CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES FOR ARCTIC GRAYLING IN THE CENTENNIAL VALLEY, MONTANA

2025 Annual Report

Montana Fish, Wildlife & Parks

The Candidate Conservation Agreement with Assurances for Arctic Grayling in the Centennial Valley, Montana State and Federal Agency Partnership includes:

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I. Introduction

A Candidate Conservation Agreement with Assurances (CCAA) is an agreement between the U.S. Fish and Wildlife Service (USFWS) and any non-Federal entity whereby property owners who voluntarily agree to manage their lands or waters to remove threats to species at risk of becoming threatened or endangered receive assurances against additional regulatory requirements should that species be subsequently listed under the Endangered Species Act (ESA). Since 2000 there have been 50 CCAA's approved in 24 different states that have more than 25.2 million acres enrolled by 717 landowners that cover 84 species. CCAA project areas range in size from one-acre aiming to protect the Greater and Lesser Adam Cave Beetles in Kentucky to 7,214,287-acres to protect Lesser Prairie Chicken in Colorado, Kansas, Oklahoma, New Mexico, and Texas (USFWS 2018).

The conservation goal of the Centennial Valley Arctic Grayling CCAA is to secure and enhance Arctic grayling (*Thymallus arcticus*) populations and habitat in 52 stream miles on non-federal lands in the Centennial Valley. Montana Fish, Wildlife & Parks (FWP) holds a USFWS ESA section 10(a)(1)(A) Enhancement of Survival Permit and issues Certificates of Inclusion to non-Federal property owners within the Project Area who agree to comply with all stipulations of the Program and develop a Site-Specific Conservation Plan (SSP; Figure 1). SSPs are collaboratively developed by each landowner and an interdisciplinary FWP technical team and approved by USFWS. The conservation goal of the Centennial Valley Arctic Grayling CCAA will be met by implementing measures that:

1) Improve streamflows

2) Improve and protect the function of riparian habitats

3) Identify and reduce or eliminate entrainment threats for Arctic grayling

4) Remove barriers to Arctic grayling migration

The Centennial Valley Arctic Grayling CCAA is a collaborative effort among private landowners, state and federal agencies, and non-government organizations. These stakeholders have agreed to work together for the common goals of conserving Arctic grayling, improving Centennial Valley fish populations, addressing private property concerns, and enhancing the overall health of the Centennial Valley watershed.

The 2025 Centennial Valley Arctic Grayling CCAA report summarizes current enrollment, approved SSPs, implemented conservation measures, and completed projects.

