

**Table 1.CM. Carnelian-Marine Outlet Monitoring Station Information**



**Station Address:** Little Carnelian Lake Outlet near Partridge Road, Stillwater, MN  
**County:** Washington  
**Major Basin:** St. Croix River Basin  
**Watershed:** Carnelian Marine Watershed  
**Drainage Area:** 30.05 square miles

**Station Operator:** Washington County Soil and Water Conservation District

**Metropolitan Council Environmental Services Contact Information:**

**Contact Person:** Casandra Champion  
**Address:** 2400 Childs Road  
St. Paul, MN 55106  
**Phone:** 651-602-8745  
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**Watershed District or Watershed Management Organization:**

Carnelian Marine Watershed District

**Station Overview:** MCES has supported water quality monitoring of the Little Carnelian Lake Outlet since 1995. This stream flows from the outlet of Little Carnelian Lake and drains a large Washington County chain of lakes. The monitoring station is located near Stillwater, Minnesota, about three miles upstream from the stream confluence with the St. Croix River. MCES partners with the Washington County Soil and Water Conservation District to operate the Little Carnelian Lake Outlet monitoring station. The rain gauge at this monitoring station collects rainfall data; however,

supplemental winter precipitation data are obtained from the Minnesota Climatology Working Group, Stillwater Station Number 218037.

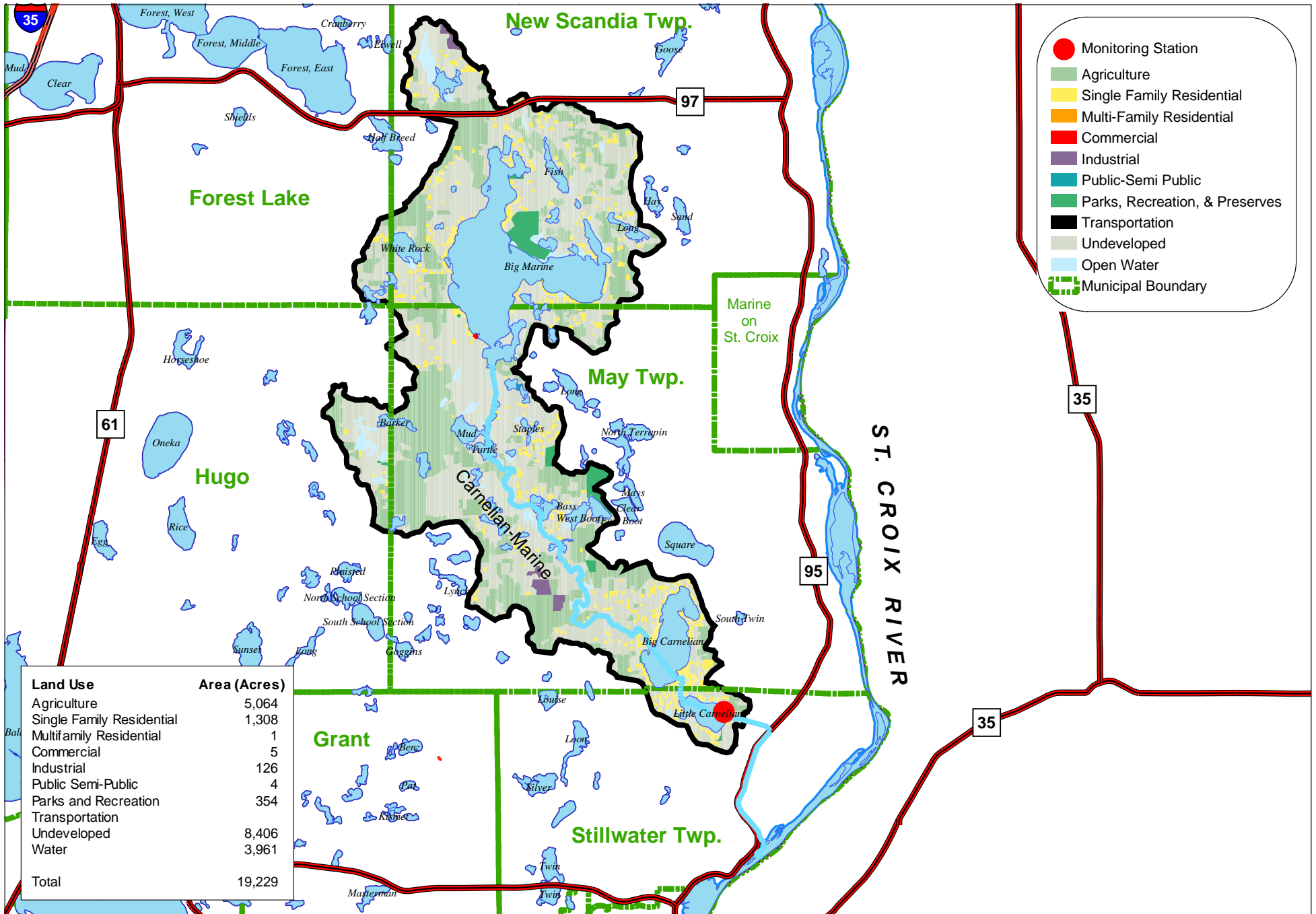
Composite samples for water chemistry analysis are not collected at this station because runoff events tend to be long and lake-attenuated, and therefore easily characterized by grab samples.

