2010 EAGLE CREEK ANNUAL REPORT
WATERSHED OUTLET MONITORING PROGRAM

(Preliminary Data)

Prepared for:

Lower Minnesota River Watershed District

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Introduction

Eagle Creek is a unique water resource in the metropolitan area. It is a Class 2A self-reproducing trout stream that originates at the Boiling Springs (an area considered sacred by the Mdewakanton Sioux Community) and outlets into the Minnesota River. Significant measures have been taken over the past couple decades to prevent degradation of Eagle Creek, including diverting stormwater from the stream and establishing a 200-foot natural vegetative buffer along each side of the bank. These and other steps have helped to significantly minimize impacts from this rapidly growing suburban area.

The Eagle Creek monitoring station began in 1999 as part of the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP). This program was designed and is currently managed by the Metropolitan Council, for the primary purpose of improving the ability to calculate pollutant loads to the Minnesota River. The Lower Minnesota River Watershed District (LMRWD) is the local funding partner for this station, and contracts in turn with the Scott Soil and Water Conservation District (SWCD) to perform field-monitoring activities.

The monitoring station is located in the City of Savage near Highway 13 and Highway 101, approximately 0.8 miles upstream of the confluence with the Minnesota River. This report summarizes the results of precipitation and water quality for 2010 (Tables 1 and 2, respectively). This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Samples

Samples are taken during base flow conditions and storm events. Base flow samples and event grabs are taken by dipping a bottle directly into the stream. Composite samples are taken by using an automated sampler. The sampler starts collecting if the stage rises above a predetermined level, and continues to take a sample each time a fixed volume of water has passed the station. The sampler then shuts off automatically after 96 samples have been collected or the water level has dropped below the activation stage. The samples are then combined and brought to the lab for analysis. Fifteen composite samples, twelve base flow grab samples, twelve *Escherichia Coliform* bacteria (*E. Coli*) grab samples (taken at time of composite sample pick-up), and two event grab samples were collected in 2010 (Figure 1).

Flow

There are two means of measuring stage and flow at the WOMP station. Since 1999, a bubbler system has been measuring stage. To determine the amount of flow related to stage, flow measurements are taken with a flow meter at various stages. With this data, a stage:discharge relationship can be applied to the program, which then continuously logs flow values. Nine flow measurements were taken in 2010, using a Sontek FlowTracker flow meter, to ensure accurate flow was logged in the datalogger.

A Sontek Argonaut was installed by the Metropolitan Council in 2008. This equipment calculates instantaneous flow based on the cross section, level, and velocity of the water. This equipment was determined necessary because of occasional backwater conditions caused by beaver dams or flooding by the Minnesota River. The bubbler system is not able to determine that the water is moving slower, so it automatically calculates higher flow as the stage rises. The Argonaut is able to adjust the flow as velocity changes, making the flow values more accurate during backwater conditions.

Results

Many parameters are recorded continuously at the Eagle Creek WOMP station including stage, flow, conductivity, precipitation, and stream temperature. Water quality samples are collected monthly during base flow conditions and also during storm events. Monitoring data suggests that Eagle Creek meets state water quality standards and ecoregion means[1], with the exception of bacteria, turbidity, and sediment (Table 2). The elevated levels of these parameters in winter is characteristic of this stream due to the fact that it is spring fed and does not freeze over in the winter. The open water attracts a large number of waterfowl, which results in higher bacteria, sediment, and turbidity levels than observed in summer months. However, sediment, turbidity, and *E. Coli* were also higher than average during summer months this year (Figures 2 - 5). This could possibly be due to that fact that: 1) this was the first year *E. Coli* was monitored during storm events, and 2) 2010 had higher-than-average rainfall (Table 1).

The current state turbidity standard will likely be replaced with a Total Suspended Solids (TSS) standard in 2012. Currently, the turbidity standard for Class 2A waters is 10 NTUs. Because of inconsistencies with the method in which turbidity is measured, TSS is a potential surrogate for turbidity. The proposed TSS standard for Class 2A waters would likely state that no more than 10% of the samples shall exceed 10 mg/L. This year, Eagle Creek exceeded 10 mg/L in 59% of lab samples (Figure 2 and 3).

