	<i>4/5/08 14:45</i>	<i>4/17/08 11:45</i>	12,773,700	293.40	1913.8	65.39
<i>Base</i>			2.40	0.082	<i>4/17/08 11:45</i>	<i>4/21/08 22:45</i>	5,020,707	115.32	752.2	25.70
Storm Grab	4/22/08 14:24	4/22/08 14:24	2.00	0.118	4/21/08 22:45	4/22/08 14:45	811,267	18.63	101.3	5.98
<i>Base</i>			2.40	0.082	<i>4/22/08 14:45</i>	<i>4/25/08 7:45</i>	3,187,958	73.22	477.6	16.32
Storm Grab	4/25/08 10:57	4/25/08 10:57	2.00	0.056	4/25/08 7:45	4/25/08 19:45	596,248	13.70	74.4	2.08
<i>Base</i>			2.40	0.082	<i>4/25/08 19:45</i>	<i>5/2/08 13:45</i>	7,697,620	176.81	1153.28	39.40
Storm Grab	5/5/08 11:12	5/5/08 11:12	1.00	0.036	5/2/08 13:45	5/6/08 3:45	4,520,947	103.84	282.2	10.16
Base Grab	5/21/08 9:28	5/21/08 9:28	1.00	0.042	5/6/08 3:45	5/25/08 16:45	16,785,230	385.54	1047.8	44.01
Storm Grab	5/27/08 12:21	5/27/08 12:21	2.00	0.061	5/25/08 16:45	5/27/08 12:45	1,592,219	36.57	198.8	6.06
<i>Base</i>			2.40	0.082	<i>5/27/08 12:45</i>	<i>6/5/08 15:45</i>	6,067,531	139.36	909.1	31.06
Storm Grab	6/6/08 8:50	6/6/08 8:50	4.00	0.112	6/5/08 15:45	6/9/08 16:45	2,304,776	52.94	575.5	16.11
<i>Base</i>			2.40	0.082	<i>6/9/08 16:45</i>	<i>6/11/08 10:45</i>	775,131	17.80	116.1	3.97
Storm Grab	6/12/08 9:37	6/12/08 9:37	3.00	0.114	6/11/08 10:45	6/13/08 10:45	1,158,909	26.62	217.0	8.25
Base Grab	6/23/08 10:32	6/23/08 10:32	4.00	0.114	6/13/08 10:45	6/27/08 16:45	7,458,057	171.30	1862.3	53.08
<i>Storm</i>			2.40	0.082	<i>6/27/08 16:45</i>	<i>6/27/08 22:45</i>	98,868	2.27	14.8	0.51
<i>Base</i>			2.40	0.082	<i>6/27/08 22:45</i>	<i>7/19/08 11:45</i>	3,859,992	88.66	578.3	19.76
<i>Storm</i>			2.40	0.082	<i>7/19/08 11:45</i>	<i>7/19/08 21:45</i>	38,559	0.89	5.8	0.20
<i>Base</i>			2.40	0.082	<i>7/19/08 21:45</i>	<i>7/25/08 10:45</i>	211,652	4.86	31.7	1.08
<i>Storm</i>			2.40	0.082	<i>7/25/08 10:45</i>	<i>7/25/08 16:45</i>	30,896	0.71	4.6	0.16
<i>Base</i>			2.40	0.082	<i>7/25/08 16:45</i>	<i>7/29/08 2:45</i>	335,278	7.70	50.2	1.72
<i>Storm</i>			14.50	0.166	<i>7/29/08 2:45</i>	<i>7/29/08 7:45</i>	20,791	0.48	18.8	0.22
Base Grab	7/31/08 9:00	7/31/08 9:00	12.00	0.229	7/29/08 7:45	8/6/08 13:45	195,700	4.50	146.6	2.80
Storm Grab	8/6/08 15:30	8/6/08 15:30	15.00	0.250	8/6/08 13:45	8/6/08 17:45	6,703	0.15	6.3	0.10
<i>Base</i>			14.50	0.166	<i>8/6/08 17:45</i>	<i>8/12/08 19:45</i>	101,957	2.34	92.3	1.06
<i>Storm</i>			14.50	0.166	<i>8/12/08 19:45</i>	<i>8/12/08 23:45</i>	4,853	0.11	4.4	0.05
<i>Base</i>			14.50	0.166	<i>8/12/08 23:45</i>	<i>8/27/08 21:45</i>	3,147	0.07	2.8	0.03
<i>Storm</i>			14.50	0.166	<i>8/27/08 21:45</i>	<i>8/28/08 6:45</i>	6,837	0.16	6.2	0.07
Base Grab**	9/8/2008 15:00	9/8/2008 15:00	23.00	0.136	8/28/08 6:45	9/12/08 6:45	207,360	4.76	297.7	1.76
<i>Base**</i>			14.50	0.166	<i>9/12/08 6:45</i>	<i>10/12/08 6:45</i>	414,720	9.53	375.4	4.30
Base Grab**	10/22/2008 14:47	10/22/2008 14:47	8.00	0.049	10/12/08 6:45	11/3/08 6:45	304,128	6.99	151.9	0.93
<i>Base**</i>			14.50	0.166	<i>11/3/08 6:45</i>	<i>1/1/09 0:00</i>	811,728	18.64	734.8	8.41
Snowmelt Average			9.00	0.282						
Storm Average			4.14	0.107						
Base Average			6.25	0.109						
Early Year Average			2.4	0.082						
Late Year Average			14.5	0.166						
All Average			6.46	0.166						
Total							80,937,662	1,859	14,137	431
CLFLWD Major Subwatershed Total Acres							7,902			
Total Load										
Total TP/TSS (lb/ac/yr)									1.79	0.05
Total TP/TSS (kg/ha/yr)									2.01	0.06

*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 respectively for intervals after that date

** Interval volumes from 1/1/08 to 4/17/08 and 8/28/08 to 1/1/09 where estimated based upon base and storm flow

Total phosphorous loading for July Avenue in 2008 was estimated at 0.05 lbs/acre (431 lbs) (Table 7). Compared to the Manning Trail site, the total discharge at July Ave is higher and the TP load is lower. This discrepancy is due in large part to the high TP result from the 5/21/08 base grab at Manning Trail. Future years of monitoring will help to understand what's flowing into School Lake and give a better representation of the overall trends present at this site.

Little Comfort Lake Inlet

The station for the Little Comfort Lake Inlet site recorded flow between April 22-November 3, 2008 (Figure 4). Total discharge during this period was 248,125,200 cf or 5,696 acre-ft. Total rainfall recorded during the monitoring season was 16.35 inches. Peak discharge of 69.87 cfs occurred on May 4th. The high flows were caused by 1.07 inches of rain that fell from May 2nd -3rd.

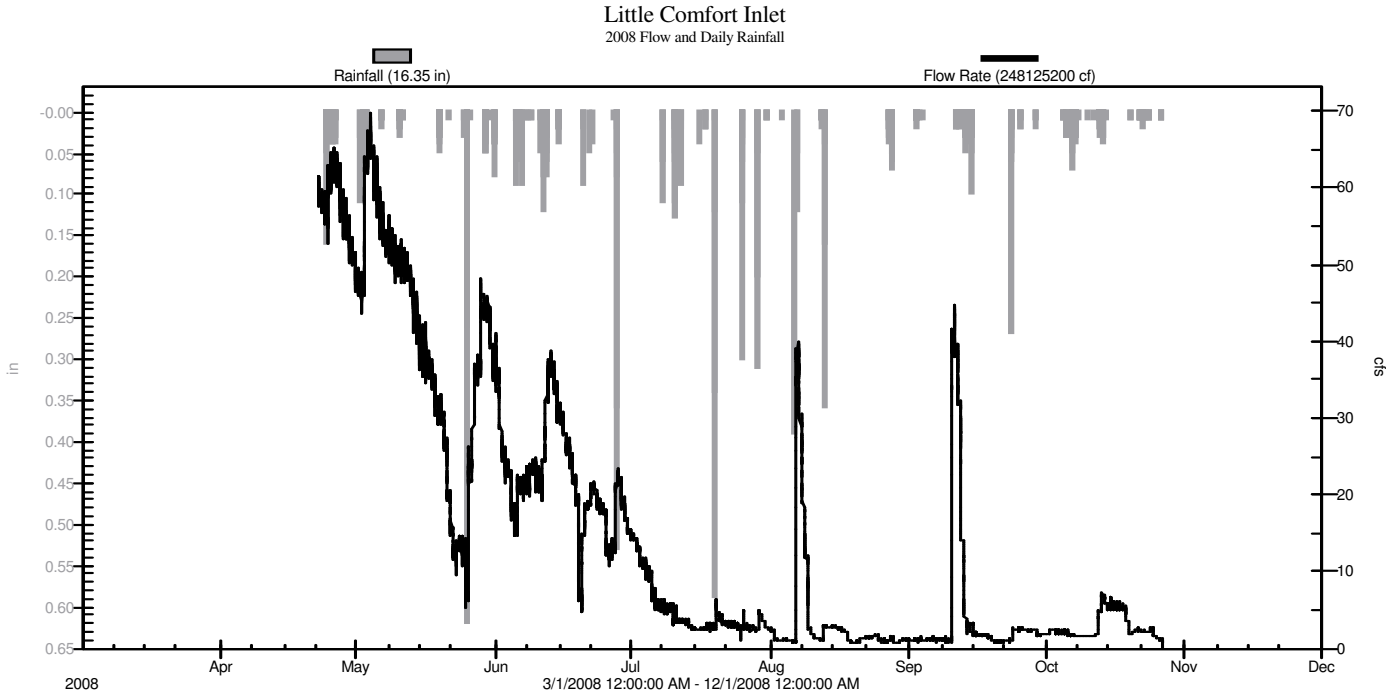


Figure 4. Little Comfort Lake Inlet 2008 Flow and Daily Rainfall

Grab samples were collected at the Little Comfort Lake Inlet site in 2008. 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 2.2 mg/L and 0.245 mg/L, respectively, both from an April 2nd snowmelt grab sample. The TSS maximum concentration of 13 mg/L was from a May 27th storm grab sample.

