Bacteria Contamination of Surface Waters Due to Livestock Grazing in the Stanislaus National Forest, California

(Fourth and Fifth Year of Study)

Summary of 2012 and 2013 Results

Lindsey Myers, staff biologist
Central Sierra Environmental Resource Center
P.O. Box 396, Twain Harte, CA 95383
(209) 586-7440
lindseym@cserc.org

Surface waters were tested for pathogenic bacteria indicators (i.e., *E. coli*, fecal coliform bacteria, and total coliform bacteria) for the fourth and fifth consecutive years within commercial cattle grazing allotments in the Stanislaus National Forest. Water samples were collected from four allotments, with four sample sites in three wilderness areas (or wild areas directly adjacent to designated wilderness areas). The sample sites from the first three years of sampling, 2009 through 2011, focused on comparative sampling done at a specific site before cattle presence and then at the same site after the arrival of cattle. The results showed that individual and average concentrations of fecal coliform bacteria in surface waters were consistently below regulatory thresholds at all sites before cattle presence or where no livestock grazed during the season. Shortly after cattle were released into the national forest to graze in allotments, fecal coliform concentrations were much higher, and in places exceeded state standards. *E. coli* and total coliform concentrations followed the same pattern. Reports at the end of study field seasons in 2009 and again in 2010 both focused on documenting the violations of state standards for fecal coliform concentrations in recreational contact waters. The 2011 report highlighted the difference in *E. coli* and fecal coliform concentrations detected in waters when cattle were not present compared to the *E. coli* and fecal coliform concentrations detected when cattle were present in the Stanislaus National Forest. This report for 2012 and 2013 discusses results from sampling that specifically focused on water quality in streams within grazed areas in national forest roadless areas and wilderness areas. In those remote areas, the potential is high for recreational users to potentially drink the contaminated stream water.

<u>Field Site Selection for 2012</u>

Five sites that were exposed to commercial livestock grazing during the summer of 2012 were sampled within the Stanislaus NF. One of these sites has also been sampled in 2009, 2010, and 2011; another site had limited sampling in 2010 and 2011 as well. These sites are described below, and Table 1 provides location (i.e., latitude, longitude) coordinates for each site, using datum NAD 83.

Lower Round Meadow

Sample site: 1,932 meters (6,338 feet) elevation

Samples were collected from a tributary stream of Bell Creek, where it flows through Lower Round Meadow (which is within the Bell Meadow/Bear Lake Range Allotment). Bell Creek is entirely within the Tuolumne River watershed and flows into the Tuolumne River via the Clavey River. Two "before livestock" grazing water samples were collected June 13, 2012.. Two more samples were collected on June 18 and June 26, 2012 – both times from the same sample site as the original samples. On those dates it was not clear if cattle were in the allotment or not. No livestock was present in the meadow, but cows may have been somewhere upstream of the meadow. The proximity of livestock to the sample site on those dates is unclear based on the tentative "on date" information provided by the U.S. Forest Service and the water sample results. Then, between June 13 and June 26, 2012, two more "before livestock" samples were collected from a stream sample site located in the forest upstream of the meadow. No cattle and/or evidence of cattle were observed near this upstream sample site). Later, eight "after livestock arrival" water samples were then collected between July 2, 2012 and July 25, 2012.

Sheep Meadow (SM2 & SM3)

SM2 sample site: 2,634 meters (8,642 feet) elevation

SM3 sample site: 2,640 meters (8660 feet) elevation

Samples were collected from an unnamed tributary of Elbow Creek below Sheep Meadow in the Mokelumne Wilderness (which is within the Highland Lakes Range Allotment). The unnamed tributary is entirely within the North Fork Mokelumne River watershed and flows into the North Fork Mokelumne River via Elbow Creek. The unnamed tributary of Elbow Creek has several confluences with tributaries and seeps that drain into the stream from Sheep Meadow. The two sample sites are located 80 feet apart on the main stream below separate confluences with water flowing from Sheep Meadow. Two "before cattle" samples were collected on June 15, 2012 from each sample site. Two more samples were collected on July 3, 2012 from each site; this is another gray sample in that there was minor evidence of cattle in a nearby area, but not enough to designate these samples as "after livestock." Four "after livestock" samples were collected from each site after livestock clearly had arrived in the area. Two samples were taken at each site on July 12 and July 18, 2012.