E. coli was also higher this year when compared to past years of monitoring. The *E. Coli* standard is applicable from April 1 – October 31 and is exceeded when greater than 10% of the samples exceed 1260 Colony Forming Units per 100 ml (CFU's) *or* the geometric mean of all values in a calendar month exceed 126 CFUs. None of the samples exceeded 1260 CFU's from April through October (Figure 4), however, from 2006 to 2010, the geometric mean of E*. Coli* exceeded 126 CFU's in the months of June, July, and August (Figure 5).

It is important to note that conclusions based on monitoring data for Eagle Creek are influenced (i.e. biased) by the relative percentage of samples collected during and immediately after storm events. For instance, 17 of the 29 (59%) samples were collected during storm events, which is the same percentage of samples for which the TSS standard was exceeded. This bias is a result of the monitoring protocols specifically used at the Eagle Creek station. As stated, these protocols were designed to enable the Metropolitan Council to calculate pollutant loads to the Minnesota River. In order to assign load values, it is best to collect many storm event samples. Different protocols are typically used for assessing whether or not a particular water body meets state water quality standards. Therefore, caution must be used when attempting to characterize the condition of Eagle Creek based on data collected through this project.

[1] There are seven ecoregions in Minnesota. Ecoregions are classified by geographic areas with similar plant communities, land use, soil, and geology. Eagle Creek is located in the North Central Hardwood Forest ecoregion. Each ecoregion has unique water quality goals as determined by historical monitoring of representative and minimally impacted reference streams within that ecoregion.

Table 1. Precipitation near Eagle Creek WOMP station.

Month	2010 Precipitation* (inches)	30 year precipitation average**
January	0.68	.67
February	1.29	.72
March	0.91	1.54
April	1.88	2.13
May	2.96	3.68
June	8.43	4.76
July	4.52	4.09
August	5.67	4.01
September	8.07	2.67
October	2.20	1.92
November	2.17	1.17
December	3.07	.77
Total	**41.85**	**28.13**

*Precipitation data obtained from volunteer rain gauge monitor in Prior Lake.
** Data from MN State Climatology Office