Table 8. Little Comfort Lake Inlet 2008 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)	E. Coli (mpn/100ml)
Snowmelt Grab	4/2/08 14:15	4/2/08 14:15	7	~5	2.2	0.245	0.146	13	<0.03	0.19	0.66	
Storm Grab	4/22/08 14:48	4/22/08 14:48	8		1.1	0.053	~0.013	13	<0.03	0.14	0.15	
Storm Grab	4/25/08 11:06	4/25/08 11:06	7	5	1.1	0.068	~0.022	12	<0.03	0.06	0.07	
Storm Grab	5/5/08 10:39	5/5/08 10:39	4	3	1	~0.037	~0.013	13	<0.03	<0.05	~0.02	
Base Grab	5/21/08 9:38	5/21/08 9:38	4	3	0.86	~0.047	<0.010	14	<0.03	<0.05	<0.02	
Storm Grab	5/27/08 12:05	5/27/08 12:05	13	6	1.6	0.101	~0.014	14	<0.03	<0.05	<0.02	
E. Coli Grab	6/5/08 9:30	6/5/08 9:30										38
Storm Grab	6/6/08 9:05	6/6/08 9:05	~2	~1	0.77	0.065	~0.015	12	<0.03	<0.05	~0.04	
Storm Grab	6/12/08 9:27	6/12/08 9:27	4	3	0.78	0.055	~0.023	11	<0.03	0.06	~0.04	
E. Coli Grab	6/12/08 9:27	6/12/08 9:27										148
E. Coli Grab	6/19/08 9:15	6/19/08 9:15										31
Base Grab	6/23/08 10:18	6/23/08 10:18	5	3	0.83	~0.047	~0.012	13	<0.03	<0.05	<0.02	
E. Coli Grab	6/26/08 9:35	6/26/08 9:35										63
E. Coli Grab	6/30/08 9:45	6/30/08 9:45										23
E. Coli Grab	7/7/08 9:20	7/7/08 9:20										72
E. Coli Grab	7/14/08 9:20	7/14/08 9:20										225
E. Coli Grab	7/17/08 8:01	7/17/08 8:01										1733
E. Coli Grab	7/24/08 8:53	7/24/08 8:53										365
Base Grab	7/31/08 9:15	7/31/08 9:15	~1	~1	0.53	~0.029	~0.019	13	<0.03	<0.05	<0.02	
E. Coli Grab	7/31/08 9:15	7/31/08 9:15										145
E. Coli Grab	8/4/08 9:00	8/4/08 9:00										261
E. Coli Grab	8/7/08 9:10	8/7/08 9:10										687
E. Coli Grab	8/14/08 9:22	8/14/08 9:22										172
E. Coli Grab	8/21/08 9:00	8/21/08 9:00										56
E. Coli Grab	8/27/08 9:15	8/27/08 9:15										261
Base Grab	10/22/08 14:33	10/22/08 14:33	~1	~1	0.87	~0.017	<0.010	13	0.03	0.09	<0.02	
Exceeds Water Quality Standard												

Table 9. Little Comfort Lake Inlet 2008 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)
4/22/08 14:48	115	11.9	8.7
4/25/08 10:49	90	9.6	8.52
5/5/08 10:39	105	10.8	9.67
5/14/08 15:49		17.6	8.05
5/21/08 9:38	119	13.3	8.24
6/6/08 9:05	>100	18.5	4.56
6/12/08 9:27	120	18.1	5.46
6/19/08 9:15	>120	20.9	5.68
6/23/08 10:18	103	22.3	6.34
6/30/08 9:45	>120	21.5	3.88
7/2/08 9:42	>120	21.5	3.21
7/7/08 9:23	>100	22.9	3.98
7/14/08 9:20	>120	18.8	4.61
7/17/08 8:01	>120	22.8	3.66
7/24/08 8:53	>120	21.7	4.58
7/31/08 9:11	>100	21.1	2.57
8/4/08 9:00	>120	20.8	4.25
8/7/08 9:10	95	21.4	3.54
8/14/08 9:22	>120	19.7	3.65
8/21/08 8:52	>120	20.9	3.25
8/27/08 9:15	>100	17.3	5.06
10/22/08 14:33	>100	7.5	10.63
Exceeds Water Quality Standard			

Table 10. Little Comfort Lake Inlet 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		TSS (mg/L)	TP (mg/L)	Loading Interval		Interval Volume (cf)	Interval Volume (ac-ft)	Interval TSS (lb)	Interval TP (lb)
	Start	End			Start	End				
<i>Base**</i>			3	0.035	<i>1/1/08 0:00</i>	<i>4/2/08 14:00</i>	<i>17,278,272</i>	<i>396.86</i>	<i>2876</i>	<i>37.8</i>
Snowmelt Grab	4/2/08 14:15	4/2/08 14:15	7	0.245	4/2/08 14:00	4/4/2008 15:00	10,603,404	243.55	4634	162.2
<i>Base**</i>			3	0.035	<i>4/4/08 15:00</i>	<i>4/22/08 11:00</i>	<i>73,249,632</i>	<i>1,682.46</i>	<i>12194</i>	<i>160.0</i>
Storm Grab	4/22/08 14:48	4/22/08 14:48	8	0.053	4/22/08 11:00	4/22/08 17:00	1,322,328	30.37	660	4.4
<i>Base</i>			3	0.035	<i>4/22/08 17:00</i>	<i>4/24/08 9:00</i>	<i>8,373,642</i>	<i>192.33</i>	<i>1394</i>	<i>18.3</i>
Storm Grab	4/25/08 11:06	4/25/08 11:06	7	0.068	4/24/08 9:00	4/28/08 18:00	22,945,530	527.03	10027	97.4
<i>Base</i>			3	0.035	<i>4/28/08 18:00</i>	<i>5/2/08 12:00</i>	<i>16,313,000</i>	<i>374.69</i>	<i>3055</i>	<i>35.6</i>
Storm Grab	5/5/08 10:39	5/5/08 10:39	4	0.037	5/2/08 12:00	5/8/08 18:00	31,545,700	724.57	7877	72.9
Base Grab	5/21/08 9:38	5/21/08 9:38	4	0.047	5/8/08 18:00	5/25/08 16:00	49,890,770	1,145.93	12458	146.4
Storm Grab	5/27/08 12:05	5/27/08 12:05	13	0.101	5/25/08 16:00	5/30/08 22:00	16,651,350	382.46	13513	105.0
<i>Base</i>			3	0.035	<i>5/30/08 22:00</i>	<i>6/5/08 15:00</i>	<i>13,452,240</i>	<i>308.98</i>	<i>2239</i>	<i>29.4</i>
Storm Grab	6/6/08 9:05	6/6/08 9:05	2	0.065	6/5/08 15:00	6/7/08 0:00	2,458,573	56.47	307	10.0
<i>Base</i>			6	0.035	<i>6/7/08 0:00</i>	<i>6/11/08 10:00</i>	<i>8,553,086</i>	<i>196.45</i>	<i>3356</i>	<i>18.7</i>
Storm Grab	6/12/08 9:27	6/12/08 9:27	4	0.055	6/11/08 10:00	6/14/08 14:00	9,038,181	207.60	2257	31.0
Base Grab	6/23/08 10:18	6/23/08 10:18	5	0.047	6/14/08 14:00	6/27/08 16:00	22,262,610	511.35	6949	65.3
<i>Storm</i>			6	0.063	<i>6/27/08 16:00</i>	<i>6/30/08 8:00</i>	<i>4,427,915</i>	<i>101.70</i>	<i>1659</i>	<i>17.4</i>
<i>Base</i>			3	0.035	<i>6/30/08 8:00</i>	<i>7/19/08 13:00</i>	<i>10,322,020</i>	<i>237.08</i>	<i>1718</i>	<i>22.6</i>
<i>Storm</i>			6	0.063	<i>7/19/08 13:00</i>	<i>7/20/08 8:00</i>	<i>354,968</i>	<i>8.15</i>	<i>133</i>	<i>1.4</i>
Base Grab	7/31/08 9:15	7/31/08 9:15	1	0.029	7/20/08 8:00	8/6/08 13:00	3,654,786	83.95	228	6.6
<i>Storm</i>			6	0.063	<i>8/6/08 13:00</i>	<i>8/9/08 6:00</i>	<i>5,104,441</i>	<i>117.24</i>	<i>1912</i>	<i>20.1</i>
<i>Base</i>			3	0.035	<i>8/9/08 6:00</i>	<i>8/12/08 19:00</i>	<i>500,137</i>	<i>11.49</i>	<i>83</i>	<i>1.1</i>
<i>Storm</i>			6	0.063	<i>8/12/08 19:00</i>	<i>8/18/08 14:00</i>	<i>1,215,693</i>	<i>27.92</i>	<i>455</i>	<i>4.8</i>
<i>Base</i>			3	0.035	<i>8/18/08 14:00</i>	<i>9/25/08 14:00</i>	<i>12,446,600</i>	<i>285.88</i>	<i>2072</i>	<i>27.2</i>
Base Grab	10/22/08 14:33	10/22/08 14:33	1	0.017	9/25/08 14:00	10/25/08 14:00	7,150,848	164.25	446	7.6
<i>Base</i>			3	0.035	<i>10/25/08 14:00</i>	<i>11/3/08 11:00</i>	<i>130,831</i>	<i>3.01</i>	<i>22</i>	<i>0.3</i>
<i>Base**</i>			3	0.035	<i>11/3/08 11:00</i>	<i>1/1/09 0:00</i>	<i>10,925,280</i>	<i>250.94</i>	<i>1819</i>	<i>23.9</i>
Storm Average			6	0.063						
Base Average			3	0.035						
Snowmelt Average			7	0.245						
All Average			5	0.069						
Total							360,171,837	8,273	94,344	1,127
CLFLWD Major Subwatershed Total Acres										
Total Load							10,513			
Total TP/TSS (lb/ac/yr)									8.97	0.11
Total TP/TSS (kg/ha/yr)									10.06	0.12

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

** Interval volumes from 1/1/08 to 4/22/08 and 11/3/08 to 1/1/09 where estimated based upon base flow

Total phosphorus loading for Little Comfort Lake Inlet for 2008 was estimated at 0.11 lb/ac (1,127 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. The average nutrient concentrations for base and storm samples were actually lower at the Little Comfort Inlet.

2) Forest Lake Subwatershed

Forest Lake Outlet

The station at the Forest Lake Outlet site recorded stage, velocity, and flow from April 3 - November 3, 2008 (Figure 5). A power failure from June 22nd - July 2nd and no data was recorded during this period. Total discharge during the recorded period was 143,048,300 cf or 3,284 acre-ft. No automated rain gage was installed at this site to determine total seasonal rainfall. The highest discharge recorded of 33.93 cfs occurred on May 25, 2008. This peak is a result of a large storm event recorded in the general area of this site. The County Line Ditch site received 1.35 inches of rain over a 2-hour period contributing to this peak discharge event.

