



# COLORADO

## Parks and Wildlife

Department of Natural Resources

Water Resources Section - Aquatic,  
Terrestrial, and Natural Resources  
Branch

January 11, 2023

Mr. Rob Viehl, Section Chief  
Colorado Water Conservation Board (CWCB)  
Stream and Lake Protection Section  
1313 Sherman Street, 7th Floor  
Denver, CO 80203

Subject: Instream Flow Recommendations for Red Canyon Creek in Water Division 4,  
Montrose County to be presented at the January 2023 CWCB Meeting

Dear Mr. Viehl:

The information contained in and referred to in this letter forms the scientific and biological basis for an instream flow (ISF) recommendation on Red Canyon Creek in Water Division 4. The field investigations relating to this ISF recommendation were conducted by Colorado Parks and Wildlife (CPW) staff beginning in 2020. Red Canyon Creek supports a core conservation population of Colorado River cutthroat trout (CRCT) of the Gunnison Basin lineage. This stream reach was presented to interested parties at the ISF Workshop in January 2020. Outreach was also conducted to the Montrose County Commissioners in November 2022. It is the CPW staff's opinion that the information contained in this letter is sufficient for the CWCB's staff to recommend an ISF appropriation to the Board on Red Canyon Creek and to specifically address the findings required in Rule 5(i) of the Instream Flow Program Rules.

CPW participates in the ISF Program and develops instream flow recommendations for the Board's consideration in an effort to address CPW's legislative declarations "... that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors ... and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.), and "... that the natural, scenic, scientific, and outdoor recreation areas ... be protected, preserved, enhanced and managed for the use, benefit, and enjoyment of the people of this state and (its) visitors ... and that, to carry out such program and policy, there shall be a continuous operation of acquisition, development, and management of ... lands, waters, and facilities." (See §33-10-101 (1) C.R.S.).

In addition to these broad statutory guidelines, CPW's current strategic planning document (CPW Strategic Plan, 2015) explains current agency goals to, "[c]onserve wildlife and habitat to ensure healthy sustainable populations and ecosystems." In order to, "protect and enhance water resources for fish and wildlife populations," by pursuing, "partnerships and agreements



to enhance instream flows, protect reservoir levels, and influence water management activities,” and to, “[a]dvocate for water quality and quantities to conserve aquatic resources.” In addition to the CPW Strategic Plan, the agency’s fish and wildlife conservation activities are also directed by the State Wildlife Action Plan (2002, Revised 2015). The goals and priorities from these documents direct CPW to advocate for the preservation of the state’s fish and wildlife resources and natural environment, and therefore link CPW’s mission to the goals and priorities of CWCB’s ISF and Natural Lake Level (NLL) Program.

#### Recommended Segments

CPW is proposing an ISF recommendation on Red Canyon Creek from its headwaters (located at UTM 12S 221751.70 4245322.94) to its confluence with Big A Creek (UTM 12S 219603.08 4240822.17). The reach is approximately 3.2 miles in length. All of the proposed reach is on public lands managed as Uncompahgre National Forest.

#### Colorado Cutthroat Trout Conservation Goals

In 2001, CPW entered into a multi-state and multi-agency conservation agreement and strategy concerning Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*). Colorado’s partners in this plan and agreement include the natural resource management agencies from Utah and Wyoming, a number of federal agencies including the USFS, USFWS, BLM and NPS, and the Ute Indian Tribe of the Uintah and Ouray Reservation. The purpose of the strategy is to provide a framework for the long-term conservation of the Colorado River cutthroat trout (CRCT). Conservation measures include actions that reduce or eliminate threats that warrant CRCT being listed as a special status species by federal agencies and might lead to a listing under the Endangered Species Act of 1973. Essentially, the parties agreed that in order to prevent listing of the subspecies, and to reach desired recovery goals without hindering further development of our state resources, continued implementation of the conservation strategy was necessary.

The objectives of the strategy are to identify and characterize all CRCT conservation populations, secure and enhance conservation populations, restore populations, secure and enhance watershed conditions, public outreach, data sharing, and coordination. CPW believes that flow protection by way of establishing an ISF water right is a conservation action aligned with “securing and enhancing watershed conditions” and will support the core conservation population of CRCT in Red Canyon Creek. Information about the species and CPW’s conservation strategy can be found here: [CPW Cutthroat Trout Research](#). CPW believes that securing ISF water rights for core conservation populations of CRCT is a critical step in the overall preservation and conservation of these iconic native trout.

#### Natural Environment and Biological Summary

Red Canyon Creek is a tributary of Horsefly Creek located east of the town of Nucla. The stream drains southwesterly off the Uncompahgre Plateau. The stream’s hydrology is dominated by snowmelt; the basin receives approximately 29 inches of precipitation a year. The drainage basin contributing to the ISF reach is approximately 6 square miles in size. It is forested, mainly containing stands of aspen interspersed with blue spruce, ponderosa pine, and scrub oak. Red Canyon Creek supports a healthy riparian area consisting of willow and alder.

Red Canyon Creek through the recommended instream flow reach is a first to second order headwaters stream. The stream is a relatively high-gradient, mainly single thread channel

with substrate size that ranges from medium cobbles to large boulders. The reach contains a variety of notable fish habitat including undercut banks, productive riffles, large volume pools and glides, and ample woody debris and riparian cover. A couple of very large beaver dam complexes were observed. Riparian cover is abundant adding complexity and temperature buffering during periods of low flow. The creek supports a robust macroinvertebrate community including three species of caddisfly, two species of mayflies, aquatic beetle larvae, water strider, and diptera, which were all observed in the field.

The resident trout population in Red Canyon Creek are a core conservation population of CRCT, meaning genetic analyses indicate greater than 99% purity. CRCT are state species of special concern and considered federally sensitive species (State Wildlife Action Plan, 2015). Length-frequency data collected in 2009 and 2017 (see attached) indicates multiple age classes of fish, evidence that the cutthroat trout in Red Canyon Creek are a self-sustaining population.

### R2Cross Background

Initial biological instream flow recommendations were developed using the R2Cross methodology (Espegren, 1996<sup>1</sup>). R2Cross uses field data that has been collected in a riffle habitat type. Riffles are often the limiting habitat type in streams during low flow events, so maintaining specific conditions across riffle habitat types will also maintain aquatic habitat in pools and runs for most life stages of fish and macroinvertebrates (Nehring, 1979<sup>2</sup>). The R2Cross model uses field data, including a survey of cross-sectional channel geometry, a longitudinal slope of the water surface, and a flow measurement, as input to a single transect hydraulic model. R2Cross uses Ferguson's Variable-Power Equation (Ferguson, 2007<sup>3</sup>) to model a stage-discharge relationship and compute corresponding hydraulic parameters of average depth, average velocity, and percent wetted perimeter over modeled stages. Maintaining these three hydraulic parameters at specified levels should ensure conditions that allow movement of fish longitudinally across riffles and adequate depths, velocities, and oxygenation for production of macroinvertebrates and development of trout eggs. Baseflow recommendations are typically developed based on the flows that meet two of three hydraulic criteria and summer flow recommendations are based on hydraulic criteria that meet three of three hydraulic criteria (as described in Nehring 1979 and Espegren 1996).

In 2020 through 2022, CPW collected four datasets on Red Canyon Creek. Red Canyon Creek is remote and access requires a 5-mile round trip hike with approximately 1,000 feet of elevation gain. Because of the remote nature of Red Canyon Creek, cross-sectional datasets were collected under low streamflow conditions that wouldn't normally be considered suitable. These datasets were used for reconnaissance-level information gathering, and ultimately were determined to be unsuitable for use in final flow recommendations. R2Cross results are summarized in the table below.

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<sup>1</sup> Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

<sup>2</sup> Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

<sup>3</sup> Ferguson, R.I., 2007. Flow resistance equations for gravel- and boulder-bed streams. Water Resources Research 43. <https://doi.org/10.1029/2006WR005422>

|                        | Bankfull Top Width | Date Measured | Flow Measured | Flow Meeting Two Criteria | Flow Meeting Three Criteria |
|------------------------|--------------------|---------------|---------------|---------------------------|-----------------------------|
| 1                      | 21.0 ft            | 5/19/2022     | 6.894 cfs     | 1.45 cfs                  | 6.15 cfs                    |
| Recommended Flow Rates |                    |               |               | 1.45 cfs                  | 6.15 cfs                    |

In formulating biological flow recommendations for Red Canyon Creek, CPW relied solely on results from one cross-section collected in 2022. This cross-section is a critical riffle with a large bankfull top width. This transect was selected because it is the most critical limiting transect for fish passage over the observed reach as streamflows drop. In this circumstance, this approach is appropriate because the core conservation population of CRCT in Red Canyon Creek require a high level of protection. These factors considered, the initial biological flow recommendation in the winter is 1.45 cfs. This rate will be protective during the overwintering period by maintaining an average depth of 0.2 feet and percent wetted perimeter of 50 percent of the bankfull top width in the most critical limiting riffle. The initial biological flow recommendation in the summer is 6.15 cfs, which will maintain depth and wetted perimeter criteria, as well as average velocity of 1 foot per second (fps) in the most critical limiting riffle.

