Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

October – December 2009

Prepared By: Dakota County Soil and Water Conservation District

Prepared For: Lower Minnesota River Watershed District

February 2010

Introduction

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 4th quarter of 2009. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 2.37 cubic feet per second (cfs) or 1.53 million gallons per day (mgd) (Table 1). Total precipitation was recorded as 5.37 inches, although the rain gauge was covered for the winter on October 30th, 2009. A graph describing 2009 annual flow and precipitation results is also provided (Figure 2).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station October – December 2009

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1999-2008 (inches)
OCTOBER	5.00/3.23	5.37	2.19
NOVEMBER	1.32/0.85	na	1.27
DECEMBER	0.71/0.46	na	0.92
TOTAL QUARTER	2.37/1.53	na	1.50

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

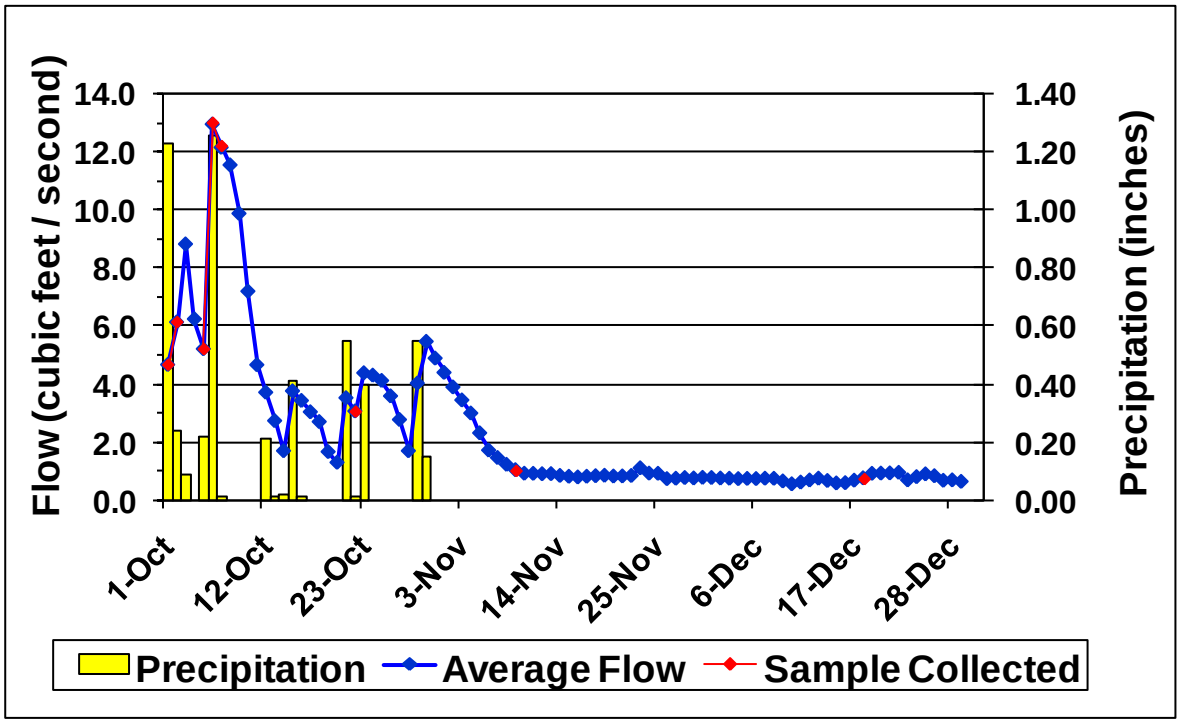


Figure 1. Flow and precipitation at Willow WOMP Station October-December, 2009

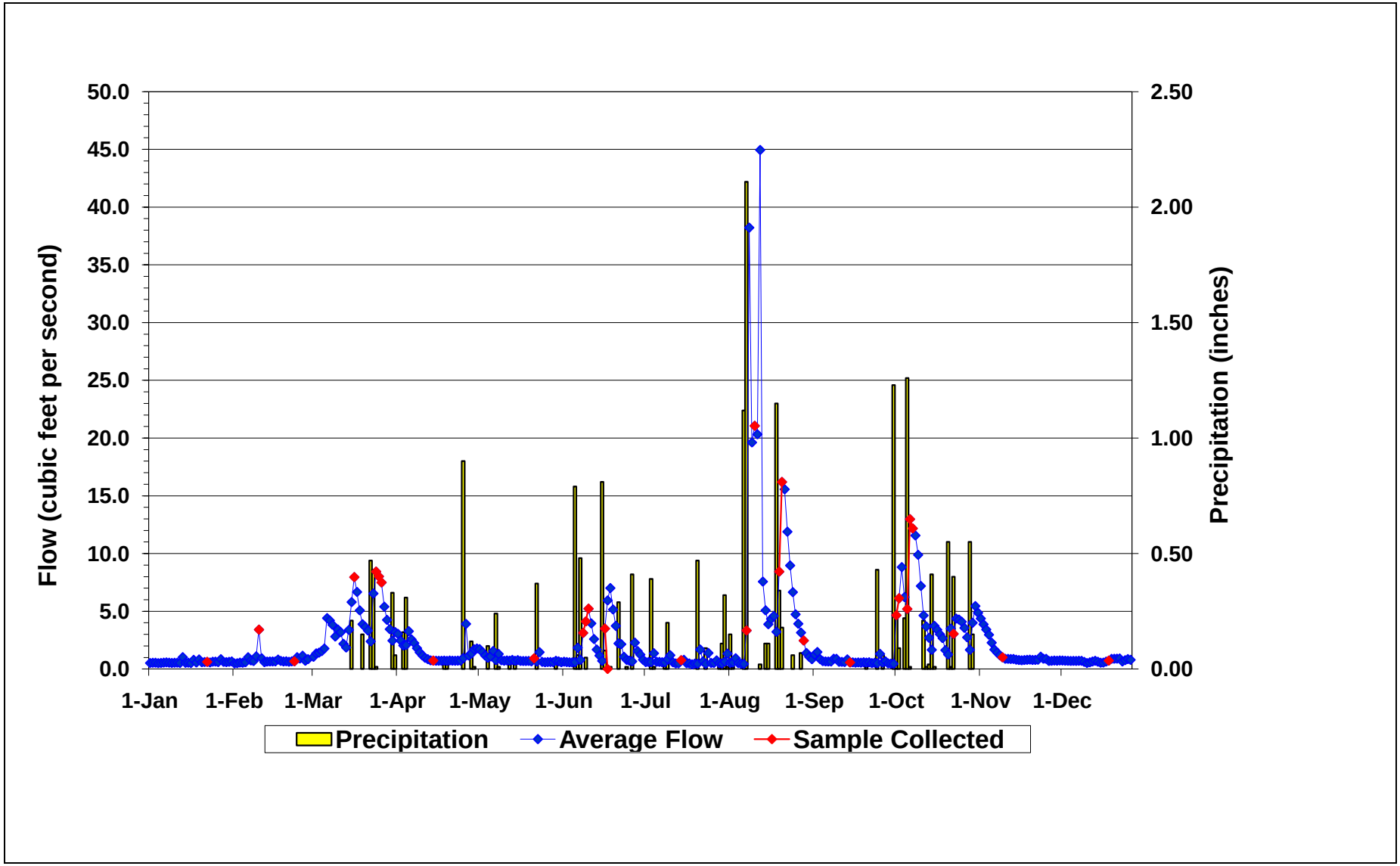


Figure 2. 2009 Willow WOMP Station Flow (January – December 2009) and Precipitation (March 16th – October 30th) Results

Water Quality

4th Quarter Summary:
During the fourth quarter of 2009, two precipitation based event composite samples (10/1/09-10/2/09 and 10/5/09-10/6/09) and three base flow grab samples (10/22/09, 11/9/09 and 12/18/09) were collected at the Willow Creek WOMP station. Overall, fourth quarter water quality in Willow Creek should be considered good, with most parameter concentrations below state standards or minimally impacted stream eco-region means, with the exception of conductivity results and *E. coli* bacteria concentrations (Table 2).

Annual Conductivity Results:
Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, sulfate, sodium, calcium and other solids. Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through limestone and clay soils will have higher conductivity values. High conductance readings can also come from industrial pollution or urban runoff. Extended dry periods, low flow conditions, and warmer water temperatures may also contribute to higher specific conductance readings (Source: http://www.epa.gov/volunteer/stream/).

Dakota County Soil and Water Conservation District (SWCD) staff have identified soil types common to the Willow Creek Watershed, in an attempt to explain the source of continually elevated conductivity results. According to the U.S. Department of Agriculture, Soil Survey of Dakota County (1980), soils in this watershed consist primarily of sand, silts, and clays. The high mineral content of these clay soils likely accounts for much of the elevated conductivity results reported throughout the 2009 monitoring season (Table 2).