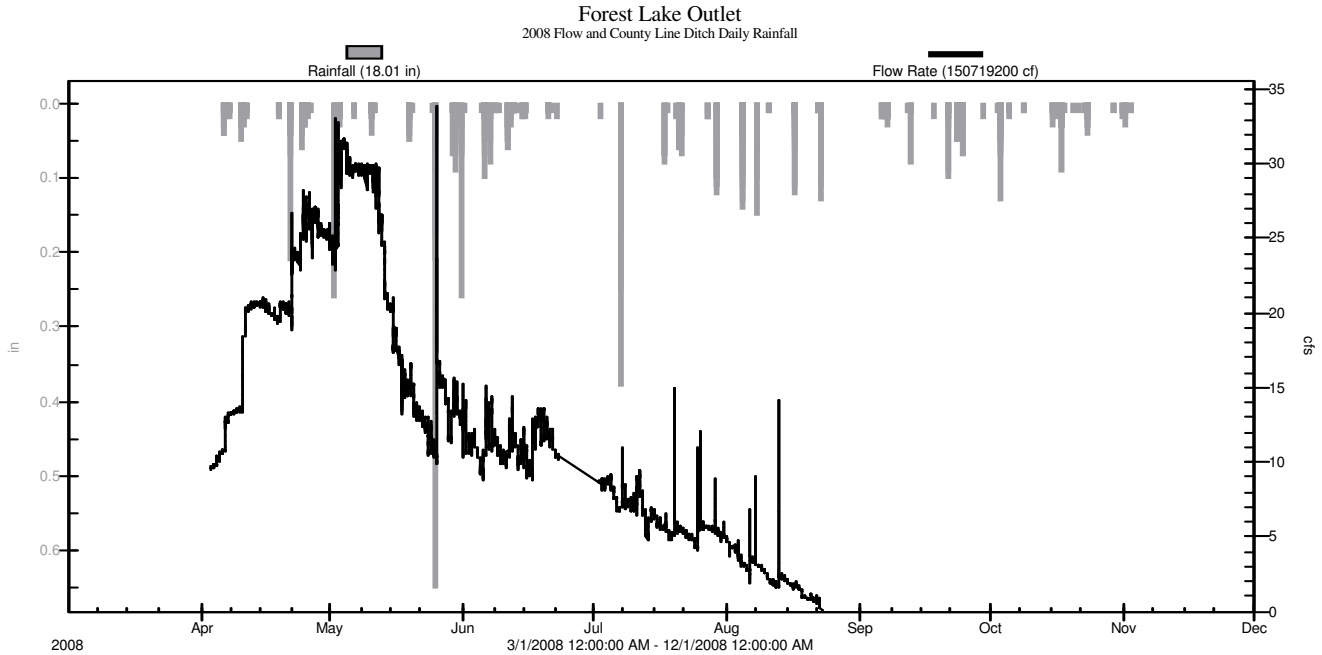


Figure 5. Forest Lake Outlet 2008 Flow and Daily Rainfall

Table 11. Forest Lake Outlet 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		Loading Interval		Interval Volume (cf)	Interval TSS (lb)	Interval TP (lb)			
	Start	End	TSS (mg/L)	TP (mg/L)				Start	End	
Base**			N/A	0.026	1/1/08 0:00	3/1/08 0:00	1,296,000	29.8	N/A	2.1
Base**			N/A	0.026	3/1/08 0:00	4/3/08 12:00	14,472,000	332.4	N/A	23.5
Base			N/A	0.026	4/3/08 12:00	4/10/08 13:00	7,275,990	167.1	N/A	11.8
Storm			N/A	0.037	4/10/08 13:00	4/14/08 1:00	5,937,881	136.4	N/A	13.7
Base			N/A	0.026	4/14/08 1:00	4/21/08 21:00	13,684,133	314.3	N/A	22.2
Storm			N/A	0.037	4/21/08 21:00	4/22/08 17:00	1,684,845	38.7	N/A	3.9
Base			N/A	0.026	4/22/08 17:00	4/24/08 7:00	3,237,026	74.4	N/A	5.3
Storm			N/A	0.037	4/24/08 7:00	4/28/08 0:00	8,439,125	193.8	N/A	19.5
Base			N/A	0.026	4/28/08 0:00	5/2/08 0:00	8,673,269	199.2	N/A	14.1
Storm			N/A	0.037	5/2/08 0:00	5/5/08 17:00	9,396,021	215.8	N/A	21.7
Base	5/14/2008 19:30	5/14/2008 19:30	N/A	0.051	5/5/08 17:00	5/25/08 16:00	35,596,558	817.6	N/A	113.3
Storm			N/A	0.037	5/25/08 16:00	5/26/08 9:00	1,044,003	24.0	N/A	2.4
Base	5/28/2008 18:30	5/28/2008 18:30	N/A	0.015	5/26/08 9:00	5/31/08 18:00	6,434,945	147.8	N/A	6.0
Storm	6/1/2008 18:00	6/1/2008 18:00	N/A	0.102	5/31/08 18:00	6/1/08 19:00	1,157,347	26.6	N/A	7.4
Base			N/A	0.026	6/1/08 19:00	6/5/08 16:00	3,575,076	82.1	N/A	5.8
Storm			N/A	0.037	6/5/08 16:00	6/7/08 16:00	2,163,627	49.7	N/A	5.0
Base	6/14/2008 19:30	6/14/2008 19:30	N/A	0.029	6/7/08 16:00	6/22/08 19:00	14,412,277	331.0	N/A	26.1
NO DATA					6/22/08 19:00	7/2/08 14:00	0	0.0	N/A	0.0
Base	7/5/2008 15:00	7/5/2008 15:00	N/A	0.031	7/2/08 14:00	7/7/08 19:00	3,610,602	82.9	N/A	7.0
Storm			N/A	0.037	7/7/08 19:00	7/8/08 11:00	480,043	11.0	N/A	1.1
Base			N/A	0.026	7/8/08 11:00	7/19/08 14:00	6,219,786	142.9	N/A	10.1
Storm			N/A	0.037	7/19/08 14:00	7/20/08 3:00	297,987	6.8	N/A	0.7
Base	7/22/2008 19:00	7/22/2008 19:00	N/A	0.022	7/20/08 3:00	7/25/08 10:00	2,334,842	53.6	N/A	3.2
Storm			N/A	0.037	7/25/08 10:00	7/26/08 12:00	576,242	13.2	N/A	1.3
Base	7/26/2008 13:00	7/26/2008 13:00	N/A	0.027	7/26/08 12:00	7/29/08 4:00	1,288,148	29.6	N/A	2.2
Storm			N/A	0.037	7/29/08 4:00	7/29/08 13:00	195,304	4.5	N/A	0.5
Base			N/A	0.026	7/29/08 13:00	8/6/08 14:00	2,833,512	65.1	N/A	4.6
Storm			N/A	0.037	8/6/08 14:00	8/8/08 7:00	514,980	11.8	N/A	1.2
Base	8/9/2008 16:20	8/9/2008 16:20	N/A	0.024	8/8/08 7:00	8/12/08 19:00	899,576	20.7	N/A	1.3
Storm			N/A	0.037	8/12/08 19:00	8/13/08 0:00	57,182	1.3	N/A	0.1
Base	8/31/2008 13:00	8/31/2008 13:00	N/A	0.043	8/13/08 0:00	9/13/08 0:00	1,192,655	27.4	N/A	3.2
Base	9/21/2008 13:30	9/21/2008 13:30	N/A	0.033	9/13/08 0:00	10/1/08 0:00	0	0.0	N/A	0.0
Base	10/9/2008 17:30	10/9/2008 17:30	N/A	0.035	10/1/08 0:00	11/3/08 12:00	0	0.0	N/A	0.0
Base**			N/A	0.026	11/3/08 12:00	1/1/09 0:00	252,720	5.8	N/A	0.4
Storm Average			N/A	0.102						
Base Average			N/A	0.026						
All Average			N/A	0.037						
Total							159,233,702	3,657	N/A	341
CLFLWD Major Subwatershed Total Acres							8,719			
Total TP/TSS (lb/ac/yr)									N/A	0.039
Total TP/TSS (kg/ha/yr)									N/A	0.044

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

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

Although no samples were collected at the Forest Lake Outlet site in 2008, the WCD used in-lake concentrations to estimate a total phosphorus load at this location. Total phosphorus loading for Forest Lake Outlet for 2008 was estimated at 0.039 lb/ac (341 lbs.) (Table 11). Monitored flows at the Forest Lake Outlet site were higher in 2008 than in 2007. 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 to be installed in 2009 will help to verify the contribution from the city.

3) Comfort Lake Subwatershed

County Line Ditch

The station at the County Line Ditch recorded flow from April 3, 2008 to November 4, 2008 (Figure 6). Total discharge during this period was 160,415,200 cf or 3,683 acre-ft. Total rainfall for the monitoring season was 16.85 inches. A peak flow of 50.88 cfs occurred on May 3rd from a cumulative rainfall of 1.19 inches that fell from May 2nd –3rd. 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 in the channel getting rerouted around the sensor.

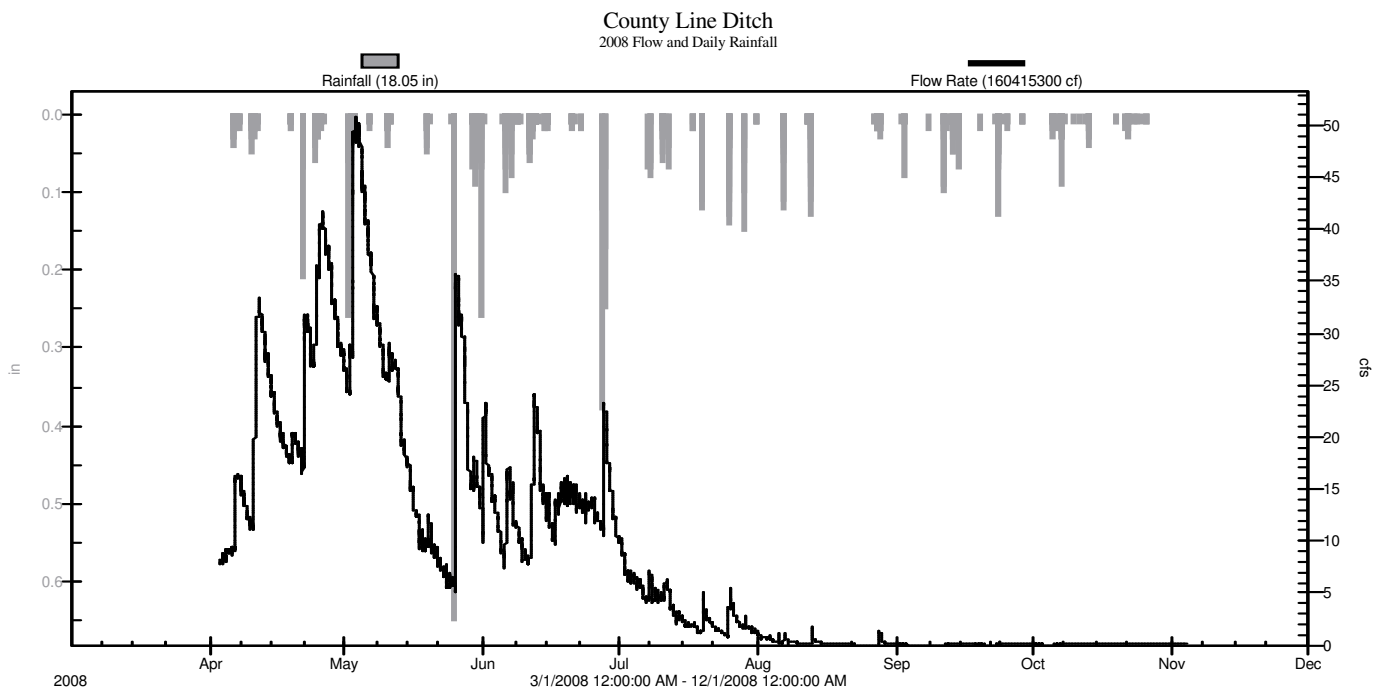


Figure 6. County Line Ditch 2008 Flow and Daily Rainfall

Grab samples and flow weighted composite samples were taken at the County Line Ditch site. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride and *E. Coli* results from all collected samples are listed in Table 12 and field water quality measurements are listed in Table 13. The highest TSS concentration of 140 mg/L was collected in a storm composite sample from July 25, 2008. The highest TKN concentration of 2.70 mg/L was collected in an April 2, 2008 snowmelt grab sample. The highest TP concentration of 0.212 mg/L was collected in a June 12 to June 13, 2008 storm composite sample.

Table 12. County Line Ditch 2008 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)	E. Coli (mpn/100ml)
Snowmelt Grab	4/2/2008 12:57	4/2/2008 12:57	6	-2	2.70	0.054	<0.010	183	<0.03	0.22	0.22	
Storm Composite	4/11/2008 2:27	4/13/2008 19:40	8	-3	2.10	0.054	<0.018	91	<0.03	0.31	0.13	
Storm Composite	4/22/2008 3:31	4/22/2008 14:52	13	3	1.00	-0.041	<0.010	76	<0.03	0.19	0.1	
Storm Composite	5/2/2008 21:07	5/5/2008 9:07	15	5	1.20	0.060	0.069	60	<0.03	0.25	0.07	
Base Grab	5/21/2008 10:13	5/21/2008 10:13	6	3	0.76	-0.030	-0.025	53	<0.03	<0.05	<0.02	
Storm Composite	5/25/2008 18:52	5/28/2008 11:58	40	-11	1.70	0.119	0.066	67	<0.03	0.23	<0.02	
E. Coli Grab	6/5/2008 9:55	6/5/2008 9:55										20
E. Coli Grab	6/12/2008 8:46	6/12/2008 8:46										1300
Storm Composite	6/12/2008 4:10	6/13/2008 11:26	97	24	2.60	0.212	-0.036	67	<0.03	0.09	-0.04	
E. Coli Grab	6/19/2008 8:50	6/19/2008 8:50										28
Base Grab	6/23/2008 9:06	6/23/2008 9:06	19	6	0.83	-0.044	<0.010	35	<0.03	<0.05	<0.02	
E. Coli Grab	6/26/2008 10:15	6/26/2008 10:15										18
E. Coli Grab	6/30/2008 9:07	6/30/2008 9:07										34
E. Coli Grab	7/7/2008 9:45	7/7/2008 9:45										66
E. Coli Grab	7/14/2008 9:45	7/14/2008 9:45										45
E. Coli Grab	7/17/2008 7:22	7/17/2008 7:22										162
Storm Composite	7/19/2008 16:35	7/19/2008 22:49	42	13	1.60	0.121	<0.010	56	<0.03	0.14	<0.02	
E. Coli Grab	7/24/2008 8:25	7/24/2008 8:25										140
Storm Composite	7/25/2008 16:14	7/25/2008 21:29	140	29	1.50	0.155	<0.010	57	<0.03	0.06	-0.02	
Base Grab	7/31/2008 10:00	7/31/2008 10:00	7	4	0.92	0.051	-0.031	41	<0.03	0.05	-0.06	
E. Coli Grab	7/31/2008 10:00	7/31/2008 10:00										129
E. Coli Grab	8/4/2008 9:20	8/4/2008 9:20										131
E. Coli Grab	8/7/2008 8:30	8/7/2008 8:30										142
E. Coli Grab	8/14/2008 8:43	8/14/2008 8:43										218
E. Coli Grab	8/21/2008 9:25	8/21/2008 9:25										210
E. Coli Grab	8/27/2008 9:50	8/27/2008 9:50										>2420
Storm Composite	8/28/2008 1:17	8/29/2008 13:08	29	13	1.70	0.170						
Base Grab	9/8/2008 15:45	9/8/2008 15:45	7	4	1.7	0.170	-0.010	108	0.05	0.07	0.14	
Storm Composite	10/7/2008 13:24	10/9/2008 9:00	8	5	2.4	0.082	-0.026	126	<0.03	0.15	-0.03	
Base Grab	10/22/2008 13:54	10/22/2008 13:54	3	-2	0.97	-0.042	-0.019	112	<0.03	0.14	0.1	
	Exceeds Water Quality Standard											