**2003 Monitoring Year:** Monitoring equipment was installed on April 10, 2003 and removed on November 3, 2003. Daily average flows were estimated during the January 1-April 9 period. The Little Carnelian Lake Outlet usually does not flow year around. In 2003, stream flow ended on October 18. The peak daily average flow of 29 cfs occurred on June 7, 2003.

Twenty-two grab samples were collected for water quality analysis during 2003. The MCES annual water quality monitoring plan includes 12 monthly baseflow (“non-event”) grab samples and approximately 10 to 15 flow-weighted composite samples collected during all runoff events in the open-water season (March-November). However, the MCES sampling scheme is modified for this monitoring station because of its unique hydrologic situation.

**For additional stream monitoring information and monitoring methods regarding this site, see [www.metrocouncil.org/environment/RiversLakes](http://www.metrocouncil.org/environment/RiversLakes).**

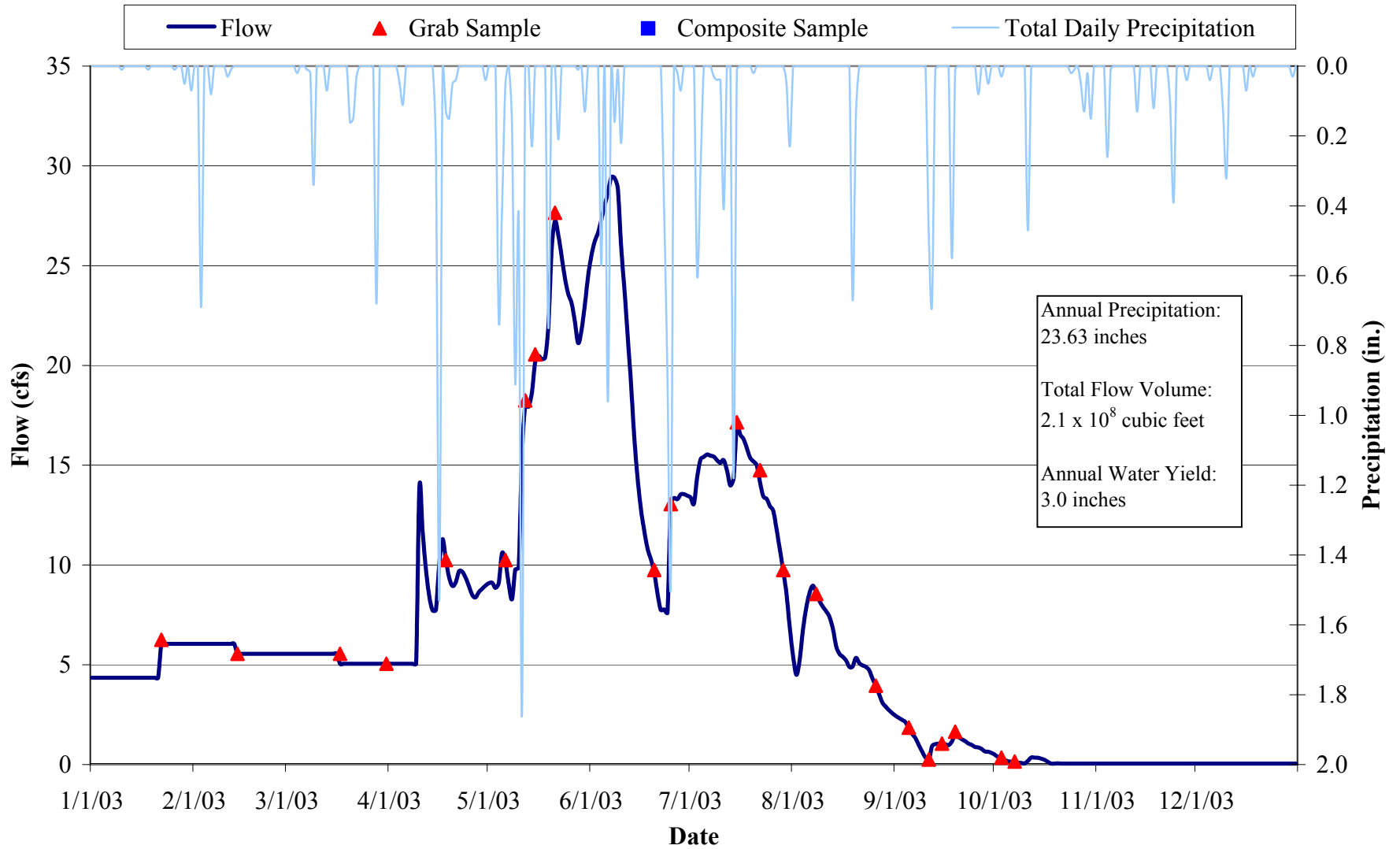
**Figure 1.CM. Carnelian-Marine Monitoring Station Location and Watershed Characteristics**