Annual Bacteria Results:
Bacteria concentrations in fresh water resources continues to be an area of research that is poorly understood. Research has suggested that the sediment of lakes, rivers, and streams can function as a bacterial reservoir, continually releasing bacteria into the water column. Under low flow conditions, sediment release of bacteria may cause elevated bacteria results in water quality samples.

The 2009 4th quarter *E. coli* results (Table 2) describe elevated bacteria concentrations in Willow Creek. Throughout the fall of 2009, SWCD staff observed numerous waterfowl in upstream wetlands while collecting samples, which may account for some portion of these elevated results. However, this problem has been well documented for a number of years, and does not appear to be directly related to the presence or absence of waterfowl. A more chronic source of bacteria in this watershed is likely the cause of this problem and explains high concentrations throughout the year. Elevated bacteria concentrations, especially under lower flow conditions, similar to what was observed in the 4th quarter of 2009, are common in other watersheds elsewhere in Dakota County.

Historical Water Quality Monitoring Results:
When 2009 monitoring results are compared against historical mean concentrations, most parameters are near or below 10-year averages and suggest that water quality has remained relatively stable over the historical monitoring period (Table 2). However, during the 1st quarter of 2009, concentrations for several endpoints (BOD, chloride, conductivity, hardness, lead, nickel, ammonia, nitrate/nitrite) were substantially higher than 10-year averages. This is a consequence of early season runoff event samples which typically carry larger pollutant loads than those events sampled later in the year or base flow samples. This pattern of higher pollutant concentrations during the first quarter has routinely been observed for this station and appears to be the norm for this watershed.

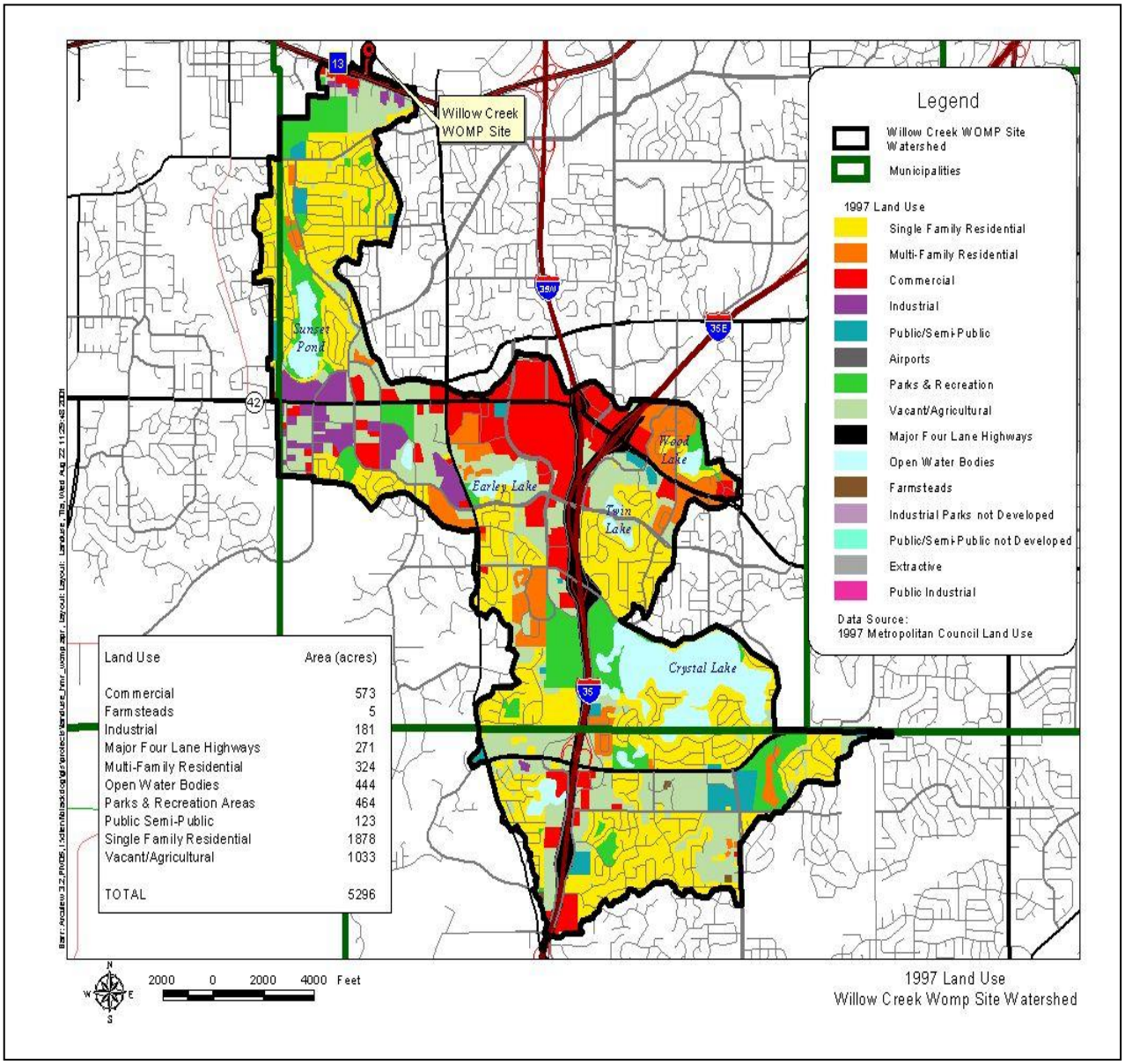
Table 2. Average concentrations at Willow Creek WOMP Station October – December 2009. 1st –3rd quarter results and historical means are included (shaded grey) for comparison purposes. Historical averages also included (shaded dark grey). Results exceeding minimally impacted stream eco-region means or state standards are listed in red font.