Table 13. County Line Ditch 2008 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)
4/14/08 9:41	118		
4/22/08 15:25	90	10.8	10.70
4/25/08 11:44	81	9.5	8.68
5/14/08 14:24	>100	16.4	8.80
5/21/08 10:13	>120	13.5	9.61
6/16/08 12:04		20.0	7.73
6/19/08 8:50	59	20.1	7.95
6/23/08 9:06	57	21.0	7.55
6/26/08 10:16		23.9	7.73
6/30/08 9:07	66	21.5	7.20
7/7/08 9:53	71	24.3	7.56
7/14/08 9:45	80	21.5	6.90
7/17/08 7:22	76	24.5	5.00
7/21/08 9:36	110	23.1	5.68
7/24/08 8:25	90	23.4	5.47
7/28/08 8:51	92	23.4	5.60
7/31/08 9:57	>100	24.1	3.57
8/4/08 9:20	75	23.2	5.15
8/7/08 8:30	95	21.4	1.88
8/14/08 8:43	91	21.4	4.03
8/21/08 9:22	>120	21.8	3.57
8/27/08 9:50	>100	17.6	4.35
8/29/08 13:56	52	22.9	4.40
10/8/08 11:37	>100	11.8	7.79
10/22/08 13:54	>100	7.2	12.23
	Exceeds Water Quality Standard		

Table 14. County Line Ditch 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		Loading Interval		Interval Volume (cf)	Interval Volume (ac ft)	Interval TSS (lb)	Interval TP (lb)		
	Start	End	TSS (mg/L)	TP (mg/L)					Start	End
Base**			8.4	0.067	1/1/08 0:00	4/1/08 11:30	1,185,570	27.2	622	5.0
Snowmelt Grab	4/2/2008 12:57	4/2/2008 12:57	6.0	0.054	4/1/08 11:30	4/3/08 13:30	5,657,999	130.0	2,119	19.1
Base			8.4	0.067	4/3/08 13:30	4/10/08 15:30	7,178,139	164.9	3,764	30.2
Storm Composite	4/11/2008 2:27	4/13/2008 19:40	8.0	0.054	4/10/08 15:30	4/13/08 20:30	7,678,015	176.4	3,834	25.9
Base			8.4	0.067	4/13/08 20:30	4/21/08 18:30	14,199,220	326.1	7,446	59.4
Storm Composite	4/22/2008 3:31	4/22/2008 14:52	13.0	0.041	4/21/08 18:30	4/22/08 15:30	2,077,883	47.7	1,686	5.3
Base			8.4	0.067	4/22/08 15:30	5/2/08 1:30	26,272,570	603.5	13,777	109.9
Storm Composite	5/2/2008 21:07	5/5/2008 9:07	15.0	0.060	5/2/08 1:30	5/5/08 9:30	12,407,720	285.0	11,618	46.5
Base Grab	5/21/2008 10:13	5/21/2008 10:13	6.0	0.030	5/5/08 9:30	5/25/08 16:30	33,059,120	759.3	12,383	61.9
Storm Composite	5/25/2008 18:52	5/28/2008 11:58	40.0	0.119	5/25/08 16:30	5/28/08 12:30	7,050,254	161.9	17,605	52.4
Base			8.4	0.067	5/28/08 12:30	5/31/08 18:30	4,349,328	99.9	2,281	18.2
Storm			43.6	0.113	5/31/08 18:30	6/1/08 14:30	1,477,532	33.9	4,017	10.4
Base			8.4	0.067	6/1/08 14:30	6/5/08 16:30	4,563,043	104.8	2,393	19.1
Storm			43.6	0.113	6/5/08 16:30	6/7/08 18:30	2,562,263	58.9	6,974	18.1
Base			8.4	0.067	6/7/08 18:30	6/11/08 10:30	3,034,947	69.7	1,591	12.7
Storm Composite	6/12/2008 4:10	6/13/2008 11:26	97.0	0.212	6/11/08 10:30	6/13/08 11:30	3,283,966	75.4	19,886	43.5
Base Grab	6/23/2008 9:06	6/23/2008 9:06	19.0	0.044	6/13/08 11:30	6/27/08 16:30	16,677,680	383.1	19,781	45.8
Storm			43.6	0.113	6/27/08 16:30	6/28/08 11:30	1,414,398	32.5	3,850	10.0
Base			8.4	0.067	6/28/08 11:30	7/19/08 14:30	10,345,860	237.6	5,425	43.3
Storm Composite	7/19/2008 16:35	7/19/2008 22:49	42.0	0.121	7/19/08 14:30	7/19/08 23:30	125,064	2.9	328	0.9
Base			8.4	0.067	7/19/08 23:30	7/25/08 10:30	826,310	19.0	433	3.5
Storm Composite	7/25/2008 16:14	7/25/2008 21:29	140.0	0.155	7/25/08 10:30	7/25/08 21:30	161,225	3.7	1,409	1.6
Base			8.4	0.067	7/25/08 21:30	7/29/08 3:30	707,494	16.3	371	3.0
Storm			43.6	0.113	7/29/08 3:30	7/29/08 13:30	84,098	1.9	229	0.6
Base Grab	7/31/2008 10:00	7/31/2008 10:00	7.0	0.051	7/29/08 13:30	8/6/08 14:30	548,512	12.6	240	1.7
Storm			43.6	0.113	8/6/08 14:30	8/6/08 22:30	21,143	0.5	58	0.1
Base			8.4	0.067	8/6/08 22:30	8/12/08 18:30	103,849	2.4	54	0.4
Storm			43.6	0.113	8/12/08 18:30	8/13/08 3:30	29,013	0.7	79	0.2
Base			8.4	0.067	8/13/08 3:30	8/27/08 23:30	85,494	2.0	45	0.4
Storm Composite	8/28/2008 1:17	8/29/2008 13:08	29.0	0.170	8/27/08 23:30	8/29/08 13:30	48,451	1.1	88	0.5
Base Grab	9/8/2008 15:45	9/8/2008 15:45	7.0	0.170	8/29/08 13:30	9/13/08 15:30	6,948	0.2	3	0.1
Storm			43.6	0.113	9/13/08 15:30	9/15/08 6:30	7,583	0.2	21	0.1
Base			8.4	0.067	9/15/08 6:30	9/23/08 14:30	2,572	0.1	1	0.0
Storm			43.6	0.113	9/23/08 14:30	9/26/08 12:30	10,548	0.2	29	0.1
Base			8.4	0.067	9/26/08 12:30	10/7/08 10:30	354	0.0	0	0.0
Storm Composite	10/7/2008 13:24	10/9/2008 9:00	8.0	0.082	10/7/08 10:30	10/9/08 9:30	10,167	0.2	5	0.1
Base			8.4	0.067	10/9/08 9:30	10/13/08 12:30	702	0.0	0	0.0
Storm			43.6	0.113	10/13/08 12:30	10/13/08 22:30	1,567	0.0	4	0.0
Base			8.4	0.067	10/13/08 22:30	10/20/08 11:30	1,460	0.0	1	0.0
Base Grab	10/22/2008 13:54	10/22/2008 13:54	3.0	0.042	10/20/08 11:30	11/4/08 10:30	766	0.0	0	0.0
Base**			8.4	0.067	11/4/08 10:30	1/1/09 0:00	59,681	1.4	31	0.3
Storm Average			43.6	0.113						
Base Average			8.4	0.067						
Snowmelt Average			6.0	0.054						
All Average			29.3	0.094						
Total							167,318,507	3,843	144,481	650
CLFLWD Major Subwatershed Total Acres							9,806			
Total TP/TSS (lb/ac/yr)									14.73	0.066
Total TP/TSS (kg/ha/yr)									16.51	0.074

*Italics indicate estimated concentrations based on average base and storm flow concentrations
 ** Interval volumes from 1/1/08 to 4/1/08 and 11/4/08 to 1/1/09 where estimated based upon base flow

Total phosphorus loading for the County Line Ditch Site for 2008 was estimated at 0.066 lb/ac (650 lbs.) (Table 14). Average total phosphorus concentrations were lower at this site in 2008 compared to 2007. If you utilize the loading data from this site with the loading data from the Forest Lake Outlet site, you can estimate that approximately 309 lbs. of phosphorus is leaving the City of Forest Lake through the Bixby Park area. One item that the monitoring staff noticed with regards to the data at this site is that although the channel has substantial sedimentation within it, the sediment does not appear to be originating from high TSS concentrations. The sediment load in the channel and what was sampled appears to be present due to a large volume of water carrying the sediment versus small volumes carrying high concentrations. Volume control rules could substantially eliminate the problem of high loads due to transport of sediment and phosphorus.

Greenway Avenue

2008 was the first year that data was collected at the Greenway Avenue site. The primary purpose of this site was to quantify the loads previous to discharging to the Shallow Pond for determination of phosphorus release or capture between this location and Comfort Lake as part of the five lake TMDL study. Flow was recorded from April 14-November 4, 2008 (Figure 7). Total discharge for this period was 196,117,700 cf, or 4502 acre-feet. No automated rain gage was installed at this site to record daily rainfall. A peak discharge of 52.75 cfs occurred on May 4, 2008. This peak was caused by a large precipitation event in the area. 1.09 inches of rain fell at the County Line Ditch site from May 2nd-5th.