Bloomfield

Sample site: 2,399 meters (7,871 feet) elevation

Samples were collected from an unnamed tributary stream of the North Fork Mokelumne River approximately 60 meters (200 feet) upstream from the confluence of the unnamed tributary stream and the river. The sample site is within the Highland Lakes Range Allotment. This site was selected because it is about a half mile upstream of the Bloomfield campground, which is immediately adjacent to the North Fork Mokelumne River. The proximity of the river to the campground makes it likely that campers, especially those unaware of possible pollution, use water from the river. Three "before livestock arrival" samples were collected on June 15 and July 12, 2012. Five "after livestock" samples were collected between July 18 and August 7, 2012.

Lower Gardner
Sample site: 2,560 meters (8,399 feet) elevation
Samples were collected from an unnamed tributary of the North Fork Mokelumne River in the Carson-Iceberg Wilderness not far from where the Pacific Crest Trail (PCT) passes through this area (within the Highland Lakes Range Allotment). This site was selected because it is very close to the PCT and backpackers could be taking water from this water source or other nearby sources for drinking water. No "before livestock" samples were collected in 2012. Six "after livestock arrival" samples were collected between August 7, 2012 and August 28, 2012.

Bear Tree
Sample site: 2,548 meters (8,361 feet) elevation
Samples were collected from an unnamed tributary of the North Fork Mokelumne River in the Carson-Iceberg Wilderness (within the Highland Lakes Range Allotment). This site was selected in order to have a second sample site that was also near the PCT and within the designated wilderness. No "before livestock" samples were collected in 2012. Seven "after livestock arrival" samples were collected between August 7, 2012 and August 28, 2012.

Field Site Selection for 2013

Two sites located in wilderness areas that were exposed to commercial livestock grazing during the summer of 2013 were sampled within the Stanislaus National Forest. A third site was sampled that is not in a grazing allotment. These sites are described below, and Table 1 provides location (i.e., latitude, longitude) coordinates for each site, using datum NAD 83.

Cooper Meadow
Sample site: 2,558 meters (8,392 feet) elevation
Samples were collected at Cooper Meadow from a tributary of the headwaters of the South Fork Stanislaus River within the Emigrant Wilderness (within the Cooper Range Allotment). This site was selected because it is in designated wilderness and is the first water source along a popular trail three and half miles into the Wilderness. Twelve water samples were taken between July 9 and September 24, 2013. It was not possible to precisely designate the water samples related to livestock, as cattle were in the allotment on July 9, 2013, but not yet obviously presentin Cooper Meadow. There were horses in the meadow throughout the summer.

Wheats Meadow Creek
Sample site: 2,013 meters (6,603 feet) elevation
Samples were collected in Wheats Meadow from Wheats Meadow Creek in the Carson-Iceberg Wilderness (within the Wheats Range Allotment). This site was selected because it is in designated wilderness and it is a possible drinking water source for those hiking on the Wheat Meadow Trail. Five water samples were collected on July 16, 2013.

Bourland Meadow (control site, not grazed)
Sample site: 2,225 meters (7,299 feet) elevation
Samples were collected from Bourland Creek at a site below Bourland Meadow.. Bourland Meadow lies within a designated research natural area (RNA). Bourland Creek is entirely within the Tuolumne River watershed and flows into the Tuolumne River via the Clavey River. This site was sampled in 2009, 2010, and 2011 as an "ungrazed" control site. This site was again sampled as an ungrazed control site in 2013. Six samples were collected on July 3 and August 3, 2013.

Table 1. List of water sample sites (lat/long datum NAD 83).

Site name	County	Latitude	Longitude
LRM	Tuolumne	38.15877200	-119.95698600
LRM upstream sample	Tuolumne	38.16985000	-119.95798333
SM2	Alpine	38.56216667	-119.85891667
SM3	Alpine	38.56238889	-119.85883333
BoM (Control site)	Tuolumne	38.10920712	-119.91242115
Bloomfield	Alpine	38.53315277	-119.81995555
Bear Tree	Alpine	38.50148055	-119.78886388
Lower Gardner	Alpine	38.49857777	-119.77641388
Cooper	Tuolumne	38.23233055	-119.82848888
Wheats	Tuolumne	38.36433611	-119.96108333

Methods

Field Water Collection

A Quality Assurance Project Plan (QAPP) was prepared for this water-monitoring project and all procedures specified in the QAPP were followed.

