



SLATE RIVER INTEGRATED MONITORING PROJECT

2019 STUDY RESULTS

TECHNICAL COMMITTEE MEMORANDUM

DECEMBER 30, 2019

COAL CREEK WATERSHED COALITION

In 2014, CCWC finalized the Upper Slate River (USR) Watershed Plan¹. **Stakeholders identified human and pet waste (nonpoint source pollution) as a pressing concern.** Dispersed camping and extensive recreational use occur throughout the Slate River Watershed. There is broad community support to assess and, where possible, reduce the impacts of recreation on local waterbodies.

As part of an on-going effort CCWC and several local partners conducted a study to assess *E. coli* concentrations in the Slate River Watershed. This memo summarizes the results of the 2019 study.

STUDY OBJECTIVES AND METHODS

The study began on May 7, 2019 and ended on September 25, 2019. The objectives and methods are summarized below:

- Confirm that freezing conditions during the winter of 2018-2019 decreased *E. coli* concentrations from peak concentrations measured in the late summer of 2018.
 - Assessed based on concentrations measured in Coal Creek upstream of the Slate River (COAL-00), Washington Gulch upstream of the Slate River (WASH-00), and the Slate River near Highway 135 (SR-20) during early spring and summer 2019.
- Evaluate attainment of the *E. coli* standard for primary contact recreational use on stream segments in the study area.
 - Assessed using Water Quality Control Commission Regulations 31 and 35², and the 2020 303(d) Listing Methodology³.
 - Collected samples weekly at 12 locations from June 19 to September 18, 2019; plus, additional locations were sampled on a monthly basis⁴.
 - Where *E. coli* concentrations exceeded the recreational use standard, we collected additional samples at targeted locations and tracked the decline of *E. coli* concentrations during the

¹ The Upper Slate River Watershed Plan was funded by the Colorado Department of Public Health and Environment Nonpoint Source Program and the Colorado Division of Reclamation Mining and Safety. The plan is available at: https://www.colorado.gov/pacific/sites/default/files/WQ_nonpoint_source-2nd-Upper-Slate-River-Watershed-Plan%20Final-2014.pdf

² The Water Quality Control Commission Regulations, effective as of 12/31/19, are available at: <https://www.colorado.gov/pacific/cdphe/water-quality-control-commission-regulations>

³ The Colorado Water Quality Control Division developed the 2020 303(d) Listing Methodology. It is available at: https://drive.google.com/file/d/1CE5GDswZ_qIwckRRPTYxLQtOGqPiEONq/view

⁴ The number of locations sampled in each event was determined by study objectives, existing data, logistics, and the project budget.



onset of freezing conditions by collecting additional samples and recording weather conditions.

- Evaluate the effect of stream flow and diversions on *E. coli* concentrations.
 - Use USGS gage data from the Slate River and Coal Creek along with manual flow measurements in Washington Gulch.
 - cursory review of diversion records and administrative calls.
- Evaluate the effect of stream temperature on *E. coli* concentrations.
 - Continuous stream temperature monitoring occurs in the Slate River near Highway 135 (SR-20). Stream temperatures in the Slate River near Highway 135 are generally expected to be characteristic of upstream temperatures except areas immediately downstream of large diversions.

214 *E. coli* samples, including 28 QA-QC samples, were collected and analyzed in local laboratories⁵. All 14 field blanks had concentrations of <1 cfu/100 mL⁶ which indicates that field technicians and laboratory staff did not introduce *E. coli* during the sample collection or analysis process. The relative percent difference exceeded 30 percent in 3 of 14 duplicate pairs. This variability may be attributed to variation in the stream, sample collection practices or laboratory protocols. Overall, the QA-QC results suggest field technicians and laboratory staff implemented sample collection and analysis protocols proficiently.

RESULTS

The sections below provide a brief description of each major area including point and nonpoint sources, instream recreational uses, and *E. coli* concentrations. Appendix A includes a description of the study locations and maps. Appendix B includes *E. coli* concentrations and standards evaluations.