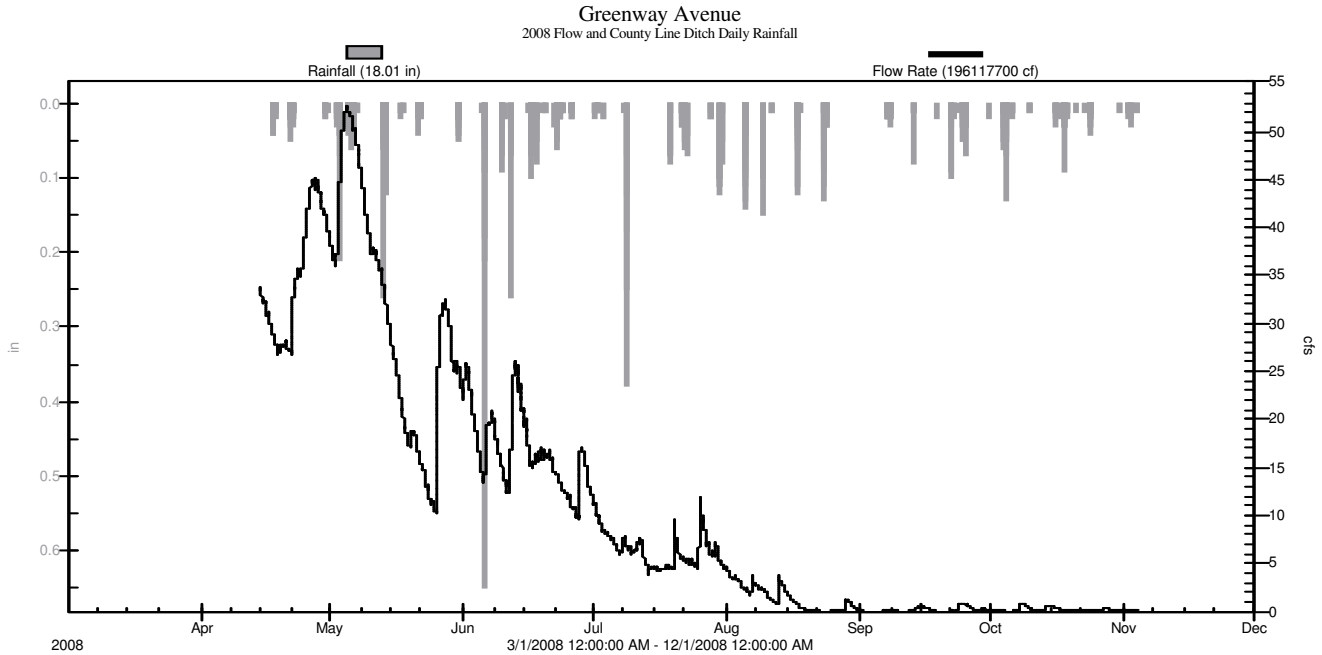


Figure 7. Greenway Avenue 2008 Flow and Daily Rainfall

Grab samples and flow weighted composite samples were taken at the Greenway Avenue site. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride and *E. Coli* results from all collected samples are listed in Table 15 and field water quality measurements are listed in Table 16. The highest TSS, TKN and TP results were from the June 28, 2008 storm composite sample. These values were 422 mg/L, 4.6 mg/L and 0.523 mg/L, respectively.

Table 15. Greenway Avenue 2008 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 N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	E. Coli (#/100ml)
Snowmelt Grab	4/2/08 13:11	4/2/08 13:11	6	~3	2.6	0.081	<0.010	171	<0.03	0.3	0.25	
Storm Grab	4/22/08 15:27	4/22/08 15:27	5	3	1.5	~0.026	~0.010	72	<0.03	0.35	0.1	
Storm Composite	4/25/08 14:34	4/28/08 21:45	97	33	2.3	0.146	~0.018	67	<0.03	0.37	~0.03	
Storm Composite	5/3/08 13:38	5/5/08 9:29	103	36	1.8	0.166	~0.012	58	<0.03	0.28	~0.02	
Base Grab	5/21/08 10:04	5/21/08 10:04	17	6	1.1	~0.047	<0.010	55	<0.03	<0.05	<0.02	
E. Coli Grab	6/5/08 9:50	6/5/08 9:50										31
Storm Composite	6/12/08 12:26	6/13/08 16:55	76	24	2.3	0.173	~0.023	65	<0.03	<0.05	~0.02	
Base Grab	6/23/08 9:31	6/23/08 9:31	9	4	0.91	0.056	<0.010	35	<0.03	<0.05	0.07	
E. Coli Grab	6/26/08 10:00	6/26/08 10:00										126
Storm Composite	6/28/08 2:38	6/29/08 4:44	422	102	4.6	0.523		51				
E. Coli Grab	7/17/08 7:38	7/17/08 7:38										147
Base Grab	7/31/08 9:45	7/31/08 9:45	5	3	0.97	0.090	~0.012	27	<0.03	0.06	~0.05	
E. Coli Grab	8/7/08 8:45	8/7/08 8:45										326
E. Coli Grab	8/27/08 9:40	8/27/08 9:40										104
Storm Composite	8/28/08 6:24	8/29/08 14:17	87	31	2.4	0.229	~0.020	77	0.06	<0.03	~0.06	
Exceeds Water Quality Standard												

Table 16. Greenway Avenue 2008 Field water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)
4/22/08 15:27	95	11.5	11.11
4/25/08 11:34	46	7.2	7.51
4/29/08 10:05	>120	5.9	11.15
5/14/08 14:21		16.0	8.92
5/21/08 10:04	100	13.0	8.80
6/16/08 12:41		19.5	7.47
6/23/08 9:31	81	20.5	5.29
7/2/08 10:40	60	23.8	4.98
7/17/08 7:38	>120	24.3	1.80
7/31/08 9:43	81	22.7	2.40
8/27/08 9:40	>100	18.9	5.56
8/29/08 14:26	77	23.3	12.96
Exceeds Water Quality Standard			

Table 17. Greenway Avenue 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		Loading Interval		Interval Volume (cf)	Interval Volume (ac-ft)	Interval TSS (lb)	Interval TP (lb)		
	Start	End	TSS (mg/L)	TP (mg/L)					Start	End
<i>Base**</i>			<i>10.3</i>	<i>0.064</i>	<i>1/1/08 0:00</i>	<i>4/2/08 12:30</i>	<i>1,279,008</i>	<i>29.4</i>	<i>825</i>	<i>5.1</i>
Snowmelt Grab	4/2/08 13:11	4/2/08 13:11	6.0	0.081	4/2/08 12:30	4/5/08 12:30	10,622,016	244.0	3,979	53.7
<i>Base**</i>			<i>10.3</i>	<i>0.064</i>	<i>4/5/08 12:30</i>	<i>4/14/08 13:30</i>	<i>22,701,672</i>	<i>521.4</i>	<i>14,644</i>	<i>91.2</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>4/14/08 13:30</i>	<i>4/21/08 21:30</i>	<i>18,508,580</i>	<i>425.1</i>	<i>11,901</i>	<i>73.9</i>
Storm Grab	4/22/08 15:27	4/22/08 15:27	5.0	0.026	4/21/08 21:30	4/24/08 6:30	6,936,824	159.3	2,165	11.3
Storm Composite	4/25/08 14:34	4/28/08 21:45	97.0	0.146	4/24/08 6:30	4/28/08 22:30	17,051,500	391.7	103,253	155.4
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>4/28/08 22:30</i>	<i>5/2/08 13:30</i>	<i>12,271,020</i>	<i>281.9</i>	<i>7,890</i>	<i>49.0</i>
Storm Composite	5/3/08 13:38	5/5/08 9:29	103.0	0.166	5/2/08 13:30	5/10/08 8:30	31,531,420	724.2	202,744	326.8
Base Grab	5/21/08 10:04	5/21/08 10:04	17.0	0.047	5/10/08 8:30	5/25/08 16:30	30,425,280	698.8	32,289	89.3
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>5/25/08 16:30</i>	<i>5/29/08 9:30</i>	<i>9,324,945</i>	<i>214.2</i>	<i>76,665</i>	<i>122.8</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>5/29/08 9:30</i>	<i>5/31/08 18:30</i>	<i>5,109,453</i>	<i>117.4</i>	<i>3,285</i>	<i>20.4</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>5/31/08 18:30</i>	<i>6/2/08 7:30</i>	<i>3,258,245</i>	<i>74.8</i>	<i>26,781</i>	<i>42.9</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>6/2/08 7:30</i>	<i>6/5/08 16:30</i>	<i>5,291,816</i>	<i>121.5</i>	<i>3,403</i>	<i>21.1</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>6/5/08 16:30</i>	<i>6/8/08 1:30</i>	<i>3,857,240</i>	<i>88.6</i>	<i>31,712</i>	<i>50.8</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>6/8/08 1:30</i>	<i>6/11/08 7:30</i>	<i>4,315,885</i>	<i>99.1</i>	<i>2,775</i>	<i>17.2</i>
Storm Composite	6/12/08 12:26	6/13/08 16:55	76.0	0.173	6/11/08 7:30	6/15/08 21:30	8,321,664	191.1	39,481	89.9
Base Grab	6/23/08 9:31	6/23/08 9:31	9.0	0.056	6/15/08 21:30	6/27/08 16:30	14,360,800	329.9	8,068	50.2
Storm Composite	6/28/08 2:38	6/29/08 4:44	422.0	0.523	6/27/08 16:30	6/29/08 17:30	2,764,618	63.5	72,831	90.3
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>6/29/08 17:30</i>	<i>7/19/08 14:30</i>	<i>11,757,800</i>	<i>270.1</i>	<i>7,560</i>	<i>47.0</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>7/19/08 14:30</i>	<i>7/20/08 20:30</i>	<i>813,747</i>	<i>18.7</i>	<i>6,690</i>	<i>10.7</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>7/20/08 20:30</i>	<i>7/25/08 9:30</i>	<i>2,022,235</i>	<i>46.4</i>	<i>1,304</i>	<i>8.1</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>7/25/08 9:30</i>	<i>7/29/08 22:30</i>	<i>2,953,480</i>	<i>67.8</i>	<i>24,282</i>	<i>38.9</i>
Base Grab	7/31/08 9:45	7/31/08 9:45	5.0	0.09	7/29/08 22:30	8/6/08 14:30	2,302,482	52.9	719	12.9
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>8/6/08 14:30</i>	<i>8/7/08 11:30</i>	<i>231,249</i>	<i>5.3</i>	<i>1,901</i>	<i>3.0</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>8/7/08 11:30</i>	<i>8/12/08 18:30</i>	<i>812,260</i>	<i>18.7</i>	<i>522</i>	<i>3.2</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>8/12/08 18:30</i>	<i>8/14/08 2:30</i>	<i>324,496</i>	<i>7.5</i>	<i>2,668</i>	<i>4.3</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>8/14/08 2:30</i>	<i>8/27/08 21:30</i>	<i>502,854</i>	<i>11.5</i>	<i>324</i>	<i>2.0</i>
Storm Composite	8/28/08 6:24	8/29/08 14:17	87.0	0.229	8/27/08 21:30	9/1/08 20:30	206,760	4.7	1,123	3.0
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>9/1/08 20:30</i>	<i>9/23/08 16:30</i>	<i>135,607</i>	<i>3.1</i>	<i>87</i>	<i>0.5</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>9/23/08 16:30</i>	<i>9/26/08 23:30</i>	<i>151,963</i>	<i>3.5</i>	<i>1,249</i>	<i>2.0</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>9/26/08 23:30</i>	<i>10/7/08 6:30</i>	<i>91,269</i>	<i>2.1</i>	<i>59</i>	<i>0.4</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>10/7/08 6:30</i>	<i>10/10/08 10:30</i>	<i>134,430</i>	<i>3.1</i>	<i>1,105</i>	<i>1.8</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>10/10/08 10:30</i>	<i>10/13/08 9:30</i>	<i>20,498</i>	<i>0.5</i>	<i>13</i>	<i>0.1</i>
<i>Storm</i>			<i>131.7</i>	<i>0.211</i>	<i>10/13/08 9:30</i>	<i>10/16/08 18:30</i>	<i>129,684</i>	<i>3.0</i>	<i>1,066</i>	<i>1.7</i>
<i>Base</i>			<i>10.3</i>	<i>0.064</i>	<i>10/16/08 18:30</i>	<i>11/4/08 10:30</i>	<i>197,470</i>	<i>4.5</i>	<i>127</i>	<i>0.8</i>
<i>Base**</i>			<i>10.3</i>	<i>0.064</i>	<i>11/4/08 10:30</i>	<i>1/1/09 0:00</i>	<i>795,744</i>	<i>18.3</i>	<i>512</i>	<i>3.2</i>
Storm Average			131.7	0.211						
Base Average			10.3	0.064						
Snowmelt Average			6.0	0.081						
All Average			82.7	0.154						
Total							231,516,014	5,318	696,004	1,505
CLFLWD Major Subwatershed Total Acres							11,122			
Total TP/TSS (lb/ac/yr)									62.58	0.135
Total TP/TSS (kg/ha/yr)									70.14	0.152

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

** Interval volumes from 1/1/08 to 4/14/08 and 11/4/08 to 1/1/09 where estimated based upon base flow

Total phosphorus loading for the Greenway Avenue Site for 2008 was estimated at 0.135 lb/ac (1,505 lbs.) (Table 17). When compared to the County Line Ditch site, total discharge and average nutrient concentrations were higher at Greenway Ave, resulting in a higher load.