0 0.5 1 2 Miles



**Figure 2.CM. Carnelian Marine Outlet 2003 Hydrograph, Precipitation and Sampling Information**



**Table 2.CM. Carnelian-Marine Outlet 2003 Water Chemistry Information**

Variable	N	Mean	Median	Minimum	Maximum	25%	75%	STD
Chloride, mg/L	19	9	10	7	10	9	10	1
Hardness, mg/L	5	118	130	92	136	96	133	20
Cadmium, ug/L	4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium, ug/L	4	0.3	0.3	0.1	0.5	0.1	0.5	0.2
Copper, ug/L	4	1.0	1.0	0.8	1.2	0.8	1.2	0.2
Lead, ug/L	4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel, ug/L	4	0.7	0.7	0.5	0.9	0.5	0.9	0.2
Zinc, ug/L	4	2.0	2.1	1.4	2.6	1.5	2.6	0.6
Total Kjeldahl Nitrogen, mg/L	22	0.43	0.44	0.33	0.58	0.38	0.46	0.06
Total Nitrate Nitrogen, mg/L	20	0.12	0.11	0.03	0.44	0.03	0.16	0.11
Total Phosphorus, mg/L	22	0.02	0.02	0.01	0.05	0.01	0.03	0.01
Total Dissolved Phosphorus, mg/L	20	0.01	0.01	<0.01	0.05	<0.01	0.01	0.01
Total Suspended Solids, mg/L	21	3	2	1	10	1	3	2
Volatile Suspended Solids, mg/L	21	2	1	1	5	1	2	1
Turbidity, NTU	20	1	1	1	2	1	2	0