In order to make a preliminary determination whether water is available for the R2Cross-based flow recommendations and to determine the appropriate seasonal transition dates, CPW examined basic hydrologic data and water rights information for Red Canyon Creek. Red Canyon Creek does not have any gage data, and because it is high-elevation and undeveloped, CPW relied upon regression estimates for monthly flow estimates to determine the seasonality of the flow recommendations. CPW is not aware of any water rights within the reach.

#### Water Availability-Refined Flow Recommendation

CPW's analysis indicates that the following flows are needed to protect the natural environment to a reasonable degree. Based on the hydrology from CSUFlow 18 (Eurich et al., 2021<sup>4</sup>), there appears to be water availability limitations during the baseflow period from October through March. Therefore, our flow recommendation has been refined based on water availability to the following:

- Early Spring Runoff Recommendation (April 1 through April 30): **5.0 cfs**
  - Earlier spring snowmelt may be a reality in a changing climate. This early season flow recommendation will support beneficial spawning conditions for cutthroat trout, a species who spawn in the spring.
- Summer Flow Recommendation (May 1 through July 31): **6.15 cfs**
  - Maintains adequate depth, velocity, and wetted perimeter during the summer period when fish are most active and stream temperatures are high. This higher flow rate will support ideal spawning conditions for cutthroat trout.
- Late-Summer Flow Recommendation (August 1 through September 30): **3.0 cfs**

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<sup>4</sup> Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

- Maintains available habitat, depth, and wetted perimeter, and allows fish movement as flows recede and temperatures may still be high during the late-summer.
- Fall Flow Recommendation (October 1 through October 31): **2.3 cfs**
  - Maintains available habitat and allows fish movement as flows recede to baseflow conditions.
- Baseflow Recommendation (November 1 through March 31): **1.0 cfs**
  - The flow recommendation has been reduced due to water availability constraints but will provide sufficient habitat availability in pools and deep glides during the overwintering period.

The purpose of this letter is to formally transmit this ISF recommendation to CWCB for the Board's consideration. CPW believes that there is a flow-dependent natural environment in Red Canyon Creek that can be preserved to a reasonable degree with an ISF water right in the recommended rates. Please refer to attachments which include; R2Cross field forms, R2Cross output, fish survey information, and photographs at each cross section location.

CPW personnel will be available at the January 2023 CWCB meeting to answer any questions that the Board might have regarding these flow recommendations. We appreciate your consideration.

Sincerely,

*Katie Birch*

Katie Birch  
CPW Instream Flow Program Coordinator  
Attachments (as stated)





# FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



COLORADO WATER  
CONSERVATION BOARD

### LOCATION INFORMATION

|                         |  |                        |  |                   |  |                 |  |
|-------------------------|--|------------------------|--|-------------------|--|-----------------|--|
| STREAM NAME:            |  | Red canyon CK          |  | CROSS-SECTION NO: |  | 22-3            |  |
| CROSS-SECTION LOCATION: |  | U/S of Trail crossing  |  |                   |  |                 |  |
|                         |  | UTM 12S 745711 4242687 |  |                   |  |                 |  |
| DATE:                   |  | 5/14/22                |  |                   |  |                 |  |
| OBSERVERS:              |  | Birch Fields-Summers   |  |                   |  |                 |  |
| LEGAL DESCRIPTION       |  | 1/4 SECTION:           |  | SECTION:          |  | TOWNSHIP:       |  |
|                         |  |                        |  |                   |  | N/S             |  |
|                         |  |                        |  |                   |  | RANGE:          |  |
|                         |  |                        |  |                   |  | E/W             |  |
| COUNTY:                 |  | WATERSHED:             |  | WATER DIVISION:   |  | DOW WATER CODE: |  |
|                         |  |                        |  |                   |  |                 |  |
| MAP(S):                 |  | USGS:                  |  |                   |  |                 |  |
|                         |  | USFS:                  |  |                   |  |                 |  |

## SUPPLEMENTAL DATA

|  |             |                           |                             |
|--|-------------|---------------------------|-----------------------------|
| SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO |             | METER TYPE:               |                             |
| METER NUMBER:  | DATE RATED: | CALIB/SPIN: _____ sec     | TAPE WEIGHT: _____ lbs/foot |
| CHANNEL BED MATERIAL SIZE RANGE:                     |             | PHOTOGRAPHS TAKEN: YES/NO | NUMBER OF PHOTOGRAPHS:      |

### CHANNEL PROFILE DATA

| STATION |                 | DISTANCE FROM TAPE (ft) | ROD READING (ft) |
|---------|-----------------|-------------------------|------------------|
| ⊗       | Tape @ Stake LB | 0.0                     | ~                |
| ⊗       | Tape @ Stake RB | 0.0                     | ~                |
| ①       | WS @ Tape LB/RB | 0.0                     | 4.95 / 5.01      |
| ②       | WS Upstream     | 126.36                  | 4.87             |
| ③       | WS Downstream   |                         | 5.47             |
| SLOPE   |                 |                         |                  |

SKETCH

LEGEND:

Stake ⊗

Station ①

Photo ① →

Direction of Flow ← →

## AQUATIC SAMPLING SUMMARY

|  |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
|--|---------------------------------|---------------------|---------------------------------|---|---|---|---|---|---|----|----|----|----|----|----|-----|-------|--|
| STREAM ELECTROFISHED: YES/NO   | DISTANCE ELECTROFISHED: _____ft | FISH CAUGHT: YES/NO | WATER CHEMISTRY SAMPLED: YES/NO |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
| LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.) |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
| SPECIES (FILL IN)  | 1                               | 2                   | 3                               | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | >15 | TOTAL |  |
|  |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
|  |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
|  |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
|  |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
| AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:            |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |
|  |                                 |                     |                                 |   |   |   |   |   |   |    |    |    |    |    |    |     |       |  |

\*stream wind, tops 10 mph. mid 70°F, cloudy

## COMMENTS

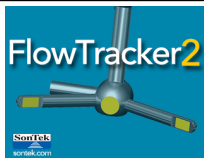
1 macrohabitat

Bluespruce, Willow, Alder, Aspen. Good riparian cover, fish habitat, pools, woody debris, habitat  
diversity. Med cobbles to small boulders. Active beaver complexes. 2<sup>+</sup> Sp. Caddisfly, 2<sup>+</sup> Sp. Mayfly,  
Giant water bugs