Comfort Lake Inlet

The station for the Comfort Lake Inlet site recorded flow between April 3-September 24, and rainfall through November 1, 2008 (Figure 8). Total discharge during this period was 267,964,800 cf or 6,152 acre-ft. Total rainfall for the monitoring season was 18.24 inches. A peak flow of 52.37 cfs occurred on May 5, 2008 due to precipitation events between May 2nd and 3rd totaling 1.24 inches.

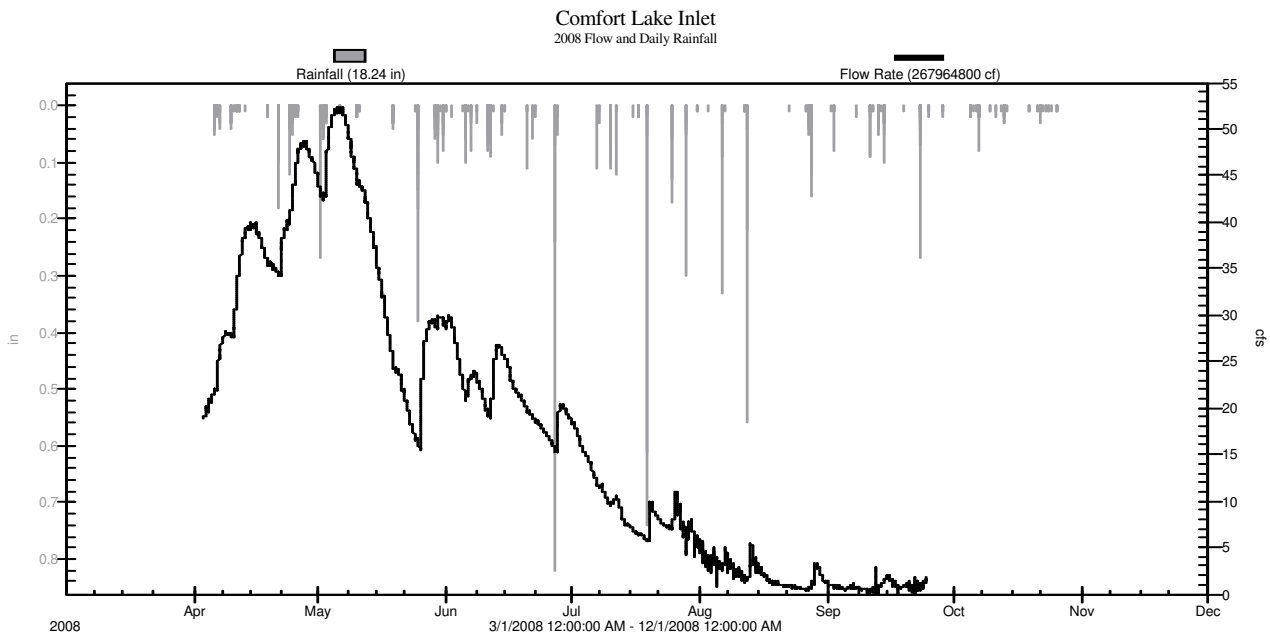


Figure 8. Comfort Lake Inlet 2008 Flow and Daily Rainfall

Grab samples were taken at the Comfort Lake Inlet site in 2008. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Dissolved Phosphorus, Ammonia Nitrogen, Chloride and *E. Coli* results from all collected samples are listed in Table 18 and field water quality measurements are listed in Table 19. The highest TKN and TP concentrations were 2.8 mg/L (April 2nd snowmelt grab) and 0.097 mg/L (June 6th storm grab), respectively. The highest TSS concentration observed was 17 mg/L from a May 21st base grab and a June 6th storm grab.

Table 18. Comfort Lake Inlet 2008 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)	E. Coli (mpn/100ml)
Snowmelt Grab	4/2/08 13:18	4/2/08 13:18	4	~2	2.8	0.069	~0.021	165	<0.03	0.41	0.24	
Storm Grab	4/22/08 15:04	4/22/08 15:04	4	~2	1.3	~0.038	<0.010	77	<0.03	0.44	~0.06	
Storm Grab	4/25/08 11:14	4/25/08 11:14	12	4	1.4	~0.047	~0.021	69	<0.03	0.37	0.07	
Storm Grab	5/5/08 10:14	5/5/08 10:14	8	4	1.5	0.058	<0.010	58	<0.03	0.25	~0.02	
Base Grab	5/21/08 9:52	5/21/08 9:52	17	6	1.2	0.067	~0.011	56	<0.03	0.07	~0.02	
Storm Grab	5/27/08 11:11	5/27/08 11:11	16	6	1.6	0.081	~0.022	66	<0.03	0.14	~0.05	
E. Coli Grab	6/5/08 10:35	6/5/08 10:35										86
Storm Grab	6/6/08 8:37	6/6/08 8:37	17	6	1.8	0.097	~0.012	79	<0.03	0.13	0.1	
Storm Grab	6/12/08 9:07	6/12/08 9:07	16	7	1.6	0.087	~0.019	71	<0.03	0.16	0.12	
E. Coli Grab	6/12/08 9:07	6/12/08 9:07										365
E. Coli Grab	6/19/08 9:00	6/19/08 9:00										150
Base Grab	6/23/08 9:49	6/23/08 9:49	14	6	0.86	0.066	<0.010	36	<0.03	0.12	0.06	
E. Coli Grab	6/26/08 9:45	6/26/08 9:45										249
E. Coli Grab	6/30/08 9:28	6/30/08 9:28										206
E. Coli Grab	7/7/09 9:30	7/7/08 9:30										115
E. Coli Grab	7/14/08 10:00	7/14/08 10:00										160
E. Coli Grab	7/17/08 7:50	7/17/08 7:50										238
E. Coli Grab	7/24/08 8:40	7/24/08 8:40										172
Base Grab	7/31/08 9:30	7/31/08 9:30	3	~2	0.98	0.050	~0.020	46	<0.03	0.2	0.08	
E. Coli Grab	7/31/08 9:30	7/31/08 9:30										167
E. Coli Grab	8/7/08 9:00	8/7/08 9:00										649
E. Coli Grab	8/11/08 9:30	8/11/08 9:30										179
E. Coli Grab	8/14/08 9:08	8/14/08 9:08										387
E. Coli Grab	8/21/08 9:10	8/21/08 9:10										150
E. Coli Grab	8/27/08 9:25	8/27/08 9:25										326
Storm Grab	9/15/08 10:07	9/15/08 10:07	3	~2	1.5	0.060	~0.015	104	<0.03	0.57	0.06	
Base Grab	10/20/08 14:14	10/20/08 14:14	~1	~1	0.62	~0.039	<0.010	61	0.04	1.04	<0.02	
Exceeds Water Quality Standard												

Table 19. Comfort Lake Inlet 2008 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)
4/22/08 15:04	105	10.2	12.03
4/25/08 11:14	77	8.9	7.47
5/5/08 10:14	100	8.9	7.47
5/14/08 15:01		13.8	8.84
5/21/08 9:52	102	11.7	7.14
6/6/08 9:22	61	17.7	5.14
6/12/08 9:07	60	17.0	5.40
6/19/08 9:00	75	18.7	4.97
6/26/08 9:56		21.7	3.89
6/30/08 9:28	76	19.8	4.50
7/2/08 10:16	69	22.4	3.83
7/7/08 9:37	>100	22.7	3.89
7/14/08 10:00	>120	19.3	5.62
7/17/08 7:50	>120	23.8	4.44
7/24/08 8:40	>120	22.7	5.09
7/31/08 9:28	>100	22.7	3.49
8/7/08 9:00	100	20.3	4.74
8/11/08 9:34	>120	18.7	5.59
8/14/08 9:08	115	20.7	4.56
8/21/08 9:05	>120	20.5	2.71
8/27/08 9:25	>120	16.3	6.20
10/22/08 14:14	>100	7.1	4.18
Exceeds Water Quality Standard			

Table 20. Comfort Lake Inlet 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		TSS (mg/L)		TP (mg/L)		Loading Interval		Interval Volume (cf)	Interval Volume (ac-ft)	Interval TSS (lb)	Interval TP (lb)
	Start	End			Start	End						
Base**			10.4	0.066	1/1/08 0:00	4/2/08 13:00	3,997,800	91.8	2,586	16.4		
Snowmelt Grab	4/2/08 13:18	4/2/08 13:18	4.0	0.069	4/2/08 13:00	4/3/08 14:00	1,998,900	45.9	499	8.6		
Base			10.4	0.066	4/3/08 14:00	4/10/08 15:00	14,883,120	341.8	9,629	60.9		
Storm			10.4	0.066	4/10/08 15:00	4/15/08 5:00	14,463,810	332.2	9,358	59.2		
Base			10.4	0.061	4/15/08 5:00	4/21/08 21:00	21,117,760	485.1	13,662	80.9		
Storm Grab	4/22/08 15:04	4/22/08 15:04	4.0	0.038	4/21/08 21:00	4/24/08 8:00	8,270,583	190.0	2,065	19.6		
Storm Grab	4/25/08 11:14	4/25/08 11:14	12.0	0.047	4/24/08 8:00	4/28/08 3:00	15,194,240	349.0	11,382	44.6		
Base			10.4	0.066	4/28/08 3:00	5/2/08 14:00	17,469,720	401.3	11,302	71.5		
Storm Grab	5/5/08 10:14	5/5/08 10:14	8.0	0.058	5/2/08 14:00	5/7/08 11:00	21,292,600	489.1	10,634	77.1		
Base			10.4	0.066	5/7/08 11:00	5/20/08 16:00	42,680,740	980.3	27,613	174.6		
Base Grab	5/21/08 9:52	5/21/08 9:52	17.0	0.068	5/20/08 16:00	5/25/08 16:00	8,204,573	188.4	8,707	34.8		
Storm Grab	5/27/08 11:11	5/27/08 11:11	16.0	0.081	5/25/08 16:00	6/3/08 4:00	20,766,750	477.0	20,742	105.0		
Base			10.4	0.066	6/3/08 4:00	6/5/08 16:00	9,849,600	226.2	6,372	40.3		
Storm Grab	6/6/08 8:37	6/6/08 8:37	17.0	0.097	6/5/08 16:00	6/8/08 6:00	5,152,491	118.3	5,468	31.2		
Base			10.4	0.066	6/8/08 6:00	6/11/08 11:00	5,812,437	133.5	3,760	23.8		
Storm Grab	6/12/08 9:07	6/12/08 9:07	16.0	0.087	6/11/08 11:00	6/14/08 21:00	7,358,401	169.0	7,350	40.0		
Base Grab	6/23/08 9:49	6/23/08 9:49	14.0	0.066	6/14/08 21:00	6/27/08 17:00	21,746,570	499.5	19,006	89.6		
Storm			10.4	0.066	6/27/08 17:00	6/29/08 5:00	2,572,230	59.1	1,664	10.5		
Base			10.4	0.066	6/29/08 5:00	7/19/08 14:00	20,341,420	467.2	13,160	83.2		
Storm			10.4	0.066	7/19/08 14:00	7/20/08 10:00	675,793	15.5	437	2.8		
Base			10.9	0.066	7/20/08 10:00	7/25/08 9:00	3,361,143	77.2	2,278	13.8		
Storm			10.4	0.066	7/25/08 9:00	7/26/08 13:00	976,146	22.4	632	4.0		
Base Grab	7/31/08 9:30	7/31/08 9:30	3.0	0.05	7/26/08 13:00	8/6/08 14:00	4,863,488	111.7	911	15.2		
Storm			10.4	0.066	8/6/08 14:00	8/9/08 14:00	848,501	19.5	549	3.5		
Base			10.4	0.066	8/9/08 14:00	8/12/08 19:00	539,363	12.4	349	2.2		
Storm			10.4	0.066	8/12/08 19:00	8/14/08 9:00	518,876	11.9	336	2.1		
Base			10.4	0.066	8/14/08 9:00	8/27/08 23:00	1,351,532	31.0	874	5.5		
Storm			10.4	0.066	8/27/08 23:00	8/30/08 3:00	449,357	10.3	291	1.8		
Base			10.4	0.066	8/30/08 3:00	9/10/08 2:00	777,990	17.9	503	3.2		
Storm Grab	9/15/08 10:07	9/15/08 10:07	3.0	0.060	9/10/08 2:00	9/16/08 10:00	534,722	12.3	100	2.0		
Base			10.4	0.066	9/16/08 10:00	9/23/08 6:00	443,636	10.2	287	1.8		
Storm			10.4	0.066	9/23/08 6:00	9/24/08 17:15	157,277	3.6	102	0.6		
Base**			10.4	0.066	9/24/08 17:15	11/28/08 17:00	4,211,325	96.7	2,725	17.2		
Base**			10.4	0.066	11/28/08 17:00	1/1/09 0:00	1,438,200	33.0	934	5.9		
Storm Average			10.9	0.067								
Base Average			11.3	0.061								
Snowmelt Average			4.0	0.069								
All Average			10.4	0.066								
Total							284,321,095	6,531	196,267	1,153		
CLFLWD Major Subwatershed Total Acres							13,732					
Total TP/TSS (lb/ac/yr)										14.29	0.08	
Total TP/TSS (kg/ha/yr)										16.02	0.09	