N: Sample Count

25%, 75%: 25th and 75th Percentiles

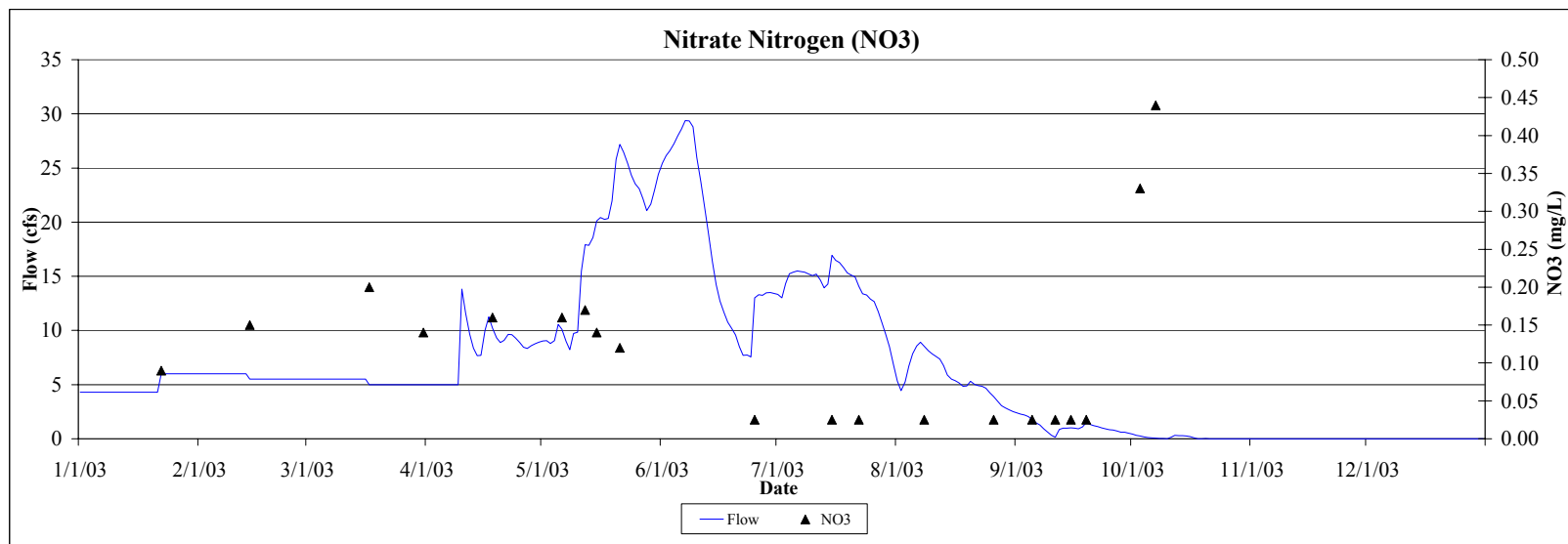
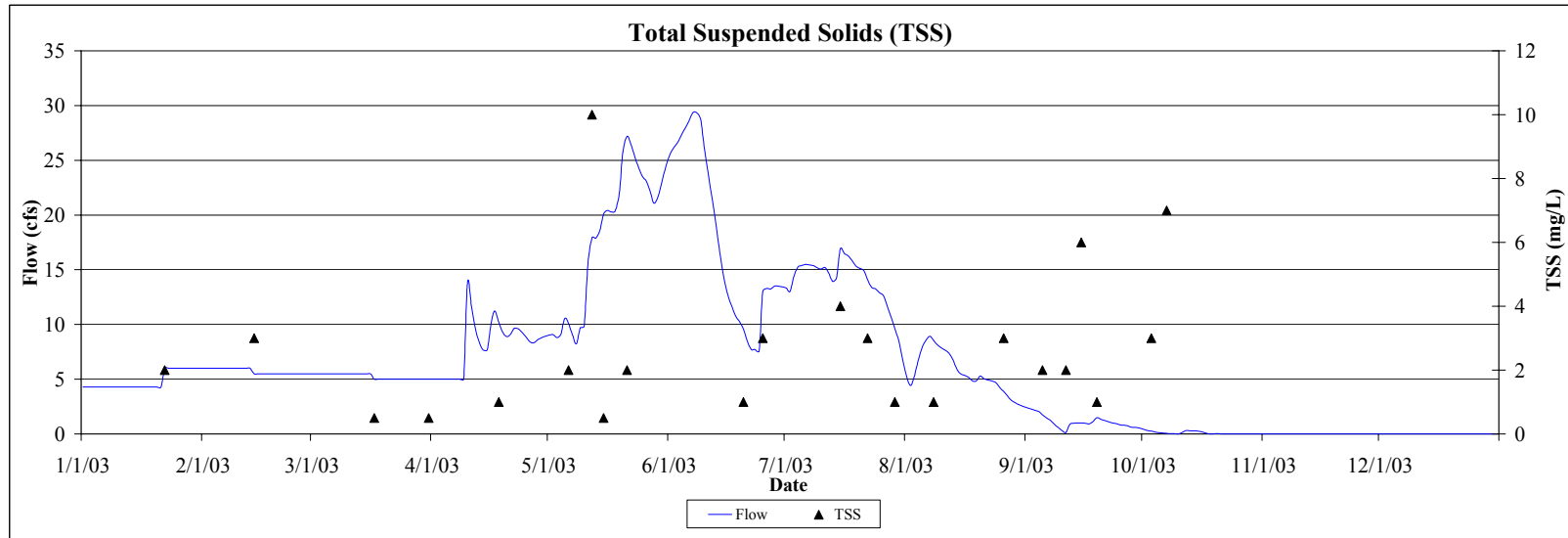
STD: Standard Deviation