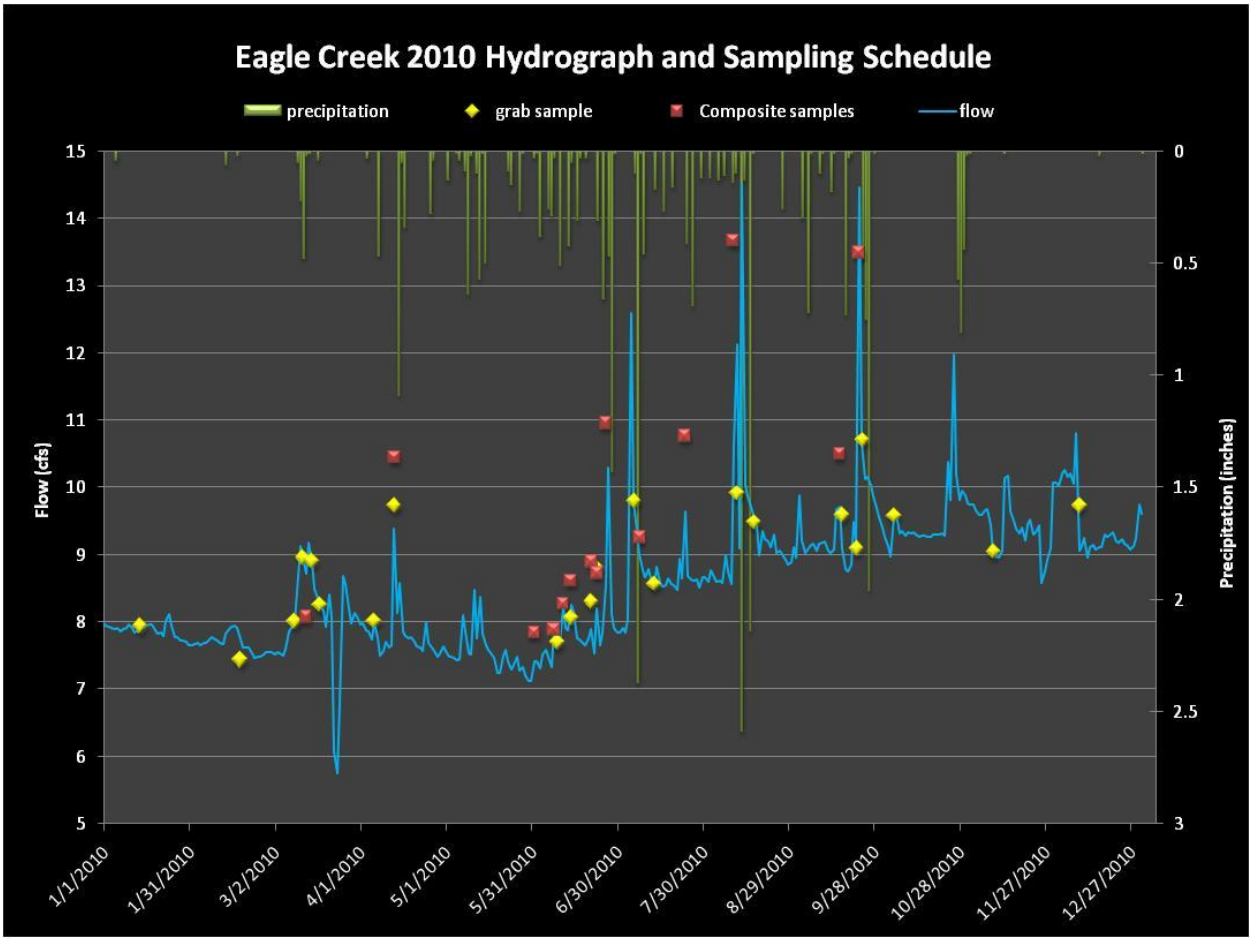

Figure 1. Flow, Precipitation, and Sample Schedule. Graph courtesy of MCES.

Table 2. Water quality results. Red, italicized text indicates sample exceeds the state standard or North Central Hardwood Forest ecoregion mean.

Parameter	Min	25th %	Avg	75th %	Max	Median	Samples	Notes
Ammonia Nitrogen, Unfiltered (mg/L)	0.02	0.04	0.06	0.06	0.36	0.05	30	
COD (mg/L)	5.00	8.25	14.50	19.00	42.00	10.50	30	
Chloride (mg/L)	23.00	32.00	32.45	34.00	36.00	33.00	29	State standard = 230 mg/L.
Chlorophyll-a (µg/L)	49.00	67.50	74.87	82.00	100.00	73.00	15	% Pheo-Corrected Average Of Result
Conductivity (mMHOs)	457.00	596.50	612.79	636.25	691.00	611.50	38	
Dissolved Oxygen (mg/L)	7.61	7.84	8.45	8.88	9.36	8.48	16	State standared = 7 mg/L.
E. Coli Bacteria Count (CFU/100ml)	4.00	75.00	*301.65*	*305.75*	*1986.00*	118.50	26	State Standard = 126 organisms/100 ml as a geometric mean of not < 5 samples within any calendar month (Apr – Oct)
Hardness (mg/L)	220.00	300.00	307.59	320.00	376.00	316.00	29	No state standard. Water above 180 mg/L considered very hard water.
Nitrate + Nitrite (mg/L)	0.09	0.13	0.17	0.19	0.30	0.16	30	
Ortho Phosphate as P (mg/L)	0.01	0.01	0.01	0.01	0.02	0.01	29	
Sulfate (mg/L)	13.70	17.05	18.04	19.28	22.50	17.90	30	
Suspended Solids (mg/L)	2.00	4.00	*19.87*	*23.00*	*97.00*	14.00	30	Proposed future state standard 10 mg/L
Total Alkalinity (mg/L)	153.00	239.00	246.21	265.00	294.00	257.00	29	No state standard. 20 – 200 mg/L typical. Less than 10 mg/L indicate poor buffer.
Total Kjeldahl Nitrogen (mg/L)	0.08	0.22	0.32	0.34	0.88	0.28	30	
Total Organic Carbon (mg/L)	1.90	2.40	3.12	3.38	6.10	2.80	30	
Total Phosphorus (mg/L)	0.01	0.02	0.05	0.06	*0.14*	0.03	30	Ecoregion mean = 0.13 mg/L. EPA recommends less than 0.1 mg/L. These results are the unfiltered average of result.
Transparency Tube (cm)	17.00	60.00	55.14	60.00	60.00	60.00	35	
Lab Turbidity (NTRU)	3.00	5.00	*11.21*	*13.00*	*50.00*	7.00	29	State standard for trout waters = 10 NTU, however lab reports in NTRU. Not quite comparable.
Volatile Suspended Solids (mg/L)	1.00	2.00	5.73	6.50	29.00	4.00	30	
pH	7.18	7.71	7.92	8.11	8.42	7.95	17	