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

** Interval volumes from 1/1/08 to 4/2/08 and 9/24/08 to 1/1/09 where estimated based upon base flow

Total phosphorus loading at the Comfort Lake Inlet for 2008 was estimated at 0.08 lb/ac (1,153 lbs.) (Table 20). In order to properly assess the capture or release capacity of the Shallow Pond wetland area, we can compare the Greenway Ave. monitoring site's loading data and this site's loading data to determine how this particular wetland functioned in 2008. Based on the loading estimates, in 2008 the area between the Greenway Ave. site and this monitoring site captured approximately 350 lbs of phosphorus. It is cautioned that TSS and TP loading calculation are estimates and some variability within its interpretation exists. Based on this data, the Shallow Pond wetland area did not contribute phosphorus to Comfort Lake in 2008, and the data instead points to sediment and nutrient setting occurring.

Comfort Lake Outlet

The station for the Comfort Lake Outlet site recorded flow from May 1-November 3, 2008 (Figure 9). Total flow for this period was 229,578,200 cf or 5,270 acre/ft. Total rainfall for the monitoring season was 16.53 inches. On May 6, 2008, the highest flow was recorded for the monitoring season at 139.83 cfs. This high flow was due to precipitation events between May 2nd and May 6th totaling 1.22 inches. No water quality data was collected at the Comfort Outlet site in 2008 by the WCD, but samples taken by the Army Corps of Engineers were utilized to develop a loading estimate.

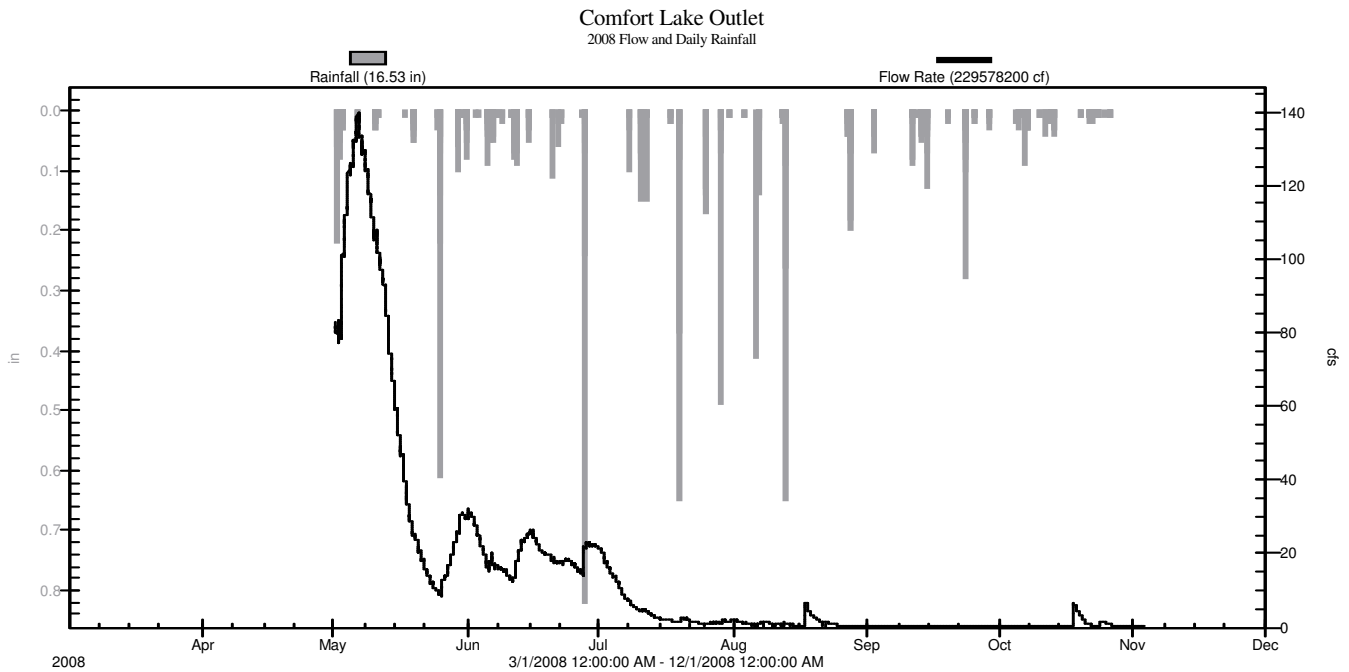


Figure 9. Comfort Lake Outlet 2008 Flow and Daily Rainfall

Grab samples were taken by the Army Corps of Engineers at the Comfort Lake Outlet site in 2008. The TSS, VSS, TN, TKN, Particulate Organic Nitrogen, Dissolved Organic Nitrogen, Ammonia Nitrogen, Nitrate plus Nitrite, TP, Particulate Phosphorus, SRP, and Chloride results are listed in Table 21 and field water quality measurements are listed in Table 22. The highest TKN and TP were 1.63 mg/L (October 30th base grab) and 0.039 mg/L (July 11th storm grab, October 21st base grab), respectively. The highest TSS value that was recorded was 10.3 mg/L, from the June 4th base grab.

Table 21. Comfort Lake Outlet 2008 Sample Chemistry Results

Sample Type	Start Date	End Date	TSS (mg/L)	VSS (mg/L)	TN (mg/L)	TKN (mg/L)	PON (mg/L)	DON (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate/Nitrite (mg/L)	TP (mg/L)	PP (mg/L)	SRP (mg/L)	Chloride (mg/L)
Storm Grab	5/27/08 11:00	5/27/08 11:00	2.3	1.2	1.025	1.015	0.021	0.984	0.01	0.01	0.005	0.005	0.002	47.0
Base Grab	6/4/08 12:06	6/4/08 12:06	10.3	5.0	1.331	1.321	0.301	1.01	0.01	0.01	0.021	0.016	0.002	47.3
Storm Grab	6/12/08 11:00	6/12/08 11:00	7.4	3.6	1.1	1.09	0.055	1.025	0.01	0.01	0.035	0.03	0.002	48.6
Base Grab	6/18/08 11:15	6/18/08 11:15	4.4	2.2	1.089	1.079	0.068	1.001	0.01	0.01	0.011	0.006	0.002	48.5
Base Grab	6/25/08 9:52	6/25/08 9:52	4.2	2.5	1.017	1.007	0.058	0.926	0.023	0.01	0.038	0.015	0.002	46.7
Storm Grab	7/11/08 11:30	7/11/08 11:30	1.9	1.3	1.517	1.507	0.603	0.894	0.01	0.01	0.039	0.034	0.002	43.2
Storm Grab	7/25/08 9:45	7/25/08 9:45	4.4	2.2	0.964	0.954	0.11	0.834	0.01	0.01	0.005	0.005	0.008	44.1
Base Grab	8/6/08 10:40	8/6/08 10:40	2.7	1.7	0.909	0.899	0.01	0.88	0.01	0.01	0.005	0.005	0.002	44.2
Base Grab	8/19/08 10:10	8/19/08 10:10	2.7	2	0.968	0.958	0.159	0.789	0.01	0.01	0.005	0.005	0.002	43.0
Base Grab	9/4/08 11:50	9/4/08 11:50	3	1.1	1.309	1.282	0.049	1.223	0.01	0.027	0.005	0.005	0.027	
Base Grab	9/16/08 12:00	9/16/08 12:00	1.1	0.3	0.863	0.853	0.077	0.766	0.01	0.01	0.005	0.005	0.002	
Base Grab	9/25/08 11:30	9/25/08 11:30	5.1	3.4	0.938	0.928	0.119	0.799	0.01	0.01	0.005	0.005	0.002	
Base Grab	9/30/08 12:30	9/30/08 12:30	5.3	2.4	0.524	0.514	0.082	0.422	0.01	0.01	0.005	0.005	0.002	
Storm Grab	10/9/08 12:15	10/9/08 12:15	1.4	0.8	0.997	0.987	0.075	0.902	0.01	0.01	0.022	0.017	0.002	
Base Grab	10/14/08 12:00	10/14/08 12:00	1.4	0.3	1.001	0.991	0.01	0.975	0.033	0.01	0.035	0.002	0.01	
Base Grab	10/21/08 13:30	10/21/08 13:30	1.5	1.3	1.393	1.383	0.186	1.187	0.01	0.01	0.039	0.02	0.002	
Base Grab	10/30/08 12:30	10/30/08 12:30	3.1	2.2	1.634	1.624	0.294	1.32	0.01	0.01	0.012	0.007	0.002	

Table 22. Comfort Lake Outlet 2008 Field Water Quality Measurements

Date/Time	Transparency (cm)	Water Temperature (C)	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH
5/14/08 15:10		15.6	8.4		
6/4/08 12:06		17.03	10.1	400	7.36
6/18/08 11:15		19.85	8.5	417	7.7
6/25/08 9:52		23.9	6.20	414	7.46
7/2/08 9:54	98	24.1	5.25		
7/11/2008 11:30		23.6	7.03	392	7.85
7/25/2008 9:45		22.55	8.45		7.7
8/6/2008 10:40		24.16	4.1	360	8.21
8/19/2008 10:10		23.61	3.97	325	8.12
9/4/2008 11:50		17.16	9.55		5.92
9/16/2008 12:00		21.67	8.15		7.3
10/9/2008 12:15		17.56	9.08		6.71
10/14/2008 12:00		16.61	8.33		6.59
10/21/2008 13:30		11.72	8.34	260	7.54
10/30/2008 12:30		19.17	9.12		6.88
	Exceeds Water Quality Standard				

Table 23. Comfort Lake Outlet 2008 Total Phosphorus and Total Suspended Solids Loading