**Table 3.CM. Carnelian-Marine Outlet 2003 Annual Loading Information\* for Suspended Solids and Nutrients**

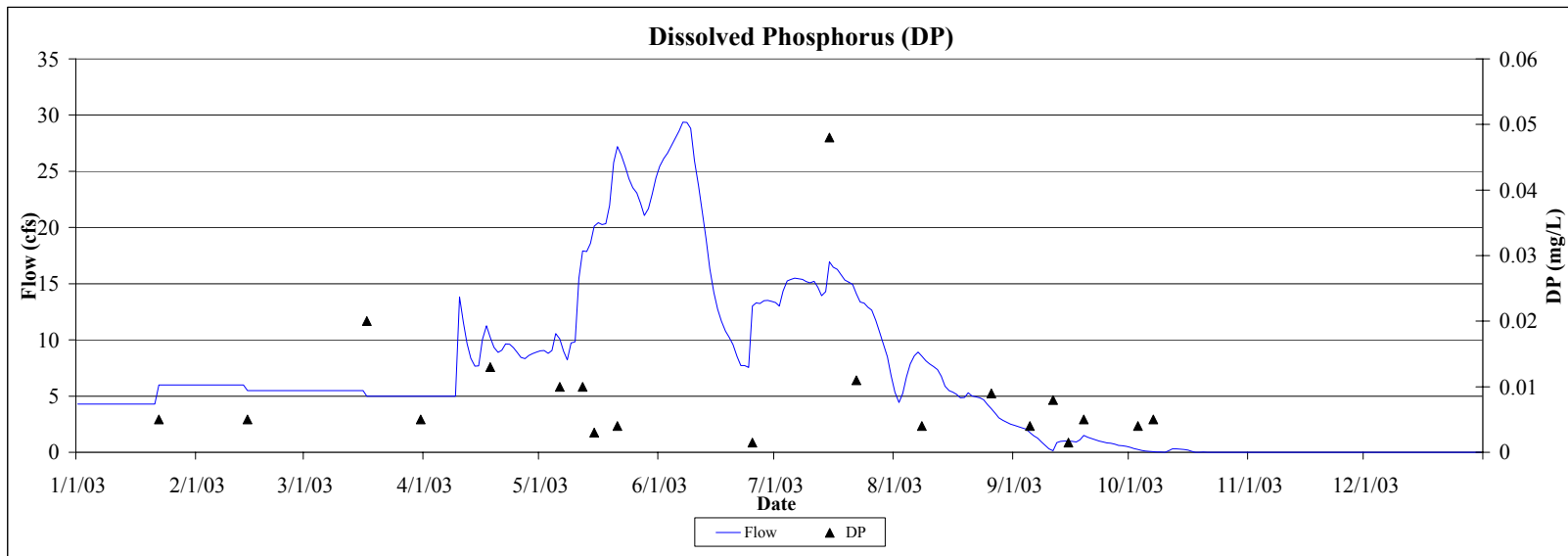
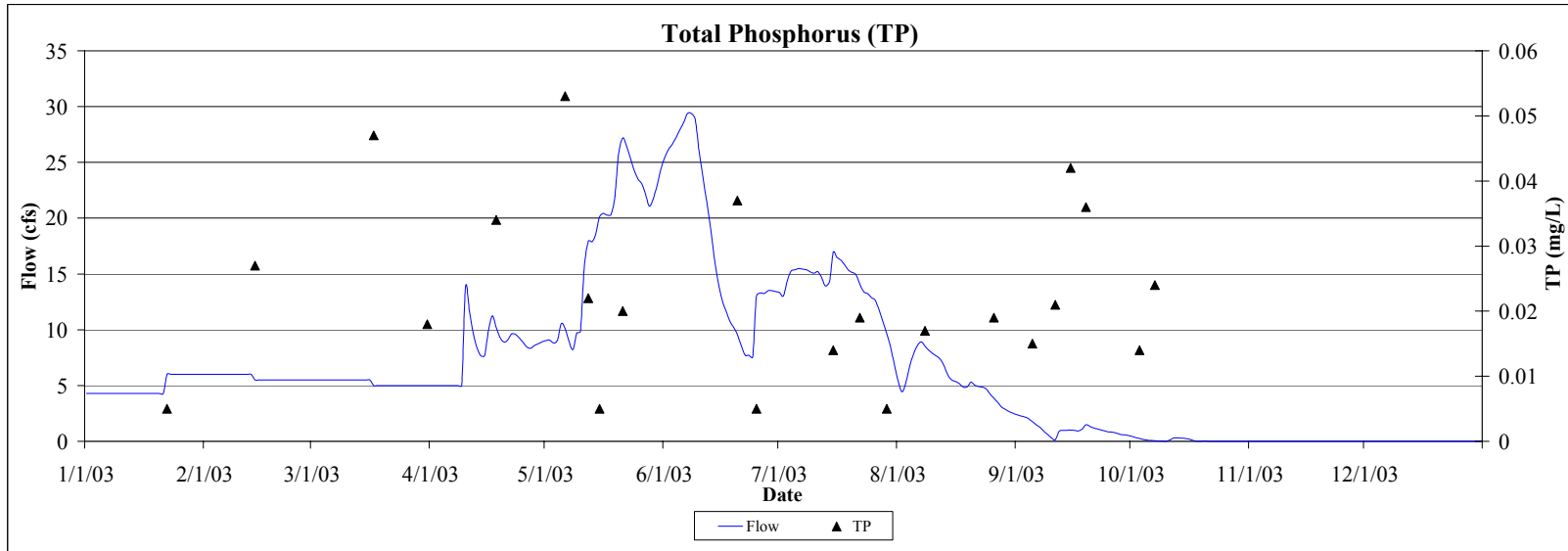
Variable	Annual Load (tons)	Annual Yield (lbs/acre)	Annual Normalized Yield (lbs/acre/in of water)	Flow Weighted Mean Concentration (mg/L)
Total Suspended Solids	16	2	1	2
Total Phosphorus	0.14	0.01	<0.01	0.02
Total Dissolved Phosphorus	0.07	0.01	<0.01	0.01
Total Nitrate Nitrogen	0.73	0.08	0.03	0.11