Water samples that were collected for bacteriological testing were collected while wearing sterile gloves and collected in sample bottles sterilized and provided by AquaLab Water Analysis (which has ELAP certification). The bacteriological samples were collected before any other work was performed at the site. The sterilized Nalgene bottles hold 125mL of liquid. They were filled to 100 mL with sample water taken directly from flowing water approximately 0.1 m below the surface.

The sample containers were marked with a unique 3-digit identifying number with an indelible marker so that the markings would not "run" or otherwise become illegible when collecting the sample. The collection date, time and samplers' names were recorded on the field datasheets, which are retained at the CSERC office; they are also recorded on the Chain-of-Custody form that was transmitted to AquaLab along with each sample. No sampling bottles were contaminated during sampling or transit.

All water samples collected for bacteriological analyses were delivered to AquaLab within six hours from the time the samples were collected. The sample bottles were placed in Zip-loc plastic bags (to avoid any potential contamination from the ice water) on ice in a cooler until delivered into the custody of AquaLab.

While collecting the water samples, the relative flow of the stream being sampled was recorded on a field datasheet along with other observations about the sample area.

<u>Laboratory Analyses</u>

Water samples were delivered at Twain Harte, CA, to AquaLab, a State-certified analytical laboratory. All water samples were tested for *E. coli,* total coliform, and fecal coliform bacteria within the 6-hour holding time specified in the QAPP, using Multiple Tube Fermentation (Most Probable Number/100 mL). The detection limit using this method of analysis is two fecal coliform organisms/100 mL of water. The detection maximum using this method of analysis is 1,600 fecal coliform organism/100 mL of water.

A copy of AquaLab's Quality Assurance SOP for Multiple Tube Fermentation is on file at the CSERC office and included in appendix 5. The analytical methods utilized by this laboratory are specified in *Standard Methods For the Examination of Water and Wastewater* (19^{th} Edition).

<u>Data Analysis for Comparison to State Standards</u>

The bacteria results were compared to the relevant water quality standards contained in the Central Valley Regional Water Quality Control Board's *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* ("Basin Plan"). Water contact recreation is a designated beneficial use of the receiving waters included in this study. To protect that beneficial use, the Basin Plan specifies (in part) the following numeric objectives (i.e., standards):

> *In waters designated for contact recreation (REC-1), the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400/100 ml. (Basin Plan at III-3)*

Data were compiled whenever five or more samples were collected within a 30-day period, and results were judged as a "Type 1 Violation" whenever the geometric mean of five samples collected over a 30-day period exceeded 200 fecal coliform colonies per 100 ml of water. Results were judged as a "Type 2 Violation" whenever more than ten percent of the samples collected over a 30-day period exceeded 400 fecal coliform colonies per 100 ml of water. In effect, a Type 2 Violation exists for this study any time there are at least five samples during a 30-day period for which any single sample exceeded 400 fecal coliform colonies per 100 ml of water.

For this study, reporting periods were tabulated only when five or more samples were collected within a 30-day period. This conservative method of data analysis documented 51 violations of the above state water quality standards for fecal coliform bacteria. A more comprehensive analysis (i.e., tabulating all possible 30-day periods by re-starting the 30-day calendar each day) would produce additional violations.

Results

<u>*Comparison of Data From Sites with "Before vs. After Livestock" Data*</u>

At Lower Round Meadow, the average *E. coli* concentration before cattle presence was 2 (n=4) [mean FC= 2, n=4]. The average *E. coli* concentration after cattle presence was 370 (n=10), with five samples of 300 or higher [mean FC=389, n=10].

At Bloomfied Meadow, the average *E. coli* concentration before cattle presence was 11 (n=4) [mean FC= 12, n=3]. The average *E. coli* concentration after cattle presence was 578 (n=5), with two samples above 1,000 [mean FC=578, n=5].

At Sheep Meadow (SM2), the average *E. coli* concentration before cattle presence was 4 (n=4) [mean FC= 4, n=4]. The average *E. coli* concentration after cattle presence was 430 (n=4), with one sample above 1,000 [mean FC=430, n=].

At Sheep Meadow (SM3), the average *E. coli* concentration before cattle presence was 2 (n=4) [mean FC= 2, n=4]. The average *E. coli* concentration after cattle presence was 1160 (n=4), with one sample above 1,000 [mean FC=1585, n=4].