Sample Type	Sample Collection Time		TSS (mg/L)		TP (mg/L)		Loading Interval		Interval Volume (cf)	Interval Volume (ac-ft)	Interval TSS (lb)	Interval TP (lb)
	Start	End			Start	End						
Base**			3.7	0.016	1/1/08 0:00	5/1/08 12:15	20,997,000	482.28	4795.8	20.32		
Base			3.7	0.016	5/1/08 12:15	5/2/08 13:45	7,404,729	170.08	1691.3	7.16		
Storm			3.7	0.021	5/2/08 13:45	5/7/08 13:45	52,357,755	1202.60	11958.8	69.29		
Base			3.7	0.016	5/7/08 13:45	5/25/08 16:45	89,084,228	2046.16	20347.4	86.20		
Storm Grab	5/27/08 11:00	5/27/08 11:00	2.3	0.005	5/25/08 16:45	5/29/08 16:30	6,140,428	141.04	881.6	1.92		
Storm			3.7	0.021	5/29/08 16:30	6/2/08 10:30	9,740,508	223.73	2224.8	12.89		
Base Grab	6/4/08 12:06	6/4/08 12:06	10.3	0.021	6/2/08 10:30	6/5/08 16:15	6,170,051	141.72	3967.3	8.09		
Storm			3.7	0.021	6/5/08 16:15	6/7/08 18:30	3,103,548	71.28	708.9	4.11		
Base			3.7	0.016	6/7/08 18:30	6/11/08 10:15	4,610,811	105.91	1053.1	4.46		
Storm Grab	6/12/08 11:00	6/12/08 11:00	7.4	0.035	6/11/08 10:15	6/15/08 23:15	8,573,947	196.93	3960.8	18.73		
Base			3.7	0.016	6/15/08 23:15	6/17/08 23:15	3,872,893	88.96	884.6	3.75		
Base Grab	6/18/08 11:15	6/18/08 11:15	4.4	0.011	6/17/08 23:15	6/22/08 16:15	7,624,102	175.12	2094.2	5.24		
Base Grab	6/25/08 9:52	6/25/08 9:52	4.2	0.038	6/22/08 16:15	6/27/08 17:15	7,230,918	166.09	1895.9	17.15		
Storm			3.7	0.021	6/27/08 17:15	7/1/08 21:00	7,895,132	181.34	1803.3	10.45		
Base			3.7	0.016	7/1/08 21:00	7/10/08 13:30	8,013,544	184.06	1830.3	7.75		
Storm Grab	7/11/08 11:30	7/11/08 11:30	1.9	0.039	7/10/08 13:30	7/12/08 13:30	772,008	17.73	91.6	1.88		
Base			3.7	0.016	7/12/08 13:30	7/19/08 15:00	1,336,751	30.70	305.3	1.29		
Storm			3.7	0.021	7/19/08 15:00	7/22/08 0:15	462,532	10.62	105.6	0.61		
Base			3.7	0.016	7/22/08 0:15	7/25/08 9:30	343,892	7.90	78.5	0.33		
Storm Grab	7/25/08 9:45	7/25/08 9:45	4.4	0.005	7/25/08 9:30	7/29/08 4:00	364,395	8.37	100.1	0.11		
Storm			3.7	0.021	7/29/08 4:00	8/2/08 0:30	558,801	12.84	127.6	0.74		
Base Grab	8/6/08 10:40	8/6/08 10:40	2.7	0.005	8/2/08 0:30	8/6/08 14:30	372,228	8.55	62.7	0.12		
Storm			3.7	0.021	8/6/08 14:30	8/9/08 2:30	242,940	5.58	55.5	0.32		
Base			3.7	0.016	8/9/08 2:30	8/12/08 19:15	189,624	4.36	43.3	0.18		
Storm			3.7	0.021	8/12/08 19:15	8/14/08 4:45	101,550	2.33	23.2	0.13		
Base			3.7	0.016	8/14/08 4:45	8/19/08 0:00	740,433	17.01	169.1	0.72		
Base Grab	8/19/08 10:10	8/19/08 10:10	2.7	0.005	8/19/08 0:00	8/21/08 18:45	449,604	10.33	75.8	0.14		
Base Grab	9/4/08 11:50	9/4/08 11:50	3.0	0.005	8/21/08 18:45	9/5/08 13:30	343,929	7.90	64.4	0.11		
Base			3.7	0.016	9/5/08 13:30	9/11/08 4:30	17,590	0.40	4.0	0.02		
Storm			3.7	0.021	9/11/08 4:30	9/16/08 3:15	33,662	0.77	7.7	0.04		
Base Grab	9/16/08 12:00	9/16/08 12:00	1.1	0.005	9/16/08 3:15	9/23/08 6:45	36,880	0.85	2.5	0.01		
Storm			3.7	0.021	9/23/08 6:45	9/25/08 2:30	11,663	0.27	2.7	0.02		
Base Grab	9/25/08 11:30	9/25/08 11:30	5.1	0.005	9/25/08 2:30	9/29/08 8:30	22,930	0.53	7.3	0.01		
Base Grab	9/30/08 12:30	9/30/08 12:30	5.3	0.005	9/29/08 8:30	10/7/08 5:00	36,741	0.84	12.2	0.01		
Storm Grab	10/9/08 12:15	10/9/08 12:15	1.4	0.022	10/7/08 5:00	10/10/08 5:00	27,773	0.64	2.4	0.04		
Base			3.7	0.016	10/10/08 5:00	10/13/08 5:00	24,258	0.56	5.5	0.02		
Base Grab	10/14/08 12:00	10/14/08 12:00	1.4	0.035	10/13/08 5:00	10/18/08 5:00	82,944	1.91	7.2	0.18		
Base Grab	10/21/08 13:30	10/21/08 13:30	1.5	0.039	10/18/08 5:00	10/24/08 12:00	936,408	21.51	87.7	2.28		
Base Grab	10/30/08 12:30	10/30/08 12:30	3.1	0.012	10/24/08 12:00	11/3/08 11:15	320,512	7.36	62.0	0.24		
Base**			3.7	0.016	11/3/08 11:15	1/1/09 0:00	3,792,825	87.12	866.3	3.67		
Storm Average			3.5	0.021								
Base Average			3.7	0.016								
All Average			3.7	0.018								
Total							254,442,469	5,844	62,469	291		
CLFLWD Major Subwatershed Total Acres							24,558					
Total TP/TSS (lb/ac/yr)										2.54	0.01	
Total TP/TSS (kg/ha/yr)										2.85	0.01	

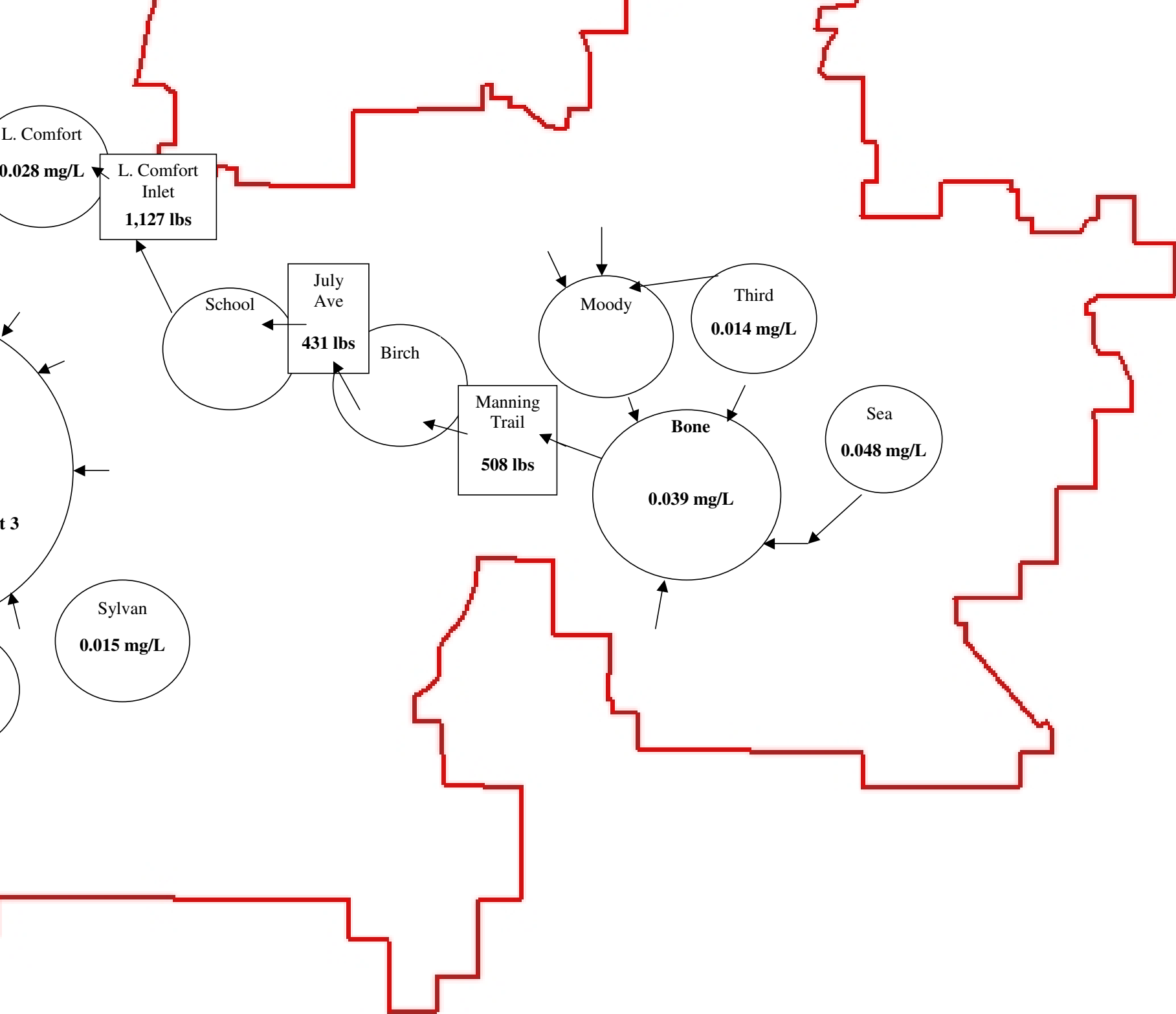
*Italics indicate estimated concentrations based on average base and storm flow concentrations

** Interval volumes from 1/1/08 to 5/1/08 and 11/3/08 to 1/1/09 where estimated based upon base flow

Total phosphorus loading at the Comfort Lake Outlet site and the entire Comfort Lake Forest Lake Watershed was estimated at 0.01 lbs./acre (291 lbs.) (Table 23). TP and TSS are captured in Big Comfort Lake and Little Comfort Lake resulting in lower load amounts leaving the watershed.

5. Watershed Phosphorus Flow Chart

2008 Total Phosphorus Loads and In-Lake Concentrations at Monitored Waters



Locations and Total Phosphorus Load Water Quality Flow Chart

4) Historical Stream Loading and Discharge Summary

Table 24. CLFLWD Historical Stream Discharge and Rainfall Summary

Site	Year	Monitoring Season	Total Monitored Discharge		Growing Season (June 1-Sept 30) Discharge*		Yearly Estimated Discharge		Monitored Rainfall (inches)
			Cubic Feet	Acre Feet	Cubic Feet	Acre Feet	Cubic Feet	Acre Feet	
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 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 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 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 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
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 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

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

Table 25. CLFLWD Historical Loading and Rainfall Summary

Site	Year	Monitoring Season	Total Monitored Load		Growing Season (June 1-Sept 30) Load*		Total Yearly Estimated Load		Monitored Rainfall (inches)
			TP (lbs.)	TSS (lbs.)	TP (lbs.)	TSS (lbs.)	TP (lbs.)	TSS (lbs.)	
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 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 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 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 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
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 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

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

5) Appendices and References

Appendix A – Individual Lake Summaries References