Washington Gulch Watershed

The Washington Gulch Watershed includes both point and nonpoint sources that may influence *E. coli* concentrations. Mt. Crested Butte Water and Sanitation District (MCBWS) collects and treats wastewater produced in the town of Mt. Crested Butte, Meridian Lake Park subdivision, and Saddle Ridge Ranch subdivision. The wastewater treatment facility (WWTF) removes *E. coli* using modern UV-treatment protocols. Treated wastewater is discharged to Woods Creek, a tributary to Washington Gulch that drains much of the town of Mt. Crested Butte and a portion of Crested Butte Mountain Resort.

Potential nonpoint sources within the Washington Gulch Watershed include recreational use, dispersed camping, grazing, flood irrigation, individual on-site wastewater treatment systems, and stormwater runoff. Cattle grazed near sample locations in lower Washington Gulch from mid-August to late fall; additional grazing occurred in other portions of the watershed.

⁵ Samples collected by USGS within the study area were also evaluated during this assessment.

⁶ cfu/100 mL= colony forming units per 100 milliliters of water. Results reported in cfu/100 mL can be compared directly to the water quality standards which are reported in col/100 mL.



Instream recreational use including fishing, swimming, and paddling occurs in Washington Gulch upstream of Meridian Lake Park Reservoir, Meridian Lake (more commonly known as Long Lake), and in Meridian Lake Park Reservoir. In the Mt. Crested Butte area, children may play in tributaries to Woods Creek. The land adjacent to Washington Gulch downstream of Meridian Lake Park Reservoir is privately owned and instream recreational use occurs occasionally, based on reports from landowners.

Washington Gulch was the most frequently sampled watershed in the study area with 12 locations that were sampled from 1 to 17 times each for a total of 62 samples. **Samples collected during the early stages of runoff confirmed that *E. coli* concentrations declined to less than 5 cfu/100 mL from peak concentrations measured in the late summer of 2018.**

During the 2019 study, *E. coli* concentrations in the effluent treated at the MCBWSD WWTF ranged from 1 to 2 cfu/100 mL. In 7 of 14 samples the MCBWSD WWTF diluted *E. coli* concentrations in Woods Creek. In 3 of 14 samples *E. coli* concentrations increased by less than 20 percent⁷ in Woods Creek downstream of the MCBWSD WWTF. **Throughout the study, *E. coli* concentrations in Woods Creek were less than the primary contact standard.**

In 14 of 14 samples *E. coli* concentrations in Woods Creek were less than or approximately equal to concentrations in Washington Gulch upstream of Woods Creek. In 8 of 15 samples Woods Creek reduced *E. coli* concentrations in Washington Gulch. In 2 of 15 samples *E. coli* concentrations increased by less than 20 percent in Washington Gulch downstream of Woods Creek. **Overall, Woods Creek did not increase *E. coli* concentrations in Washington Gulch.**

Although *E. coli* concentrations measured at some locations exceeded the value of the primary contact recreation standard in late summer and early fall, the anti-biasing method provided in the 303(d) listing methodology prevented the 61-day geometric mean from exceeding the standard in Washington Gulch⁸. *E. coli* concentrations measured in 2018 indicate that the primary contact standard was exceeded during the summer of 2018. Together, the 2018 and 2019 studies suggest that some portion of the mainstem of Washington Gulch is impaired for *E. coli*.⁹

The 2019 study suggests that *E. coli* concentrations are not an issue in the early summer months, in Washington Gulch upstream of Meridian Lake Park Reservoir or in the mainstem of Woods Creek (i.e. below Crystal Road). The 2019 study indicates that *E. coli* concentrations can become problematic in the latter part of summer and early fall and may be attributed to decreased stream flows, increased air and

⁷ Natural variability in streams can account for up to 20 percent variability in *E. coli* concentrations; in addition to variability attributed to the study methods (i.e. samples collected over the course of several hours). Thus, when the relative percent difference between samples was less than 20 percent, the change was considered minor.

⁸ The protocol to evaluate compliance with *E. coli* standard includes two steps. First, an anti-biasing method is applied, where the median is calculated from all samples collected from a segment within a 7-day period. Second, a 61-day geometric mean is calculated. The 61-day geometric mean must be less than 126 col/100 mL to be in attainment of the standard.