mg/L = milligrams per liter
mMHO = micromhos or micorseimens
NTU = nephelometric turbidity units
su = standard units
ug/L = micrograms per liter
CFU = colony forming units
Highlighted areas indicate areas of concern.
State standard = state standard for Class 2A waters, hardness greater than 200

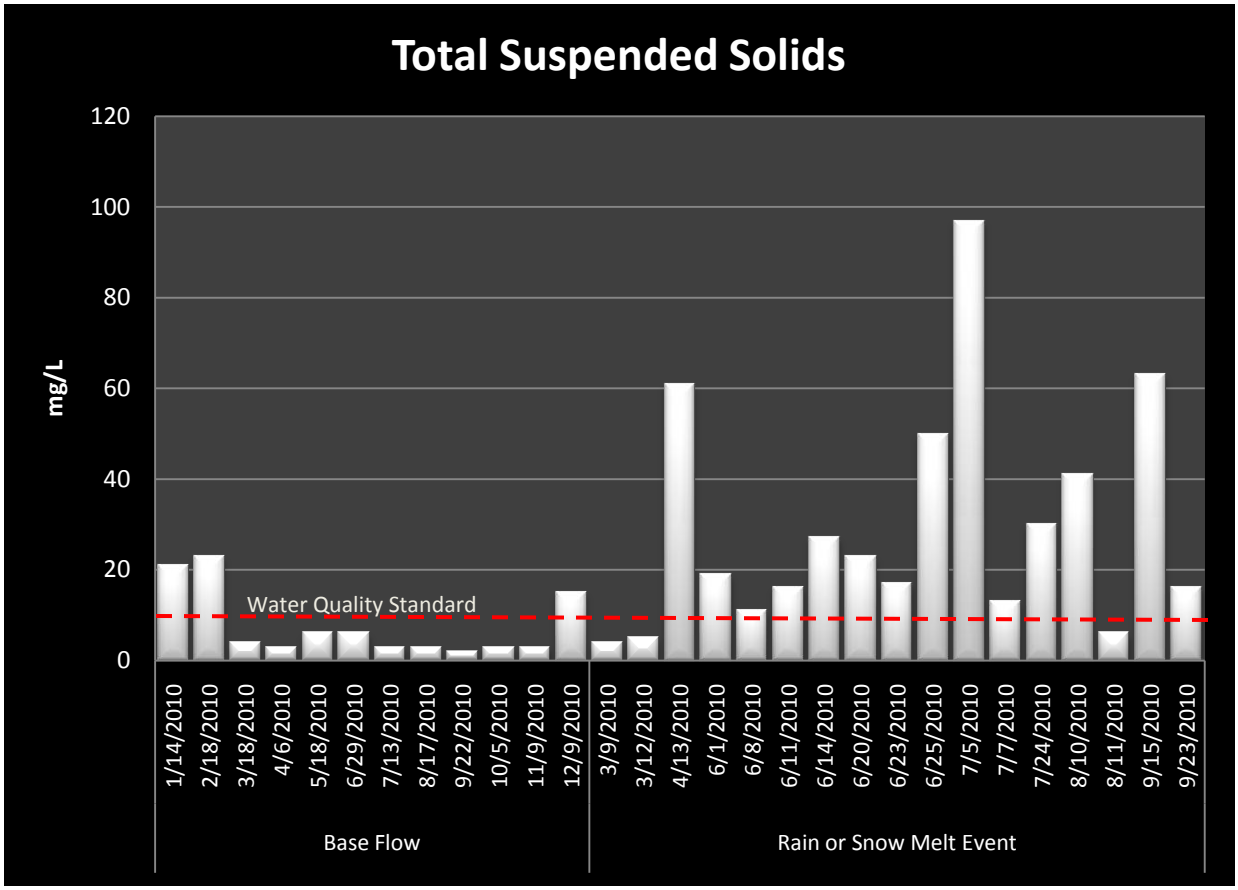

Figure 2. Proposed 2012 TSS State Standard for Class 2A Waters = 10 mg/L (no more than 10% exceedence).