\* 2003 Annual Loading Information is provisional and may be subject to minor revisions.

**Figure 3.CM. Carnelian-Marine Outlet 2003 Hydrograph with Total Suspended Solids and Nitrate Nitrogen Concentrations**



**Figure 4.CM. Carnelian-Marine Outlet 2003 Hydrograph with Total and Dissolved Phosphorus Concentrations**



**Table 4.CM. Carnelian-Marine Outlet: Comparison of 2001-2003 Hydrology and Water Chemistry**

	<b>2001</b>	<b>2002</b>	<b>2003</b>
<b>Hydrology</b>			
<b>Total Precipitation (inches)</b>	29.75	36.92	23.63
<b>Water Yield (inches)</b>	2.5	3.8	3.0
<b>Total Volume (cubic feet)</b>	$1.8 \times 10^8$	$2.6 \times 10^8$	$2.1 \times 10^8$
<b>Annual Load (tons)</b>			
<b>Total Suspended Solids</b>	14	21	16
<b>Total Phosphorus</b>	0.15	0.16	0.14
<b>Total Dissolved Phosphorus</b>	0.06	0.09	0.07
<b>Total Nitrate Nitrogen</b>	0.91	0.91	0.73
<b>Annual Yield (lbs/acre)</b>			
<b>Total Suspended Solids</b>	1	2	2
<b>Total Phosphorus</b>	0.02	0.02	0.01
<b>Total Dissolved Phosphorus</b>	0.01	0.01	0.01
<b>Total Nitrate Nitrogen</b>	0.09	0.09	0.08
<b>Annual Normalized Yield (lbs/acre/inch of water)</b>			
<b>Total Suspended Solids</b>	<1	1	1
<b>Total Phosphorus</b>	0.01	0.01	<0.01
<b>Total Dissolved Phosphorus</b>	<0.01	<0.01	<0.01
<b>Total Nitrate Nitrogen</b>	0.04	0.02	0.03
<b>Flow-Weighted Mean Concentration (mg/L)</b>			
<b>Total Suspended Solids</b>	2	3	2
<b>Total Phosphorus</b>	0.03	0.02	0.02
<b>Total Dissolved Phosphorus</b>	0.01	0.01	0.01
<b>Total Nitrate Nitrogen</b>	0.16	0.11	0.11