⁹ When evaluating standards attainment, Water Quality Control Division staff have discretion. It is possible that data from 2018 and 2019 could be used to identify a portion of Washington Gulch (i.e. subdivide COGUUG09_C) as impaired for *E. coli* rather than the entire mainstem. For example, 2019 data suggest that *E. coli* concentrations upstream of Meridian Lake Park Reservoir are generally very low which could be used to omit the portion of Washington Gulch upstream of the reservoir from the impaired segment portion.



water temperature, and increased use within the watershed (i.e. camping, grazing, home occupancy, etc.). **Additional data collection is recommended to better identify nonpoint sources in the Washington Gulch Watershed. Future sample collection activities should begin later in the summer and include additional “adaptive sampling” protocols.**¹⁰

Upper Slate River Watershed

The Upper Slate River Watershed is the area upstream of Coal Creek and includes multiple nonpoint sources that may affect *E. coli* concentrations. Camping occurs at Oh-Be-Joyful Campground, River Flats, Musicians’ Camp, and additional dispersed sites. Hiking, biking, and other forms of recreation occur throughout the Upper Slate River Watershed. In recent years, toilets have been installed at multiple locations and portable toilets are used during the summer and fall. All homes within the Upper Slate River Watershed use on-site wastewater treatment systems.

The upper portions of the Slate River and Oh-Be-Joyful Creek provide extremely technical kayaking opportunities and the lower portion of the Slate River is used for a variety of water sports including kayaking, stand up paddle-boarding (SUP), rafting, fishing, and swimming. Swimming frequently occurs in the Slate River at Oh-Be-Joyful Campground, Gunsight Pass Bridge, and River Flats. Swimming occurs in Oh-Be-Joyful Creek in pools downstream of waterfalls.

22 samples were collected from 5 locations. The maximum *E. coli* concentration measured in the Slate River upstream of Coal Creek was 82 cfu/100 mL on August 21, 2019. In 2019 all *E. coli* concentrations were less than the primary contact recreation standard of 126 col/100 mL.

The 2018 and 2019 studies indicate that *E. coli* concentrations peak in late summer. The Upper Slate River Watershed lacks substantial water diversions and point sources. Therefore, other factors such as natural hydrology, precipitation, and nonpoint sources control *E. coli* concentrations.

Coal Creek Watershed

The Coal Creek Watershed includes multiple nonpoint sources that may affect *E. coli* concentrations. Dispersed camping, hiking, biking, and other recreation occurs in the Coal Creek Watershed. Homes in Irwin Town Site rely on on-site wastewater treatment systems.

Children swim in Coal Creek at Totem Pole Park and angling occurs occasionally in Coal Creek. Coal Creek is the raw drinking water supply for the town of Crested Butte.

17 samples were collected from 3 locations in the Coal Creek Watershed. Samples collected during the early stages of runoff confirmed that *E. coli* concentrations declined to less than 1 cfu/100 mL from peak concentrations measured in the late summer of 2018.

The maximum *E. coli* concentration was 461 cfu/100 mL on August 28, 2019 in Coal Creek upstream of McCormick Ditch. Although, the raw sample concentration was greater than the standard, the 61-day

¹⁰ “Adaptive sampling” uses recent and current data to select sample locations, schedule, and frequency. This technique can also address questions such as “how do *E. coli* concentrations change following large precipitation events?”



geometric mean remained below the primary contact standard. **Together, the 2018 and 2019 study results indicate that the lower portion of Coal Creek is impaired for *E. coli*.**

The 2018 and 2019 studies indicate that *E. coli* concentrations peak late August in the lower portion of Coal Creek. Fewer samples have been collected from Coal Creek upstream of the Crested Butte, but the available data set indicates that *E. coli* concentrations are well-below the standard upstream of town. Water diversions and concentrated nonpoint sources within the Town of Crested Butte likely increase *E. coli* concentrations in lower Coal Creek.