## DISCHARGE/CROSS SECTION NOTES

| STREAM NAME:             |   |   |            | CROSS-SECTION NO.:                       |                  |                            |             | DATE:      |                   | SHEET ____ OF ____       |                         |                 |
|--------------------------|---|---|------------|--|------------------|----------------------------|-------------|------------|-------------------|--------------------------|-------------------------|-----------------|
| BEGINNING OF MEASUREMENT |   | EDGE OF WATER LOOKING DOWNSTREAM:<br>(0.0 AT STAKE) |            | LEFT / RIGHT                             |                  | Gage Reading: ____ ft      |             | TIME:      |                   |                          |                         |                 |
| Features                 | Stake (S)<br>Grassline (G)<br>Waterline (W)<br>Rock (R) | Distance From Initial Point (ft)                    | Width (ft) | Total Vertical Depth From Tape/Inst (ft) | Water Depth (ft) | Depth of Observation (ft)  | Revolutions | Time (sec) | Velocity (ft/sec) |                          | Area (ft <sup>2</sup> ) | Discharge (cfs) |
|                          |   |   |            |  |                  |                            |             |            | At Point          | Mean in Vertical         |                         |                 |
| BF                       |   | 0   |            | 4.01                                     |                  |                            |             |            |                   |                          |                         |                 |
|                          |   | 1.1   |            | 4.73                                     |                  |                            |             |            |                   |                          |                         |                 |
| WS                       |   | 1.8   |            | 4.94                                     |                  |                            |             |            |                   |                          |                         |                 |
|                          |   | 3   |            | 5.04                                     |                  | 1.0                        |             |            |                   |                          |                         |                 |
|                          |   | 4   |            | 5.14                                     |                  | 2.0                        |             |            |                   |                          |                         |                 |
|                          |   | 5   |            | 5.52                                     |                  | 0.6                        |             |            |                   |                          |                         |                 |
|                          |   | 6   |            | 5.31                                     |                  | 0.35                       |             |            |                   |                          |                         |                 |
|                          |   | 7   |            | 5.54                                     |                  | 0.55                       |             |            |                   |                          |                         |                 |
|                          |   | 8   |            | 5.35                                     |                  | 0.39                       |             |            |                   |                          |                         |                 |
|                          |   | 9   |            | 5.45                                     |                  | 0.52                       |             |            |                   |                          |                         |                 |
|                          |   | 10  |            | 5.42                                     |                  | 0.48                       |             |            |                   |                          |                         |                 |
|                          |   | 11  |            | 5.39                                     |                  | 0.43                       |             |            |                   |                          |                         |                 |
|                          |   | 12  |            | 5.32                                     |                  | 0.38                       |             |            |                   |                          |                         |                 |
|                          |   | 13  |            | 5.23                                     |                  | 0.28                       |             |            |                   |                          |                         |                 |
|                          |   | 14  |            | 5.15                                     |                  | 0.18                       |             |            |                   |                          |                         |                 |
|                          |   | 15  |            | 5.27                                     |                  | 0.31                       |             |            |                   |                          |                         |                 |
|                          |   | 16  |            | 5.38                                     |                  | 0.42                       |             |            |                   |                          |                         |                 |
|                          |   | 17  |            | 5.40                                     |                  | 0.44                       |             |            |                   |                          |                         |                 |
|                          |   | 18  |            | 5.44                                     |                  | 0.48                       |             |            |                   |                          |                         |                 |
|                          |   | 19  |            | 5.401                                    |                  | 0.45                       |             |            |                   |                          |                         |                 |
| WS                       |   | 18.6  |            | 5.01                                     |                  |                            |             |            |                   |                          |                         |                 |
|                          |   | 19  |            | 4.60                                     |                  |                            |             |            |                   |                          |                         |                 |
|                          |   | 20.5  |            | 4.35                                     |                  |                            |             |            |                   |                          |                         |                 |
| BF                       |   | 21  |            | 4.03                                     |                  |                            |             |            |                   |                          |                         |                 |
| TOTALS:                  |   |   |            |  |                  |                            |             |            |                   |                          |                         |                 |
| End of Measurement       |   | Time:   |            | Gage Reading: ____ ft                    |                  | CALCULATIONS PERFORMED BY: |             |            |                   | CALCULATIONS CHECKED BY: |                         |                 |



# Discharge Measurement Summary

|                    |                        |
|--------------------|------------------------|
| <b>Site name</b>   | Red                    |
| <b>Site number</b> | 3                      |
| <b>Operator(s)</b> | Kb                     |
| <b>File name</b>   | Red_20220519-173043.ft |
| <b>Comment</b>     |                        |

|                                 |                   |                               |             |
|---------------------------------|-------------------|-------------------------------|-------------|
| <b>Start time</b>               | 5/19/2022 5:08 PM | <b>Sensor type</b>            | Top Setting |
| <b>End time</b>                 | 5/19/2022 5:29 PM | <b>Handheld serial number</b> | FT2H2113010 |
| <b>Start location latitude</b>  | 38.286            | <b>Probe serial number</b>    | FT2P2114008 |
| <b>Start location longitude</b> | -108.185          | <b>Probe firmware</b>         | 1.30        |
| <b>Calculations engine</b>      | FlowTracker2      | <b>Handheld software</b>      | 1.6.4       |

|                   |                         |   |
|-------------------|-------------------------|---|
| <b># Stations</b> | <b>Avg interval (s)</b> | <b>Total discharge (ft<sup>3</sup>/s)</b> |
| 19                | 40                      | 6.894                                     |

|                         |                                    |                              |
|-------------------------|------------------------------------|------------------------------|
| <b>Total width (ft)</b> | <b>Total area (ft<sup>2</sup>)</b> | <b>Wetted Perimeter (ft)</b> |
| 16.200                  | 6.795                              | 16.642                       |

|                      |                        |                             |
|----------------------|------------------------|-----------------------------|
| <b>Mean SNR (dB)</b> | <b>Mean depth (ft)</b> | <b>Mean velocity (ft/s)</b> |
| 54.010               | 0.419                  | 1.015                       |

|                       |                       |                            |
|-----------------------|-----------------------|----------------------------|
| <b>Mean temp (°F)</b> | <b>Max depth (ft)</b> | <b>Max velocity (ft/s)</b> |
| 48.528                | 0.700                 | 1.883                      |

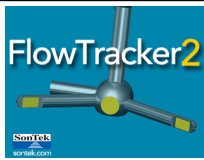
| Discharge Uncertainty |             |              |
|-----------------------|-------------|--------------|
| <b>Category</b>       | <b>ISO</b>  | <b>IVE</b>   |
| <b>Accuracy</b>       | 1.0%        | 1.0%         |
| <b>Depth</b>          | 0.4%        | 6.7%         |
| <b>Velocity</b>       | 0.9%        | 14.3%        |
| <b>Width</b>          | 0.1%        | 0.1%         |
| <b>Method</b>         | 2.1%        |              |
| <b># Stations</b>     | 2.6%        |              |
| <b>Overall</b>        | <b>3.7%</b> | <b>15.8%</b> |

|                              |             |
|------------------------------|-------------|
| <b>Discharge equation</b>    | Mid Section |
| <b>Discharge uncertainty</b> | IVE         |
| <b>Discharge reference</b>   | Rated       |

| Data Collection Settings   |              |
|----------------------------|--------------|
| <b>Salinity</b>            | 0.000 PSS-78 |
| <b>Temperature</b>         | -            |
| <b>Sound speed</b>         | -            |
| <b>Mounting correction</b> | 0.000 %      |

| Summary overview                  |
|-----------------------------------|
| No changes were made to this file |
| Quality control warnings          |





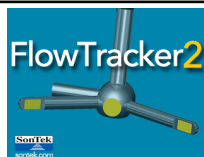
# Discharge Measurement Summary

**Site name** Red  
**Site number** 3  
**Operator(s)** Kb  
**File name** Red\_20220519-173043.ft  
**Comment**

## Station Warning Settings

|                                  |                                       |  |
|----------------------------------|---------------------------------------|--|
| <b>Station discharge OK</b>      | Station discharge < 5.000%            |  |
| <b>Station discharge caution</b> | 5.000% >= Station discharge < 10.000% |  |
| <b>Station discharge warning</b> | Station discharge >= 10.000%          |  |

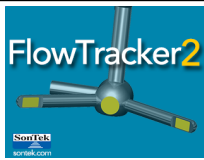




# Discharge Measurement Summary

|                    |                        |
|--------------------|------------------------|
| <b>Site name</b>   | Red                    |
| <b>Site number</b> | 3                      |
| <b>Operator(s)</b> | Kb                     |
| <b>File name</b>   | Red_20220519-173043.ft |
| <b>Comment</b>     |                        |