At Bear Tree, no "before cattle" presence samples were taken. The average *E. coli* concentration with cattle presence was 1200 (n=7), with three samples higher than 1000 [mean FC=1200, n=7].

At Lower Garderner, no "before cattle" presence samples were taken. The average *E. coli* concentration with cattle presence was 212 (n=6), with two samples of 300 or higher [mean FC=215, n=6].

At Cooper, horses were already in the meadow, so these are also considered "after livestock" presence samples, even though cattle were not yet in the meadow. The average *E. coli* concentration with horse or cattle present was 236 (n=12), with seven samples of 300 or higher [mean FC=334, n=12].

At Wheats, no "before cattle" presence samples were taken. The average *E. coli* concentration with cattle presence was 448 (n=5), with four samples of 300 or higher [mean FC=448, n=5].

Bourland Meadow was the "control/ungrazed site" in 2009, 2010, 2011, and again in 2013. In 2009, the average *E. coli* concentration was 5 (n=8), with six samples of 2 or less [mean FC=6, n=8]. In 2010, the average *E. coli* concentration was 2 (n=6), with five samples of 2 or less [mean FC=3, n=6]. In 2011, this site was sampled once; the *E. coli* concentration was less than 2 [FC=<2]. In 2013, the average *E. coli* concentration was 3 (n=6), with six samples of 2 or less [mean FC=3, n=6].

Comparison to State Standards

Below are tables that provide results for each of the 51 documented violations of state water quality standards.

Violation #1 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 18, 2012 – July 11, 2012

Date	FC / 100ml
6/18/12	220
6/26/12	300
7/2/12	170
7/11/12 (1)	500
7/11/12 (2)	170
Geo Mean	**249**

Violation #2 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 18, 2012 – July 11, 2012

Date	FC / 100ml
6/18/12	220
6/26/12	300
7/2/12	170
7/11/12 (1)	500
7/11/12 (3)	130
Geo Mean	**236**

Violation #3 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 26, 2012 – July 17, 2012

Date	FC / 100ml
6/26/12	300
7/2/12	170
7/11/12 (1)	500
7/11/12 (2)	170
7/17/12	300
Geo Mean	**265**

Violation #4 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 26, 2012 – July 17, 2012

Date	FC / 100ml
6/26/12	300
7/2/12	170
7/11/12 (1)	500
7/11/12 (3)	130
7/17/12	300
Geo Mean	**251**

Violation #5 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 26, 2012 – July 17, 2012

Date	FC / 100ml
6/26/12	300
7/2/12	170
7/11/12 (2)	170
7/11/12 (3)	130
7/17/12	300
Geo Mean	**202**

Violation #6 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 26, 2012 – July 17, 2012

Date	FC / 100ml
6/26/12	300
7/2/12	170
7/11/12 (1)	500
7/11/12 (2)	170
7/17/12	1300
Geo Mean	**355**

Violation #7 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 26, 2012 – July 17, 2012

Date	FC / 100ml
6/26/12	300
7/2/12	170
7/11/12 (1)	500
7/11/12 (3)	130
7/17/12	1300
Geo Mean	**336**

Violation #8 (Type 1 Violation) — Site: Lower Round
Sampling dates: June 26, 2012 – July 17, 2012

Date	FC / 100ml
6/26/12	300
7/2/12	170
7/11/12 (2)	170
7/11/12 (3)	130
7/17/12	1300
Geo Mean	**271**

Violation #9 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 17, 2012

Date	FC / 100ml
7/11/12	500
7/11/12	170
7/11/12	130
7/17/12	300
7/17/13	1300
Geo Mean	**336**

Violation #10 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 25, 2012

Date	FC / 100ml
7/11/12 (1)	500
7/11/12 (2)	170
7/17/12	300
7/17/13	1300
7/25/13	500
Geo Mean	**440**

Violation #11 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 25, 2012

Date	FC / 100ml
7/11/12 (1)	500
7/11/12 (3)	130
7/17/12	300
7/17/13	1300
7/25/13	500
Geo Mean	**417**

Violation #12 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 15, 2012

Date	FC / 100ml
7/11/12 (2)	170
7/11/12 (3)	130
7/17/12	300
7/17/13	1300
7/25/13	500
Geo Mean	**336**