Slate River Near Crested Butte

This reach includes the Slate River downstream of the confluence with Coal Creek to the Highway 135 Bridge near Skyland. This reach includes both point and nonpoint sources that may affect *E. coli* concentrations.

The Town of Crested Butte discharges treated wastewater effluent into the Slate River upstream of the Recreation Path Bridge. The WWTF removes *E. coli* using modern UV-treatment protocols.

Nonpoint sources in this reach include cattle grazing, pet waste, stormwater runoff, and on-site wastewater treatment systems. Disturbance and development within and near the riparian corridor may also influence *E. coli* concentrations. In 2019, cattle grazed pastures adjacent to the Slate River throughout the summer and fall.

Instream recreational use occurs on the Slate River near Crested Butte and includes swimming, SUP, rafting, and fishing. The reach includes public access points for recreational use.

57 samples were collected from 5 locations during 2019. Samples collected during the early stages of runoff confirmed that *E. coli* concentrations declined from peak concentrations measured in the late summer of 2018.

During the 2019 study, *E. coli* concentrations in the effluent treated at the Town's WWTF ranged from 1 to 4 cfu/100 mL. In 7 of 14 samples *E. coli* concentrations were lower in the Slate River downstream of the Town of Crested Butte's WWTF; and one sample exhibit minimal change. In 6 of 14 samples *E. coli* concentrations increased in the Slate River downstream of the WWTF. The increase in *E. coli* concentrations may be attributed to nonpoint sources in the vicinity (i.e. construction activity, irrigation return flows, stormwater runoff, pet waste, etc.).

In 11 of 14 samples Washington Gulch increased *E. coli* concentrations in the Slate River. Although, *E. coli* concentrations in the Slate River downstream of Washington Gulch (SR-12) remained below the primary contact standard. In 13 of 14 samples *E. coli* concentrations increased by a small margin in the Slate River between Washington Gulch and the Highway 135 bridge. Nonpoint sources within this area include cattle grazing, irrigation, and stormwater runoff.

The maximum *E. coli* concentration in the Slate River was 206 cfu/100 mL on July 2, 2019. Other locations in the Slate River also had elevated *E. coli* concentrations on July 2, 2019. In late June several small mass wasting events (i.e. landslides, mud flows, slope failure) were reported in the headwaters of



the Slate River and Washington Gulch watersheds following a rain-on-snow event¹¹. Increased *E. coli* concentrations measured on July 2, 2019 may be a result of increased sediment loads following the late June rain-on-snow event.

Aside from the July 2 event, median *E. coli* concentrations in the Slate River peaked in late August like other portions of the study area. Although *E. coli* concentrations measured at some locations approached the value of the primary contact recreation standard, the anti-biasing method provided in the 303(d) listing methodology prevented the 61-day geometric mean from exceeding the standard. *E. coli* concentrations measured in the Slate River in 2018 indicate that the primary contact standard was exceeded during the summer of 2018. **Together, the 2018 and 2019 studies suggest that the Slate River is impaired for *E. coli* concentrations that exceed the primary contact recreation standard.**¹²

Future Activities

If funding is secured, CCWC and local partners plan to collect additional *E. coli* samples in the Washington Gulch Watershed in 2020; the study will be expanded to include nutrient and algae samples based on additional concerns identified during 2019. CCWC has submitted a concept paper to the Colorado Department of Public Health and Environment (CDPHE) Nonpoint Source Program (NPS) in preparation for a formal application to the NPS grant program. The concept paper is provided in Appendix C. The NPS grant requires 40 percent non-federal match (cash or in-kind). CCWC is updating project partners and requesting funds.

¹¹ Based on personal communication with community members.

¹² When evaluating standards attainment, Water Quality Control Division staff have discretion. It is possible that data could be used to identify a portion of Slate River (i.e. subdivide COGUUG08) as impaired for *E. coli* rather than the entire segment. Currently, the lower portion of the segment may lack data to support this conclusion. Additional data collection in the Slate River upstream of the confluence with the East River is recommended.



APPENDIX B: SLATE RIVER INTEGRATED MONITORING PROJECT RESULTS 2019