| Measurement results |         |               |        |            |        |                     |         |                 |            |                      |                         |                           |        |   |
|---------------------|---------|---------------|--------|------------|--------|---------------------|---------|-----------------|------------|----------------------|-------------------------|---------------------------|--------|---|
| St#                 | Time    | Location (ft) | Method | Depth (ft) | %Depth | Measured Depth (ft) | Samples | Velocity (ft/s) | Correction | Mean Velocity (ft/s) | Area (ft <sup>2</sup> ) | Flow (ft <sup>3</sup> /s) | %Q     |   |
| 0                   | 5:08 PM | 2.200         | None   | 0.000      | 0.000  | 0.000               | 0       | 0.000           |            | 0.159                | 0.000                   | 0.000                     | 0.000  | ✓ |
| 1                   | 5:08 PM | 3.100         | 0.6    | 0.700      | 0.600  | 0.420               | 80      | 0.159           | 1.000      | 0.159                | 0.630                   | 0.100                     | 1.455  | ✓ |
| 2                   | 5:10 PM | 4.000         | 0.6    | 0.600      | 0.600  | 0.360               | 80      | 0.612           | 1.000      | 0.612                | 0.540                   | 0.330                     | 4.791  | ✓ |
| 3                   | 5:11 PM | 4.900         | 0.6    | 0.600      | 0.600  | 0.360               | 80      | 0.954           | 1.000      | 0.954                | 0.540                   | 0.515                     | 7.472  | ✓ |
| 4                   | 5:12 PM | 5.800         | 0.6    | 0.600      | 0.600  | 0.360               | 80      | 1.357           | 1.000      | 1.357                | 0.540                   | 0.733                     | 10.629 | ✓ |
| 5                   | 5:14 PM | 6.700         | 0.6    | 0.500      | 0.600  | 0.300               | 80      | 1.695           | 1.000      | 1.695                | 0.450                   | 0.763                     | 11.065 | ✓ |
| 6                   | 5:15 PM | 7.600         | 0.6    | 0.400      | 0.600  | 0.240               | 80      | 0.931           | 1.000      | 0.931                | 0.360                   | 0.335                     | 4.862  | ✓ |
| 7                   | 5:16 PM | 8.500         | 0.6    | 0.400      | 0.600  | 0.240               | 80      | 1.816           | 1.000      | 1.816                | 0.360                   | 0.654                     | 9.484  | ✓ |
| 8                   | 5:17 PM | 9.400         | 0.6    | 0.500      | 0.600  | 0.300               | 80      | 1.055           | 1.000      | 1.055                | 0.450                   | 0.475                     | 6.883  | ✓ |
| 9                   | 5:18 PM | 10.300        | 0.6    | 0.400      | 0.600  | 0.240               | 80      | 0.775           | 1.000      | 0.775                | 0.360                   | 0.279                     | 4.045  | ✓ |
| 10                  | 5:20 PM | 11.200        | 0.6    | 0.300      | 0.600  | 0.180               | 80      | 1.177           | 1.000      | 1.177                | 0.270                   | 0.318                     | 4.608  | ✓ |
| 11                  | 5:21 PM | 12.100        | 0.6    | 0.350      | 0.600  | 0.210               | 80      | 0.187           | 1.000      | 0.187                | 0.315                   | 0.059                     | 0.853  | ✓ |
| 12                  | 5:22 PM | 13.000        | 0.6    | 0.200      | 0.600  | 0.120               | 80      | 1.883           | 1.000      | 1.883                | 0.180                   | 0.339                     | 4.916  | ✓ |
| 13                  | 5:23 PM | 13.900        | 0.6    | 0.200      | 0.600  | 0.120               | 80      | 1.588           | 1.000      | 1.588                | 0.180                   | 0.286                     | 4.147  | ✓ |
| 14                  | 5:25 PM | 14.800        | 0.6    | 0.400      | 0.600  | 0.240               | 80      | 1.717           | 1.000      | 1.717                | 0.360                   | 0.618                     | 8.965  | ✓ |
| 15                  | 5:26 PM | 15.700        | 0.6    | 0.450      | 0.600  | 0.270               | 80      | 0.261           | 1.000      | 0.261                | 0.405                   | 0.106                     | 1.536  | ✓ |
| 16                  | 5:27 PM | 16.600        | 0.6    | 0.450      | 0.600  | 0.270               | 80      | 0.372           | 1.000      | 0.372                | 0.405                   | 0.151                     | 2.188  | ✓ |
| 17                  | 5:28 PM | 17.500        | 0.6    | 0.500      | 0.600  | 0.300               | 80      | 1.854           | 1.000      | 1.854                | 0.450                   | 0.834                     | 12.102 | ✓ |
| 18                  | 5:29 PM | 18.400        | None   | 0.000      | 0.000  | 0.000               | 0       | 0.000           |            | 1.854                | 0.000                   | 0.000                     | 0.000  | ✓ |



# Discharge Measurement Summary

**Site name** Red  
**Site number** 3  
**Operator(s)** Kb  
**File name** Red\_20220519-173043.ft  
**Comment**

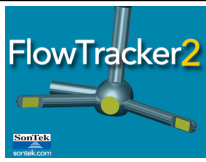
## Quality Control Settings

**Maximum depth change** 50.000%  
**Maximum spacing change** 100.000%  
**SNR threshold** 10.000 dB  
**Standard error threshold** 0.033 ft/s  
**Spike threshold** 10.000%  
**Maximum velocity angle** 20.000 deg  
**Maximum tilt angle** 5.000 deg

## Quality control warnings

| St# | Time    | Location (ft) | Method | Depth (ft) | %Depth | Measured Depth (ft) | Warnings                                  |
|-----|---------|---------------|--------|------------|--------|---------------------|---|
| 3   | 5:11 PM | 4.900         | 0.6    | 0.600      | 0.600  | 0.360               | Standard Error > QC                       |
| 4   | 5:12 PM | 5.800         | 0.6    | 0.600      | 0.600  | 0.360               | Standard Error > QC, High Stn % Discharge |
| 5   | 5:14 PM | 6.700         | 0.6    | 0.500      | 0.600  | 0.300               | High Stn % Discharge                      |
| 7   | 5:16 PM | 8.500         | 0.6    | 0.400      | 0.600  | 0.240               | Standard Error > QC                       |
| 8   | 5:17 PM | 9.400         | 0.6    | 0.500      | 0.600  | 0.300               | Standard Error > QC                       |
| 11  | 5:21 PM | 12.100        | 0.6    | 0.350      | 0.600  | 0.210               | Velocity Angle > QC                       |
| 17  | 5:28 PM | 17.500        | 0.6    | 0.500      | 0.600  | 0.300               | High Stn % Discharge                      |





# Discharge Measurement Summary

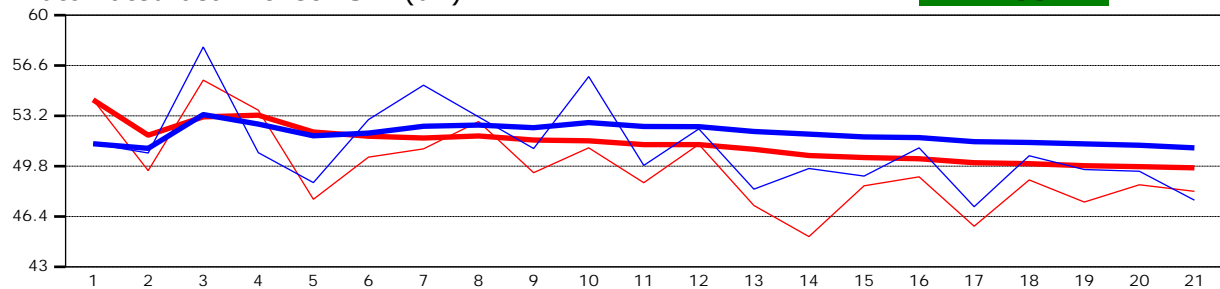
**Site name** Red  
**Site number** 3  
**Operator(s)** Kb  
**File name** Red\_20220519-173043.ft  
**Comment**

|               |  |
|---------------|--|
| <b>Beam 1</b> |  |
| <b>Beam 2</b> |  |

Automated beam check Start time 5/19/2022 5:07:58 PM

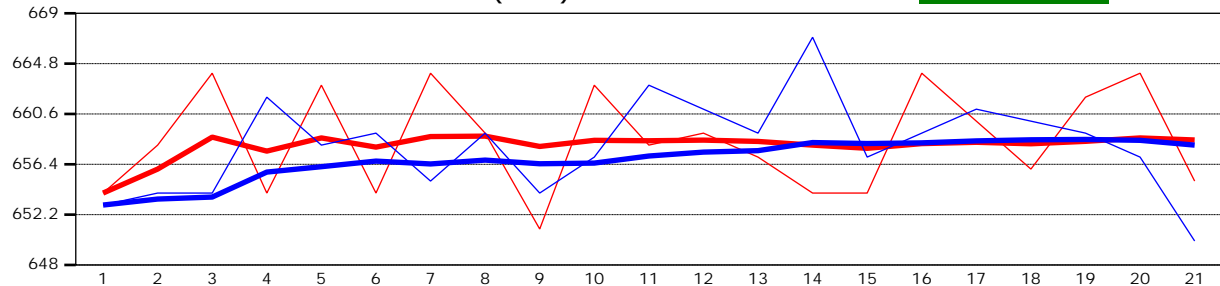
Automated beam check SNR(dB)

PASS



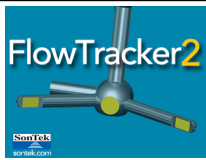
Automated beam check Noise level(cnts)