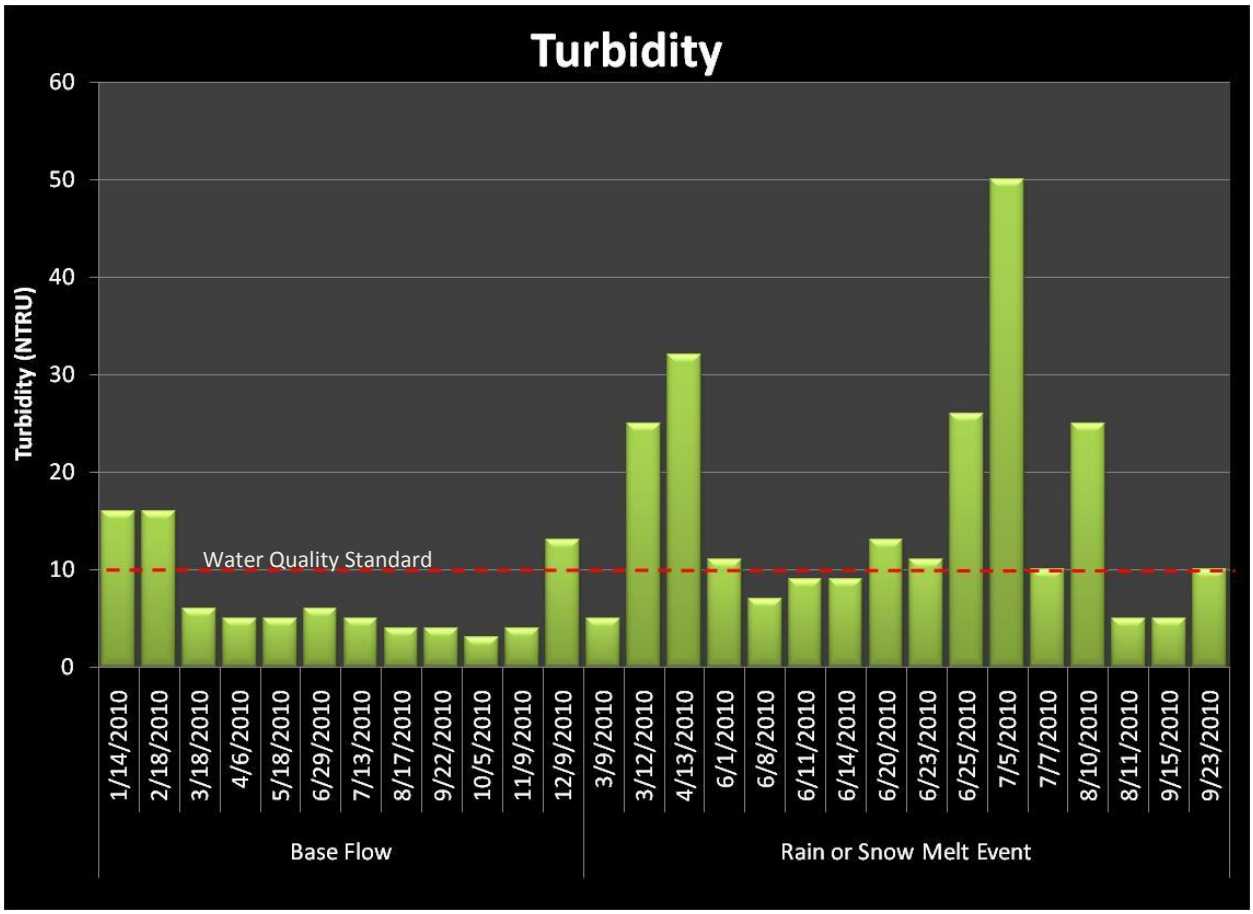

Figure 3. The red line indicates an approximate standard. Because turbidity was measured in Nephelometric Turbidity Ratio Units (NTRU), rather than Nephelometric Turbidity Units (NTU), the standard of 