Violation #13 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 25, 2012

Date	FC / 100ml
7/11/12 (1)	500
7/11/12 (2)	170
7/17/12	300
7/17/13	1300
7/25/13	300
Geo Mean	**398**

Violation #14 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 25, 2012

Date	FC / 100ml
7/11/12 (1)	500
7/11/12 (3)	130
7/17/12	300
7/17/13	1300
7/25/13	300
Geo Mean	**377**

Violation #15 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 25, 2012

Date	FC / 100ml
7/11/12 (2)	170
7/11/12 (3)	130
7/17/12	300
7/17/13	1300
7/25/13	300
Geo Mean	**304**

Violation #16 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 25, 2012

Date	FC / 100ml
7/11/12	500
7/17/12	300
7/17/13	1300
7/25/13	500
7/25/12	300
Geo Mean	**493**

Violation #17 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 25, 2012

Date	FC / 100ml
7/11/12	170
7/17/12	300
7/17/13	1300
7/25/13	500
7/25/12	300
Geo Mean	**398**

Violation #18 (Type 1 Violation) — Site: Lower Round
Sampling dates: July 11, 2012 – July 15, 2012

Date	FC / 100ml
7/11/12	130
7/17/12	300
7/17/13	1300
7/25/13	500
7/25/12	300
Geo Mean	**377**

Violation #19 (*Type 2 Violation) — Site: Lower Round
Sampling dates: June 18, 2012 – July 25, 2012

Date	FC / 100ml
6/18/12	220
6/26/12	300
7/2/12	170
7/11/12*	500
7/11/12	170
7/11/12	130
7/17/12	300
7/17/12	1300
7/25/12	500
7/25/12	300

Violation #20 (*Type 2 Violation) — Site: Lower Round
Sampling dates: June 18, 2012 – July 25, 2012

Date	FC / 100ml
6/18/12	220
6/26/12	300
7/2/12	170
7/11/12	500
7/11/12	170
7/11/12	130
7/17/12	300
7/17/12*	1300
7/25/12	500
7/25/12	300

Violation #21 (*Type 2 Violation) — Site: Lower Round
Sampling dates: June 18, 2012 – July 25, 2012

Date	FC / 100ml
6/18/12	220
6/26/12	300
7/2/12	170
7/11/12	500
7/11/12	170
7/11/12	130
7/17/12	300
7/17/12	1300
7/25/12*	500
7/25/12	300

Violation #22 (Type 1 Violation) — Site: Bear Tree
Sampling dates: August 7, 2012 - August 21, 2012

Date	FC / 100ml
8/7/12	1600
8/16/12	300
8/16/12	500
8/21/12	500
8/21/12	800
Geo Mean	**626**

Violation #23 (Type 1 Violation) — Site: Bear Tree
Sampling dates: August 16, 2012 - August 28, 2012

Date	FC / 100ml
8/16/12	300
8/16/12	500
8/21/12	500
8/21/12	800
8/28/12 (1)	1700
Geo Mean	**633**

Violation #24 (Type 1 Violation) — Site: Bear Tree
Sampling dates: August 16, 2012 - August 28, 2012

Date	FC / 100ml
8/16/12	300
8/16/12	500
8/21/12	500
8/21/12	800
8/28/12 (2)	3000
Geo Mean	**710**

Violation #25 (Type 1 Violation) — Site: Bear Tree
Sampling dates: August 16, 2012 - August 28, 2012

Date	FC / 100ml
8/16/12	300
8/21/12	500
8/21/12	800
8/28/12	1700
8/28/12	3000
Geo Mean	**906**

Violation #26 (Type 1 Violation) — Site: Bear Tree
Sampling dates: August 16, 2012 - August 28, 2012

Date	FC / 100ml
8/16/12	500
8/21/12	500
8/21/12	800
8/28/12	1700
8/28/12	3000
Geo Mean	**1004**

Violation #27 (*Type 2 Violation) — Site: Bear Tree
Sampling dates: August 7, 2012 - August 28, 2012

Date	FC / 100ml
8/7/12*	1600
8/16/12	300
8/16/12	500
8/21/12	500
8/21/12	800
8/28/12	1700
8/28/12	3000

Violation #28 (*Type 2 Violation) — Site: Bear Tree
Sampling dates: August 7, 2012 - August 28, 2012