PASS



## Automated beam check Quality control warnings

No quality control warnings

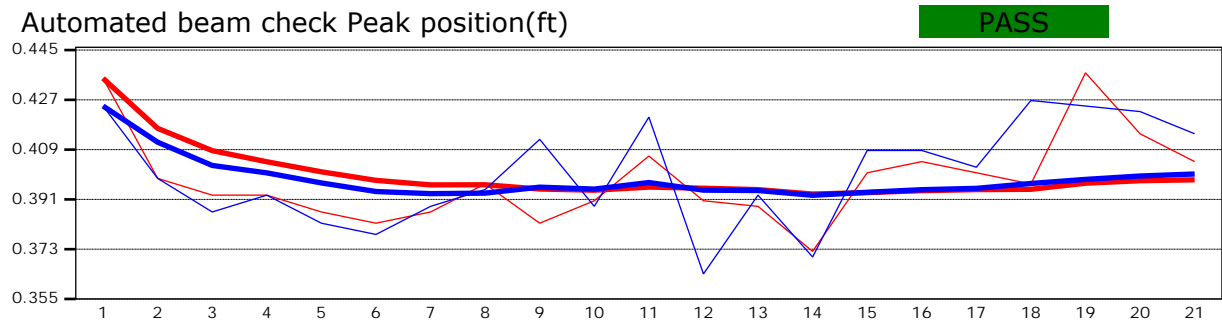
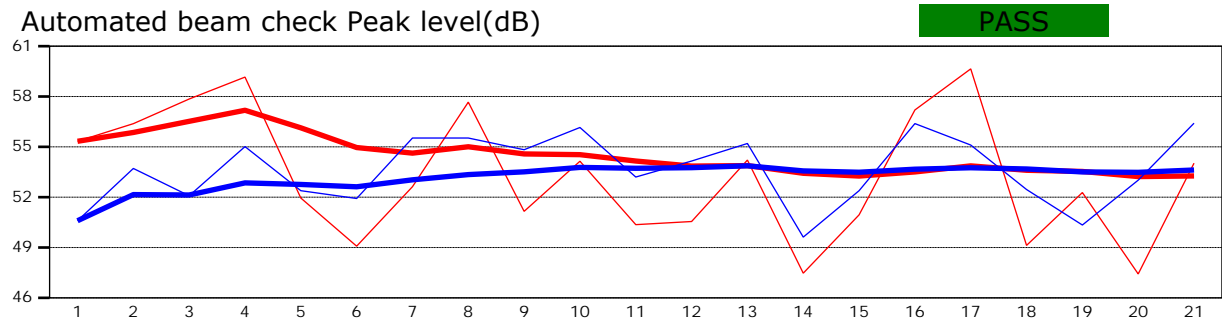


# Discharge Measurement Summary

**Site name** Red  
**Site number** 3  
**Operator(s)** Kb  
**File name** Red\_20220519-173043.ft  
**Comment**

|               |  |
|---------------|--|
| <b>Beam 1</b> |  |
| <b>Beam 2</b> |  |

Automated beam check Start time 5/19/2022 5:07:58 PM



**Automated beam check Quality control warnings**  
No quality control warnings

# R2Cross RESULTS

**Stream Name:** Red Canyon Creek

**Stream Locations:** Upstream of Trail Crossing

**Fieldwork Date:** 05/19/2022

**Cross-section:** 1

**Observers:** Birch Fields-Sommers

**Coordinate System:** UTM Zone 12

**X (easting):** 745711

**Y (northing):** 4242087

**Date Processed:** 11/30/2022

**Slope:** 0.0228

**Discharge:** Entered Value: 6.89 (cfs)

**Computation method:** Ferguson VPE

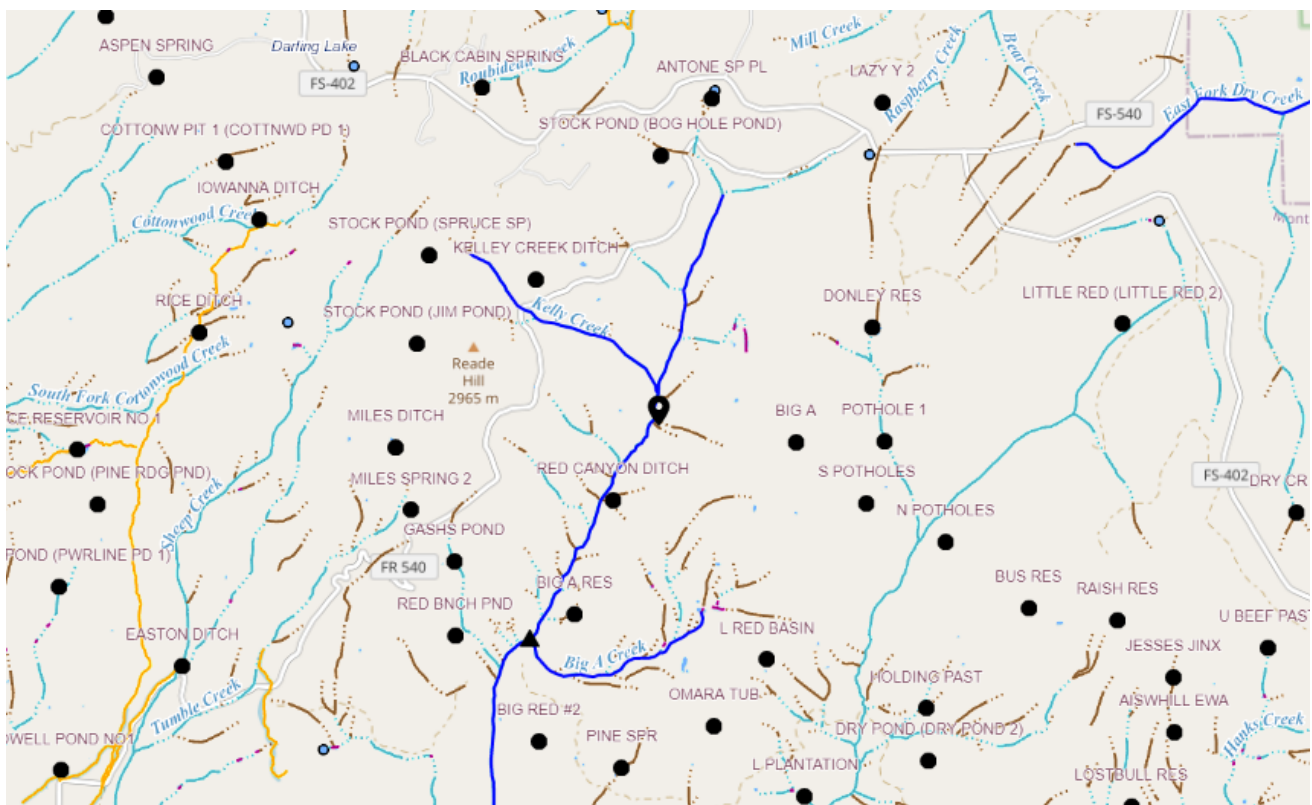
**a1:** 6.5

**a2:** 2.5

**R2Cross data filename:** R2Cross\_Red\_Canyon\_5\_19\_22-4-Q=6.894.xlsx

**R2Cross version:** 2.0.2

## LOCATION





## ANALYSIS RESULTS

### Habitat Criteria Results

Bankfull top width (ft) = 20.97

|                              | Habitat Criteria | Discharge (cfs) Meeting Criteria |
|------------------------------|------------------|----------------------------------|
| Mean Depth (ft)              | 0.2              | 1.45                             |
| Percent Wetted Perimeter (%) | 50.0             | 0.12                             |
| Mean Velocity (ft/s)         | 1.0              | 6.15                             |