10 NTU's cannot directly apply. Rather, it is an estimate.

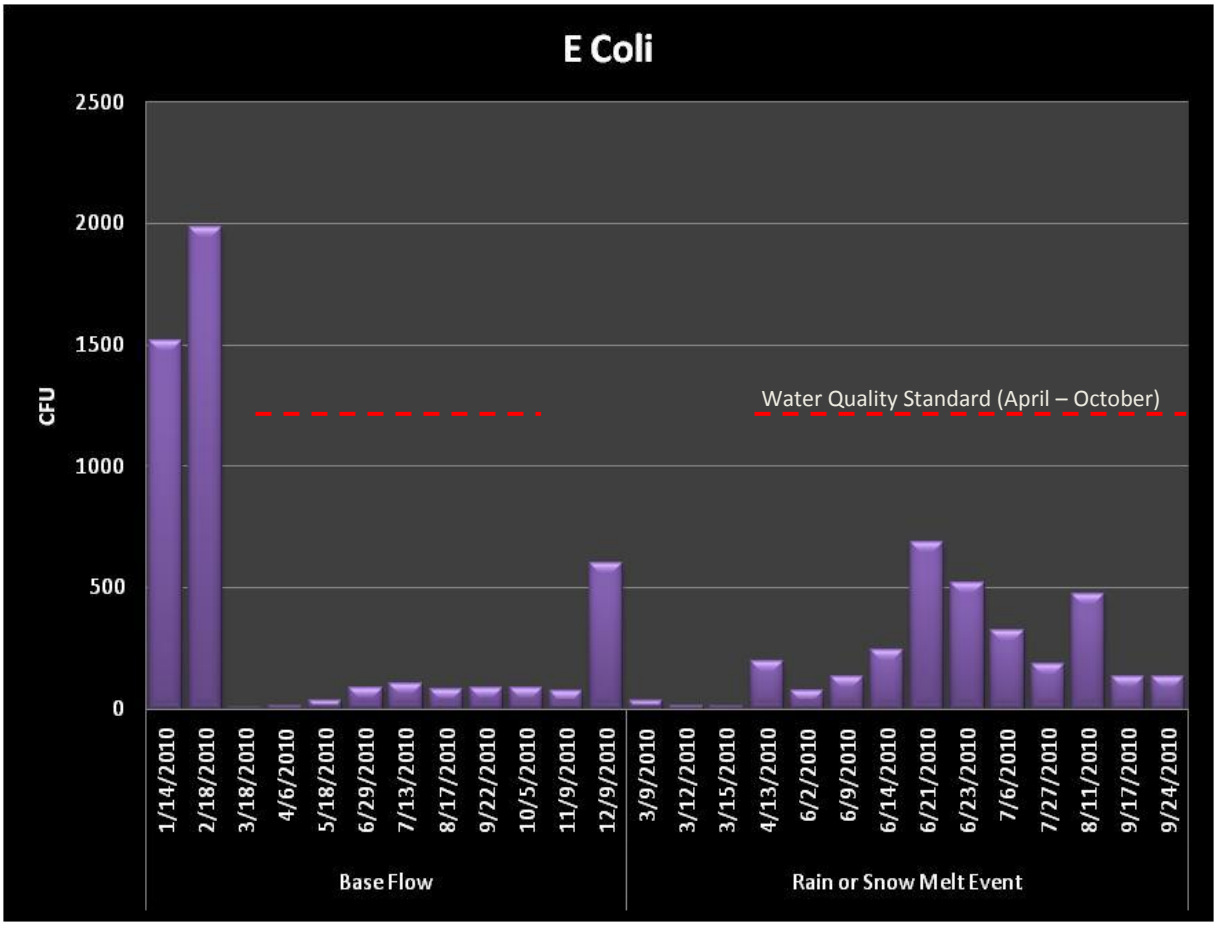

Figure 4. Presence of *E. Coli* in 2010 samples. Standard states no more than 10% exceedence of 1260 CFU / 100 ml, April through October.