Date	FC / 100ml
8/7/12	1600
8/16/12	300
8/16/12*	500
8/21/12	500
8/21/12	800
8/28/12	1700
8/28/12	3000

Violation #29 (*Type 2 Violation) — Site: Bear Tree
Sampling dates: August 7, 2012 - August 28, 2012

Date	FC / 100ml
8/7/12	1600
8/16/12	300
8/16/12	500
8/21/12*	500
8/21/12	800
8/28/12	1700
8/28/12	3000

Violation #30 (*Type 2 Violation) — Site: Bear Tree
Sampling dates: August 7, 2012 - August 28, 2012

Date	FC / 100ml
8/7/12	1600
8/16/12	300
8/16/12	500
8/21/12	500
8/21/12*	800
8/28/12	1700
8/28/12	3000

Violation #31 (*Type 2 Violation) — Site: Bear Tree
Sampling dates: August 7, 2012 - August 28, 2012

Date	FC / 100ml
8/7/12	1600
8/16/12	300
8/16/12	500
8/21/12	500
8/21/12	800
8/28/12 *	1700
8/28/12	3000

Violation #32 (*Type 2 Violation) — Site: Bear Tree
Sampling dates: August 7, 2012 - August 28, 2012

Date	FC / 100ml
8/7/12	1600
8/16/12	300
8/16/12	500
8/21/12	500
8/21/12	800
8/28/12	1700
8/28/12*	3000

Violation #33 (Type 1 Violation) — Site: SM3
Sampling dates: July 3, 2012 – July 18, 2012

Date	FC / 100ml
7/3/12 (1)	2
7/12/12	2800
7/12/12	3000
7/18/12	300
7/18/12	240
Geo Mean	**261**

Violation #34 (Type 1 Violation) — Site: SM3
Sampling dates: July 3, 2012 – July 18, 2012

Date	FC / 100ml
7/3/12 (2)	2
7/12/12	2800
7/12/12	3000
7/18/12	300
7/18/12	240
Geo Mean	**261**

Violation #35 (*Type 2 Violation) — Site: SM3
Sampling dates: July 3, 2012 – July 18, 2012

Date	FC / 100ml
7/3/12	2
7/12/12*	2800
7/12/12	3000
7/18/12	300
7/18/12	240

Violation #36 (*Type 2 Violation) — Site: SM3
Sampling dates: July 3, 2012 – July 18, 2012

Date	FC / 100ml
7/3/12	2
7/12/12	2800
7/12/12*	3000
7/18/12	300
7/18/12	240

Violation #37 (*Type 2 Violation) — Site: Bloomfield
Sampling dates: July 18, 2012 – August 7, 2012

Date	FC / 100ml
7/18/12*	1700
7/18/12	1100
7/26/12	30
7/26/12	50
8/7/12	11

Violation #38 (*Type 2 Violation) — Site: Bloomfield
Sampling dates: July 18, 2012 – August 7, 2012

Date	FC / 100ml
7/18/12	1700
7/18/12*	1100
7/26/12	30
7/26/12	50
8/7/12	11

Violation #39 (Type 1 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13	900
7/9/13	900
7/9/13	500
7/22/13 (1)	300
7/22/13 (2)	300
Geo Mean	**516**

Violation #40 (Type 1 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13	900
7/9/13	900
7/9/13	500
7/22/13 (1)	300
7/22/13 (3)	300
Geo Mean	**516**

Violation #41 (Type 1 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13	900
7/9/13	900
7/9/13	500
7/22/13 (2)	300
7/22/13 (3)	300
Geo Mean	**516**

Violation #42 (Type 1 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13	900
7/9/13	900
7/22/13	300
7/22/13	300
7/22/13	300
Geo Mean	**466**

Violation #43 (Type 1 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13 (1)	900
7/9/13	500
7/22/13	300
7/22/13	300
7/22/13	300
Geo Mean	**414**

Violation #44 (Type 1 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13 (2)	900
7/9/13	500
7/22/13	300
7/22/13	300
7/22/13	300
Geo Mean	**414**

Violation #45 (*Type 2 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13*	900
7/9/13	900
7/9/13	500
7/22/13	300
7/22/13	300
7/22/13	300

Violation #46 (*Type 2 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13	900
7/9/13*	900
7/9/13	500
7/22/13	300
7/22/13	300
7/22/13	300