## STAGING TABLE

| Feature   | Distance to Water (ft) | Top Width (ft) | Mean Depth (ft) | Maximum Depth (ft) | Area (sq ft) | Wetted Perimeter (ft) | Percent Wetted Perimeter | Hydraulic Radius (ft) | Manning's n | Mean Velocity (ft/s) | Discharge (cfs) |
|-----------|------------------------|----------------|-----------------|--------------------|--------------|-----------------------|--------------------------|-----------------------|-------------|----------------------|-----------------|
| Bankfull  | 4.03                   | 20.97          | 1.14            | 1.51               | 23.95        | 21.81                 | 100.0                    | 1.1                   | 0.05        | 4.35                 | 104.13          |
|           | 4.05                   | 20.9           | 1.12            | 1.49               | 23.45        | 21.72                 | 99.6                     | 1.08                  | 0.06        | 4.26                 | 99.97           |
|           | 4.1                    | 20.74          | 1.08            | 1.44               | 22.41        | 21.53                 | 98.75                    | 1.04                  | 0.06        | 4.08                 | 91.5            |
|           | 4.15                   | 20.59          | 1.04            | 1.39               | 21.38        | 21.35                 | 97.91                    | 1.0                   | 0.06        | 3.9                  | 83.38           |
|           | 4.2                    | 20.43          | 1.0             | 1.34               | 20.35        | 21.17                 | 97.07                    | 0.96                  | 0.06        | 3.72                 | 75.62           |
|           | 4.25                   | 20.28          | 0.95            | 1.29               | 19.33        | 20.98                 | 96.22                    | 0.92                  | 0.06        | 3.53                 | 68.23           |
|           | 4.3                    | 20.12          | 0.91            | 1.24               | 18.32        | 20.8                  | 95.38                    | 0.88                  | 0.06        | 3.34                 | 61.22           |
|           | 4.35                   | 19.95          | 0.87            | 1.19               | 17.32        | 20.6                  | 94.46                    | 0.84                  | 0.06        | 3.15                 | 54.63           |
|           | 4.4                    | 19.58          | 0.83            | 1.14               | 16.33        | 20.2                  | 92.65                    | 0.81                  | 0.06        | 3.0                  | 49.04           |
|           | 4.45                   | 19.2           | 0.8             | 1.09               | 15.36        | 19.81                 | 90.83                    | 0.78                  | 0.07        | 2.85                 | 43.78           |
|           | 4.5                    | 18.82          | 0.77            | 1.04               | 14.41        | 19.41                 | 89.02                    | 0.74                  | 0.07        | 2.7                  | 38.85           |
|           | 4.55                   | 18.45          | 0.73            | 0.99               | 13.48        | 19.02                 | 87.21                    | 0.71                  | 0.07        | 2.54                 | 34.24           |
|           | 4.6                    | 18.09          | 0.69            | 0.94               | 12.57        | 18.64                 | 85.47                    | 0.67                  | 0.07        | 2.38                 | 29.91           |
|           | 4.65                   | 17.96          | 0.65            | 0.89               | 11.67        | 18.48                 | 84.74                    | 0.63                  | 0.08        | 2.18                 | 25.47           |
|           | 4.7                    | 17.84          | 0.6             | 0.84               | 10.77        | 18.32                 | 84.0                     | 0.59                  | 0.08        | 1.99                 | 21.4            |
|           | 4.75                   | 17.67          | 0.56            | 0.79               | 9.88         | 18.12                 | 83.09                    | 0.55                  | 0.08        | 1.8                  | 17.74           |
|           | 4.8                    | 17.47          | 0.52            | 0.74               | 9.0          | 17.88                 | 82.01                    | 0.5                   | 0.09        | 1.61                 | 14.5            |
|           | 4.85                   | 17.26          | 0.47            | 0.69               | 8.14         | 17.65                 | 80.92                    | 0.46                  | 0.09        | 1.43                 | 11.61           |
|           | 4.9                    | 17.05          | 0.43            | 0.64               | 7.28         | 17.41                 | 79.84                    | 0.42                  | 0.1         | 1.24                 | 9.06            |
| Waterline | 4.95                   | 16.85          | 0.38            | 0.59               | 6.43         | 17.18                 | 78.77                    | 0.37                  | 0.11        | 1.07                 | 6.86            |
|           | 5.0                    | 16.69          | 0.34            | 0.54               | 5.59         | 16.98                 | 77.89                    | 0.33                  | 0.12        | 0.89                 | 4.97            |
|           | 5.05                   | 16.4           | 0.29            | 0.49               | 4.76         | 16.67                 | 76.44                    | 0.29                  | 0.13        | 0.72                 | 3.45            |
|           | 5.1                    | 15.82          | 0.25            | 0.44               | 3.96         | 16.07                 | 73.72                    | 0.25                  | 0.15        | 0.58                 | 2.31            |
|           | 5.15                   | 15.26          | 0.21            | 0.39               | 3.18         | 15.5                  | 71.09                    | 0.21                  | 0.17        | 0.45                 | 1.42            |
|           | 5.2                    | 14.01          | 0.17            | 0.34               | 2.45         | 14.22                 | 65.22                    | 0.17                  | 0.2         | 0.35                 | 0.85            |

|      |       |      |      |      |       |       |      |      |      |      |
|------|-------|------|------|------|-------|-------|------|------|------|------|
| 5.25 | 12.8  | 0.14 | 0.29 | 1.78 | 12.97 | 59.5  | 0.14 | 0.24 | 0.25 | 0.44 |
| 5.3  | 11.59 | 0.1  | 0.24 | 1.17 | 11.74 | 53.84 | 0.1  | 0.31 | 0.15 | 0.18 |
| 5.35 | 9.81  | 0.06 | 0.19 | 0.63 | 9.92  | 45.49 | 0.06 | 0.45 | 0.08 | 0.05 |
| 5.4  | 5.98  | 0.04 | 0.14 | 0.22 | 6.05  | 27.75 | 0.04 | 0.73 | 0.03 | 0.01 |
| 5.45 | 1.32  | 0.04 | 0.09 | 0.05 | 1.36  | 6.22  | 0.04 | 0.69 | 0.04 | 0.0  |
| 5.5  | 0.47  | 0.02 | 0.04 | 0.01 | 0.48  | 2.2   | 0.02 | 1.5  | 0.01 | 0.0  |
| 5.53 | 0.14  | 0.01 | 0.01 | 0.0  | 0.15  | 0.68  | 0.01 | 2.74 | 0.0  | 0.0  |

**This Manning's roughness coefficient was calculated based on velocity estimates from the Ferguson VPE method**



## MODEL SUMMARY

|                              |       |        |
|------------------------------|-------|--------|
| Measured Flow (Qm) =         | 6.89  | (cfs)  |
| Calculated Flow (Qc) =       | 6.88  | (cfs)  |
| (Qm-Qc)/Qm * 100 =           | 0.26% |        |
| Measured Waterline (WLm) =   | 4.98  | (ft)   |
| Calculated Waterline (WLC) = | 4.95  | (ft)   |
| (WLm-WLC)/WLm * 100 =        | 0.53% |        |
| Max Measured Depth (Dm) =    | 0.6   | (ft)   |
| Max Calculated Depth (Dc) =  | 0.59  | (ft)   |
| (Dm-Dc)/Dm * 100 =           | 2.29% |        |
| Mean Velocity =              | 1.07  | (ft/s) |
| Manning's n =                | 0.109 |        |
| a1                           | 6.5   |        |
| a2                           | 2.5   |        |
| 0.4 * Qm =                   | 2.76  | (cfs)  |
| 2.5 * Qm =                   | 17.23 | (cfs)  |

## FIELD DATA

| Feature   | Station<br>(ft) | Rod Height<br>(ft) | Water depth<br>(ft) | Velocity<br>(ft/s) |
|-----------|-----------------|--------------------|---------------------|--------------------|
| Bankfull  | 0               | 4.01               |                     |                    |
|           | 1.1             | 4.73               |                     |                    |
| Waterline | 1.8             | 4.95               | 0                   |                    |
|           | 2               | 5.04               | 0.1                 |                    |
|           | 3               | 5.14               | 0.2                 |                    |
|           | 4               | 5.52               | 0.6                 |                    |
|           | 5               | 5.31               | 0.35                |                    |
|           | 6               | 5.54               | 0.55                |                    |
|           | 7               | 5.35               | 0.39                |                    |
|           | 8               | 5.45               | 0.52                |                    |
|           | 9               | 5.42               | 0.48                |                    |
|           | 10              | 5.39               | 0.43                |                    |
|           | 11              | 5.32               | 0.38                |                    |
|           | 12              | 5.23               | 0.28                |                    |
|           | 13              | 5.15               | 0.18                |                    |
|           | 14              | 5.27               | 0.31                |                    |
|           | 15              | 5.38               | 0.42                |                    |
|           | 16              | 5.4                | 0.44                |                    |
|           | 17              | 5.44               | 0.48                |                    |
|           | 18              | 5.4                | 0.45                |                    |
| Waterline | 18.6            | 5.01               | 0                   |                    |
|           | 19              | 4.6                |                     |                    |
|           | 20.5            | 4.35               |                     |                    |
| Bankfull  | 21              | 4.03               |                     |                    |