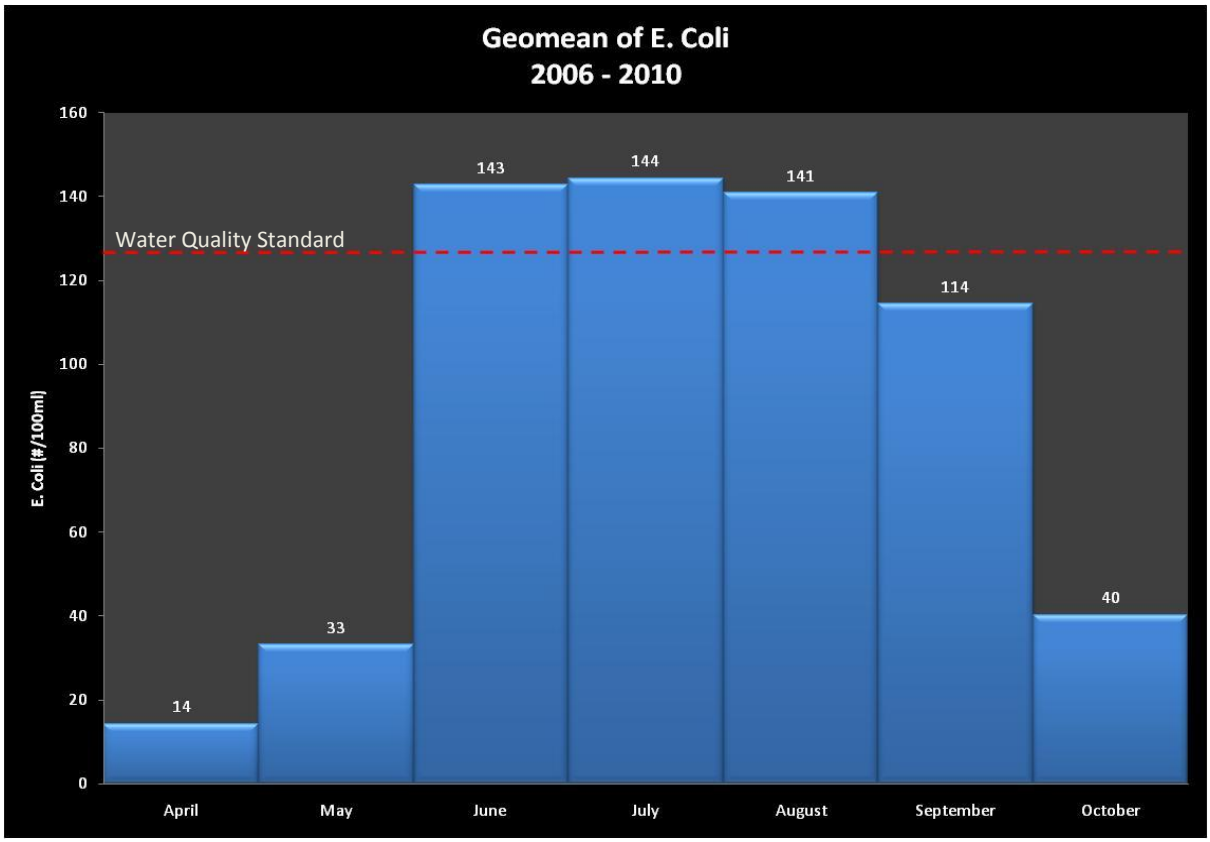

Figure 5. Geomean of *E. Coli* at Eagle Creek, 2006-2010. Standard states the geometric mean of all *E Coli* values in a calendar month (April – October) cannot exceed 126 CFU's.