Violation #47 (*Type 2 Violation) — Site: Cooper
Sampling dates: July 9, 2013 – July 22, 2013

Date	FC / 100ml
7/9/13	900
7/9/13	900
7/9/13*	500
7/22/13	300
7/22/13	300
7/22/13	300

Violation #48 (Type 1 Violation) — Site: Wheats
Sampling date: July 16, 2013

Date	FC / 100ml
7/16/13	900
7/16/13	240
7/16/13	300
7/16/13	300
7/16/13	500
Geo Mean	**396**

Violation #49 (*Type 2 Violation) — Site: Wheats
Sampling period: July 16, 2013

Date	FC / 100ml
7/16/13*	900
7/16/13	240
7/16/13	300
7/16/13	300
7/16/13	500

Violation #50 (*Type 2 Violation) — Site: Wheats
Sampling period: July 16, 2013

Date	FC / 100ml
7/16/13	900
7/16/13	240
7/16/13	300
7/16/13	300
7/16/13*	500

Violation #51 (*Type 2 Violation) — Site: SM2
Sampling period: July 3, 2012 – July 18, 2012

Date	FC / 100ml
7/3/12	8
7/12/12	80
7/12/12	300
7/18/12	240
7/18/12*	1100

Conclusion

Study results from 2012 and 2013 continue to document that significant pollution of surface waters is resulting from cattle grazing as currently permitted and regulated on National Forest System lands. After five years of collecting water samples for bacteriological testing at sites scattered throughout the Stanislaus National Forest, the results remain consistent. The concentration of indicator bacteria detected in the forest waters is very low until cattle are released into summer grazing allotments. Shortly after cattle arrive within a stream sample area, the concentration of indicator bacteria rapidly rises and remains high as long as the cattle are present.

The results presented here document 51 individual violations of California's regulatory water quality standards for bacteria within range allotments where water sampling was performed during the 2012 and 2013 summer/fall season.

The 51 individual violations, combined with CSERC's previous studies done during the 2009, 2010, and 2011grazing seasons, provide persistence evidence of the failure of Best Management Practices (BMPs) to comply with state water quality standards. This study documents that BMPs as currently applied by the Stanislaus NF are not achieving water quality in livestock-affected streams that meets state water quality standards. This study also documents that, even with implementation of BMPs, significant pollution of surface waters is still resulting from cattle grazing as currently regulated and permitted on National Forest System lands.

Further, the levels and methods of livestock grazing in the sampled areas are not unlike practices throughout the Stanislaus NF and other public lands where livestock grazing occurs in the Sierra Nevada. These findings confirm earlier studies indicating that widespread pollution of surface waters is occurring due to livestock presence on National Forest System lands in the Sierra Nevada, and demonstrate the need for consideration of: (1) appropriate changes in permitted livestock grazing activities in order to eliminate or reduce contamination of surface waters, (2) increased water quality monitoring of high use livestock sites where prolonged or concentrated presence of cattle increases the potential for violations of water quality standards, and (3) removal of livestock from known areas where current livestock management techniques (such as fencing and herding) have not resulted in compliance with water quality standards (Derlet et al, 2008 and 2010).

This is the fifth year where "before cows" and "cows present" water sampling has detected high levels of fecal coliform, total coliform, and *E. coli* in national forest areas used by varying numbers of recreational visitors. One obvious consideration for reducing the risk of exposing recreational visitors (swimmers, hikers, campers, backpackers) to pathogens or indicators of pathogens in national forest water is to evaluate where the areas with the highest levels of backcountry recreational use occur within each national forest. Keeping livestock out of those high-use recreational areas would appear to be one effective strategy to avoid, in those specific areas, recreational visitors' exposure to water that fails to meet State standards for recreational contact and public health.

References:

Derlet, R.W., K.A. Ger, J.R. Richards, and J.R. Carlson. 2008. Risk Factors for Coliform Bacteria in Backcountry Lakes and Streams in the Sierra Nevada Mountains: A 5-Year Study. *Wilderness and Environmental Medicine*, 19:82-90

Derlet, R.W., Goldman, C.R., Connor, M.J. 2010 Reducing the impact of summer cattle grazing on water quality in the Sierra Nevada Mountains of California: a proposal. *Journal of Water and Health*, 08.2