## COMPUTED FROM MEASURED FIELD DATA

| Wetted Perimeter<br>(ft) | Water Depth<br>(ft) | Area<br>(ft^2) | Discharge<br>(cfs) | Percent Discharge |
|--------------------------|---------------------|----------------|--------------------|-------------------|
| 0                        | 0                   | 0              | 0                  | 0                 |
| 0                        | 0                   | 0              | 0                  | 0                 |
| 0                        | 0                   | 0              | 0                  | 0                 |
| 0.22                     | 0.1                 | 0.06           | 0.06               | 0.93              |
| 1                        | 0.2                 | 0.2            | 0.21               | 3.11              |
| 1.07                     | 0.6                 | 0.6            | 0.64               | 9.33              |
| 1.02                     | 0.35                | 0.35           | 0.38               | 5.44              |
| 1.03                     | 0.55                | 0.55           | 0.59               | 8.55              |
| 1.02                     | 0.39                | 0.39           | 0.42               | 6.07              |
| 1                        | 0.52                | 0.52           | 0.56               | 8.09              |
| 1                        | 0.48                | 0.48           | 0.51               | 7.46              |
| 1                        | 0.43                | 0.43           | 0.46               | 6.69              |
| 1                        | 0.38                | 0.38           | 0.41               | 5.91              |
| 1                        | 0.28                | 0.28           | 0.3                | 4.36              |
| 1                        | 0.18                | 0.18           | 0.19               | 2.8               |
| 1.01                     | 0.31                | 0.31           | 0.33               | 4.82              |
| 1.01                     | 0.42                | 0.42           | 0.45               | 6.53              |
| 1                        | 0.44                | 0.44           | 0.47               | 6.84              |
| 1                        | 0.48                | 0.48           | 0.51               | 7.46              |
| 1                        | 0.45                | 0.36           | 0.39               | 5.6               |
| 0.72                     | 0                   | 0              | 0                  | 0                 |
| 0                        | 0                   | 0              | 0                  | 0                 |
| 0                        | 0                   | 0              | 0                  | 0                 |
| 0                        | 0                   | 0              | 0                  | 0                 |

## DISCLAIMER

"The Colorado Water Conservation Board makes no representations about the use of the software contained in the R2Cross platform for any purpose besides that for which it was designed. To the maximum extent permitted by applicable law, all information, modeling results, and software are provided "as is" without warranty or condition of any kind, including all implied warranties or conditions of merchantability, or fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event shall the Colorado Water Conservation Board or any state agency, official or employee be liable for any direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever including, without limitation, damages for loss of use, data, profits, or savings arising from the implementation, reliance on, or use of or inability to use the R2Cross platform.

# Red Canyon Creek

Eric Gardunio  
Aquatic Biologist  
Southwest Region

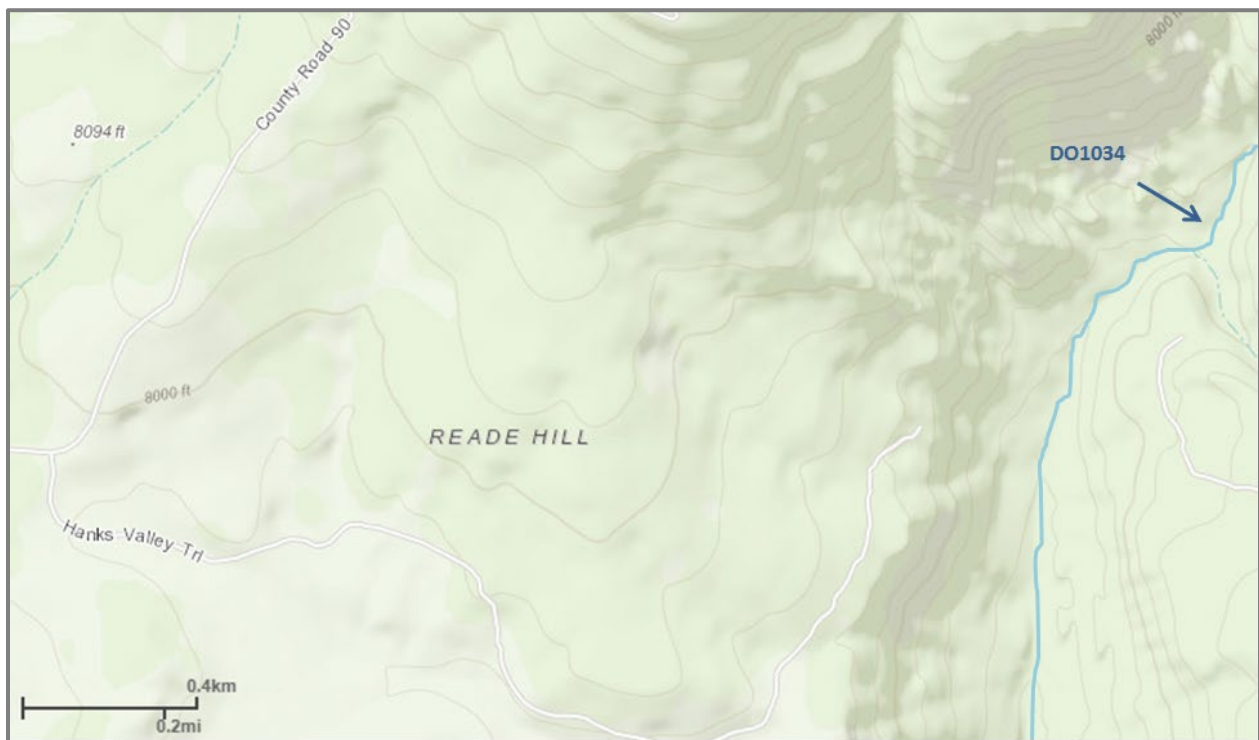


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**Water:** Red Canyon Creek  
**Location:** DO1034  
**Sampling Date:** 9/11/2017  
**Gear:** LR-24 Smith Root backpack electrofisher  
**Drainage:** Dolores  
**Water Code:** 42452

## OBJECTIVE

Red Canyon Creek was sampled in 2017 using backpack electrofishing to monitor the status of the conservation population of Colorado River cutthroat trout.



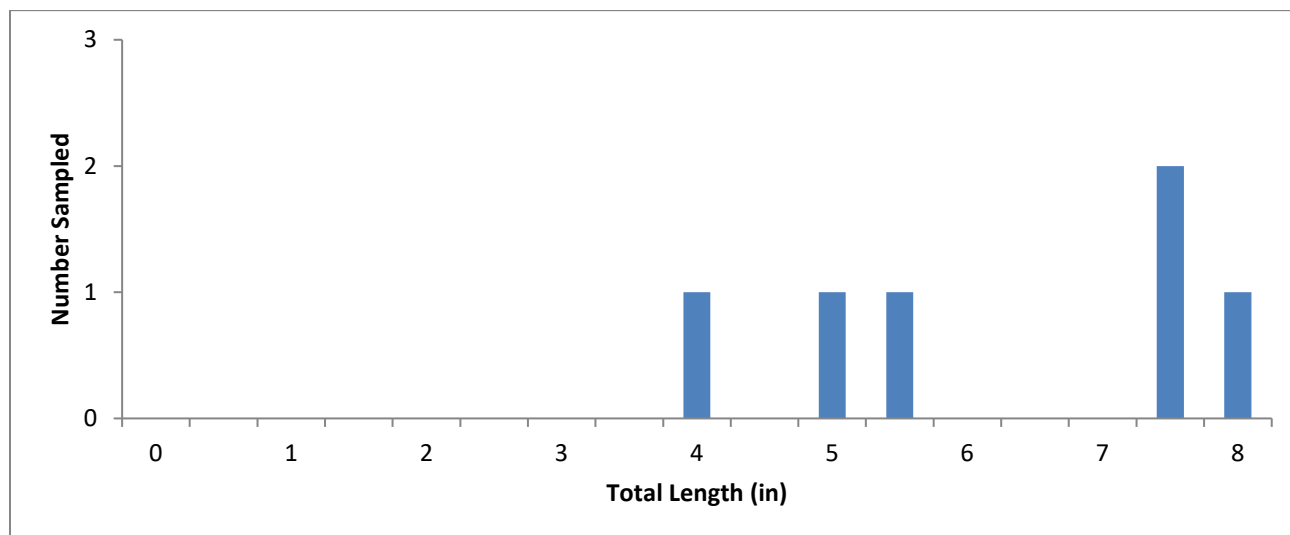
**Map 1:** Sampling location on Red Canyon Creek (DO1034) sampled in 2017 and 2009.