Parameter	Historical (1999-2008) Mean Concentration	1st Quarter 2009 Mean Concentration	2nd Quarter 2009 Mean Concentration	3rd Quarter 2009 Mean Concentration	4th Quarter 2009 Mean Concentration	Notes – 4th Quarter Results
Alkalinity	121.1 mg/L $CaCO_3$	228 mg/L $CaCO_3$	220.8 mg/L $CaCO_3$	174.9 mg/L $CaCO_3$	109.4 mg/L $CaCO_3$	Typical for freshwater; higher during lower flow
Biological Oxygen Demand (BOD5)	3.08 mg/L	3.50 mg/L	1.6 mg/L	1.6 mg/L	1.4 mg/L	Below eco-region mean
Cadmium	0.22 ug/L	0.50 ug/L	0.50 ug/L	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride	135 mg/L	235 mg/L	145 mg/L	92 mg/L	63 mg/L	In compliance with state standard
Chlorophyll-a	8.0 ug/L	11.9 ug/L	2.8 ug/L	6.5 ug/L	7.2 ug/L	Low level
Chromium	2.87 ug/L	1.2 ug/L	5.7 ug/L	4.2 ug/L	5.0 ug/L	In compliance with state standard
Conductivity	833 mMHOs	1315 mMHOs	1164 mMHOs	665 mMHOs	467 mMHOs	Above eco-region mean, higher during low flow
Copper	5.65 ug/L	4.8 ug/L	2.03 ug/L	1.67 ug/L	1.65 ug/L	In compliance with state standard
Escherichia coli Bacteria (geometric mean)	na	53.5 MPN/100 mL	320 MPN/100mL	384 MPN/100mL	284 MPN/100mL	Exceeds state standard
Hardness	191 mg/L $CaCO_3$	307 mg/L $CaCO_3$	331 mg/L $CaCO_3$	210 mg/L $CaCO_3$	184 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	2.49 ug/L	3.65 ug/L	0.10 ug/L	0.14 ug/L	0.28 ug/L	In compliance with state standard
Nickel	4.8 ug/L	5.9 ug/L	5.6 ug/L	4.72 ug/L	4.43 ug/L	In compliance with state standard
Nitrogen Ammonia	126 ug/L	345 ug/L	58 ug/L	57 ug/L	26 ug/L	In compliance with state standard
Nitrate + Nitrite	0.28 mg/L	0.42 mg/L	0.21 mg/L	0.16 mg/L	0.15 mg/L	Below eco-region mean
Phosphorus, Total	0.149 mg/L	0.146 mg/L	0.048 mg/L	0.086 mg/L	0.035 mg/L	Below eco-region mean
Suspended Solids	57.36 mg/L	7.0 mg/L	3.6 mg/L	24.1 mg/L	9.1 mg/L	Below eco-region mean
Turbidity	23 NTRU	9.5 NTRU	3.6 NTRU	4.3 NTRU	2.8 NTRU	In compliance with state standard
Zinc	20.40 ug/L	7.5 ug/L	4.3 ug/L	6.4 ug/L	6.2 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or microseimens

MPN = most probable number
NTRU = nephelometric turbidity ratio units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.