## HISTORY

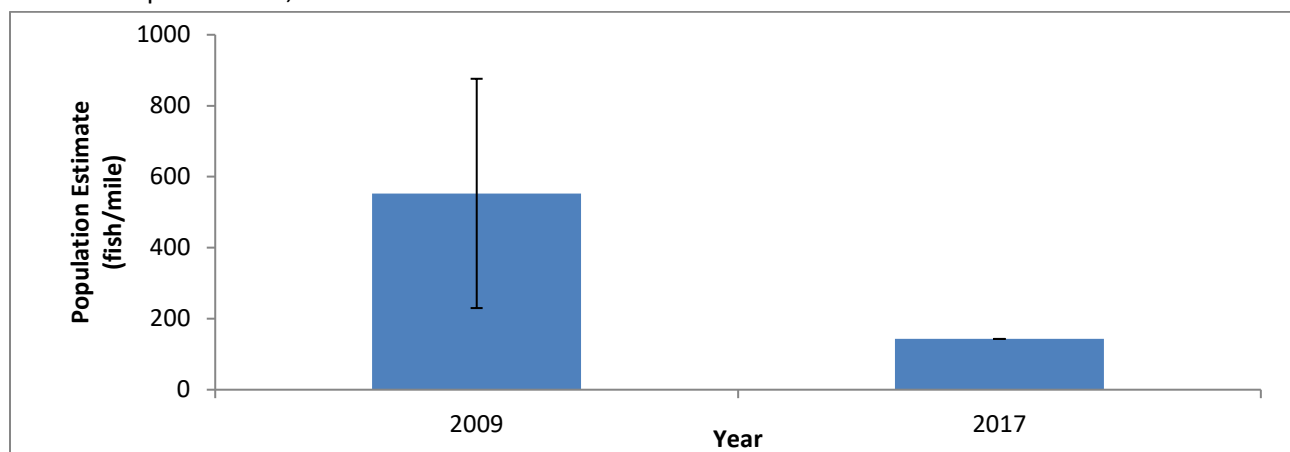
Red Canyon Creek is currently a Category 202 Native Fish Conservation Management Native cutthroat recovery/conservation stream. Red Canyon Creek is home to a Green Lineage Conservation Population of Colorado River cutthroat trout and was last sampled in July of 2009 when a population of 553 fish per mile was estimated.



## RESULTS



**Figure 1:** Length frequency histogram for Colorado River cutthroat trout sampled from Red Canyon Creek on September 11, 2017.



**Figure 1:** Population estimate (fish/mile) for Colorado River cutthroat trout sampled from Red Canyon Creek on September 11, 2017 and July 6, 2009.

## CONCLUSIONS

The Conservation Population of Colorado River cutthroat trout still inhabits Red Canyon Creek, and no other species were sampled in 2017. The 2017 sampling captured cutthroat trout from multiple age classes (Figure 1) indicating that there is natural reproduction occurring. Unfortunately, the population estimate in 2017 was far lower than in 2009 (143 compared to 553 fish/mile; Figure 2). The sampling crew noted that there was a high amount of sediment in the section of stream sampled (pictures 1 and 2) and that the sediment disappeared upstream of the sampling site (DO1034). They also noted that they were seeing more fish upstream of the sampling site, once the sediment decreased. The sediment could be limiting reproduction and invertebrate production within the sampling reach, causing fish to inhabit the better habitat upstream. An effort should be made to identify the source of the sediment, and if it is not a natural occurrence, it should be addressed. Despite the sediment, and the decrease in population, it appears that the Red Canyon Creek population will persist over the near future.

## MANAGEMENT RECOMMENDATION SUMMARY

1. *Management:* Maintain current management strategy as Category 202 native cutthroat stream. Monitor in 2-3 years to determine status of population following 2017 decline.
2. *Stocking:* None necessary.
3. *Regulations:* Current regulations of artificial only with catch and release for cutthroat conservation population.
4. *Habitat Improvement:* None needed, but attempt to determine source of sediment at sampling location.
5. *Access/Facilities:* Public access is suitable.
6. *Information/Education:* None needed.



*Pictures 1 & 2: Red Canyon Creek taken during 2017 sampling*



*Picture 3: Colorado River cutthroat trout caught during 2017 Red Canyon Creek sampling*



## Combined Summaries

Water 42452 Red Canyon Creek  
Station DO1034 ABV Big A Creek

Date 9/11/2017

Drainage Dolores River

UtmX 219665

UtmY 4240892

Elevation 7521 ft

Surveyors Palmer, Temple

Length

Width

Area

Gear BPEF LR-24

Effort

Metric PASS

Protocol TWO-PASS REMOVAL

### Proportional Stocking Density and Catch/Unit Effort

| Species                  | Total Catch | Min Cut inch | Max Cut inch | Total used | Proportional Stock Density (%) | Percent Stock Size | Percent Quality Size | Percent Preferred Size | Percent Memorable Size | Percent Trophy Size | Max Length inches |
|--------------------------|-------------|--------------|--------------|------------|--------------------------------|--------------------|----------------------|------------------------|------------------------|---------------------|-------------------|
| COLORADO RIVER CUTTHROAT | 6           | 3.94         |              | 6          | 0.00                           | 100.00             |                      |                        |                        |                     | 8.19              |

### Mean, Minimum and Maximum Length and Weight

| Species                  | Total Catch | Min cut inch | Max cut inch | Total Used | Length (inches) |         |         | Mean | Weight (lb) |         |
|--------------------------|-------------|--------------|--------------|------------|-----------------|---------|---------|------|-------------|---------|
|                          |             |              |              |            | Mean            | Minimum | Maximum |      | Minimum     | Maximum |
| COLORADO RIVER CUTTHROAT | 6           | 3.94         |              | 6          | 6.58            | 4.49    | 8.19    | 0.13 | 0.10        | 0.15    |

### Relative Abundance and Catch/Unit Effort

| Species                  | Total Catch | Min.Cut inch | Max.Cut inch | Total used | Weight Lbs | Percent Number | Percent Weight | Catch per Unit Effort Number/Effort | Lbs/Effort |
|--------------------------|-------------|--------------|--------------|------------|------------|----------------|----------------|-------------------------------------|------------|
| COLORADO RIVER CUTTHROAT | 6           | 3.94         |              | 6          | 0.79       | 100.00         | 100.00         |                                     |            |

### Abundance and Biomass

| Species                  | Total Catch | Min.Cut inch | Max.Cut inch | Total Used | Population estimate | Biomass Lbs | Percent Number | Percent Weight | Density estimates Lb/Acre | Fish/Acre | Fish/Mile |
|--------------------------|-------------|--------------|--------------|------------|---------------------|-------------|----------------|----------------|---------------------------|-----------|-----------|
| COLORADO RIVER CUTTHROAT | 6           | 3.94         |              | 6          | 6                   | 0.79        | 100.00         | 100.00         |                           |           |           |

**Notes:** 2 pass depletion population estimate. Very silty throughout this reach. We hiked up the stream about half a mile past where we ended our reach and it became less silty and saw more fish the further up we went. NO FISH caught on E2. E1 = 1156 seconds and E2 = 1071 seconds. Total electrofishing effort = 2227 seconds.





**Red Canyon Creek Cross Section 1, Looking downstream.**



**Red Canyon Creek Cross Section 1, Looking upstream.**





**Red Canyon Creek Cross Section 1, Looking across the transect from left bank.**



**Red Canyon Creek Cross Section 1, Looking downstream from left bank.**





**Red Canyon Creek Cross Section 1, Looking upstream from left bank.**



**Red Canyon Creek Overview of Habitat Features, Overhead Cover and Pocket Pools**





**Red Canyon Creek Overview of Habitat Features, Large Woody Debris Plunge Pools**



**Red Canyon Creek Overview, Dynamic Channel with Side Channel Creation**

Discharge Measurment Field Visit Data Report (Filters: Name begins with Red Canyon; Division = 4;)

| Div | Name       | CWCB Case Number | Segment ID | Meas. Date | UTM                           | Location                                    | Flow Amount (cfs) | Meas # | Rating | Station ID |
|-----|------------|------------------|------------|------------|-------------------------------|---|-------------------|--------|--------|------------|
| 4   | Red Canyon |                  | 21/4/A-010 | 05/19/2022 | UTMx: 745711<br>UTMy: 4242087 | Red Canyon Creek upstream of trail crossing | 6.89              | 1      | g      |            |