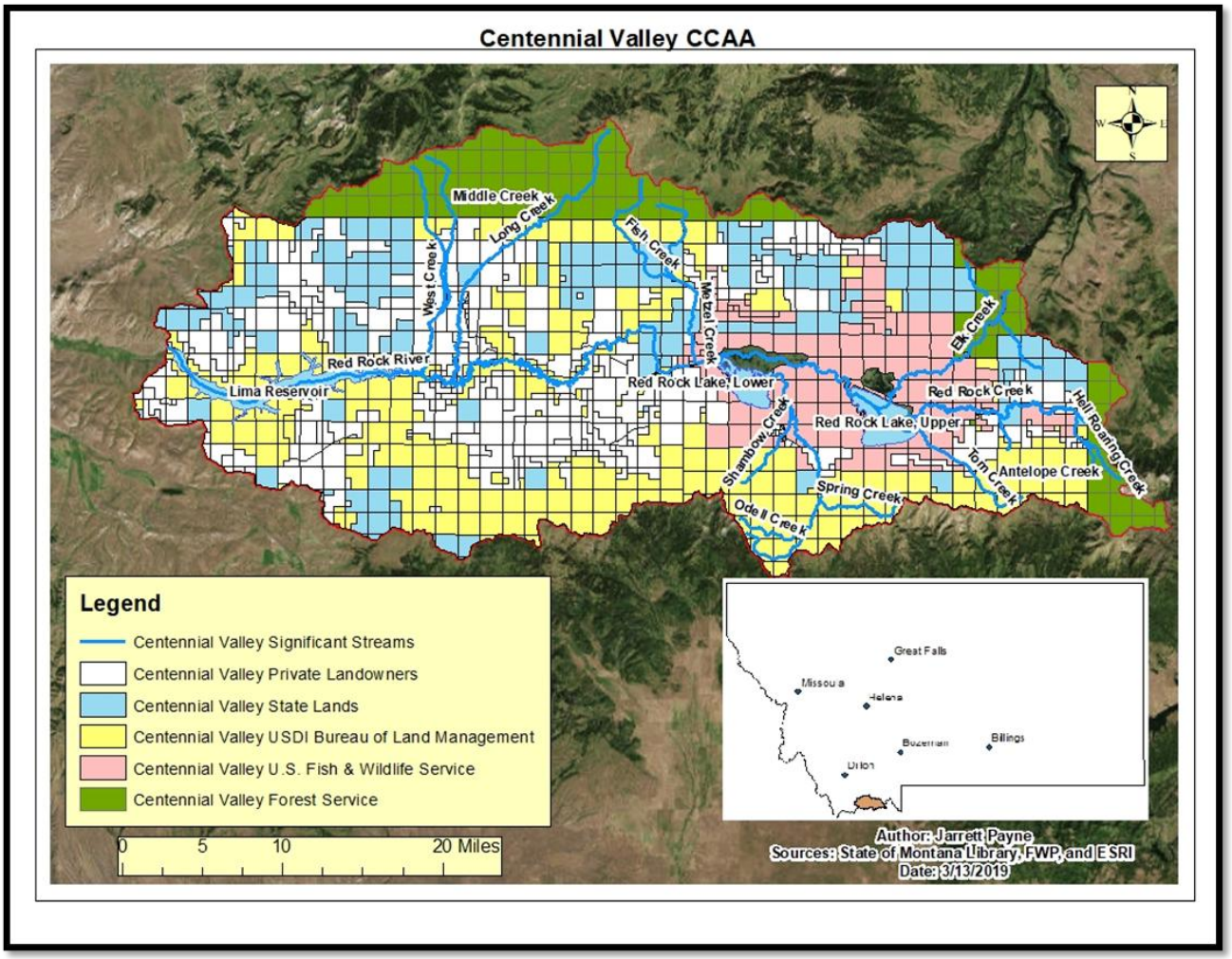

Figure 1. The Centennial Valley Arctic Grayling CCAA Project Area.

II. Legal Status of Montana Arctic Grayling

The present legal status of Arctic grayling was determined by a July 23rd, 2020, ruling where the USFWS announced that the Upper Missouri River Arctic Grayling Distinct Population Segment (DPS) did not warrant Endangered Species Act (ESA) protection. This decision was determined from the best available science, advances in the Big Hole Arctic Grayling CCAA, and critical conservation work completed by private landowners (Federal Register 2020). For complete legal review prior to 2020 please review the USFWS 2020 listing determination (Federal Register 2020).

On January 30, 2024, Earthjustice sued the USFWS challenging their 2020 finding that the DPS was not warranted for listing under the ESA. The parties associated (plaintiffs) represented by Earthjustice include the Center for Biological Diversity, Western Watersheds Project, and Butte resident Pat Munday. The plaintiffs argued that the USFWS failed to rationally assess present and future threats to the DPS and challenged specific findings from the 2020 decision such as

stability of the Big Hole River grayling population, the viability of the Ruby River population, the reliance on the Centennial Valley and Madison River populations, genetic threats posed by small, isolated populations, high stream temperatures in the Big Hole River, ability of Big Hole River grayling to access thermal refugia, low stream flows in the Big Hole River, stream temperature and flow in the Ruby River, and the durability of the Big Hole CCAA which expires in 2026. On August 6, 2024, the summary judgement was granted for Earthjustice in part for two claims of ten; (1) its failure to discuss and address the durability of the Big Hole CCAA structure and (2) its analysis of the Ruby River population status. The 2020 finding was vacated and remanded to USFWS for further analysis, and USFWS was directed to complete a new finding on the status of the DPS.

On February 21, 2025, the district court granted an unopposed motion that the new finding be included in a 24-month Special Status Assessment (SSA). This would allow the USFWS "to produce a more robust analysis of the status of the upper Missouri River basin DPS and issue a more informed listing determination". The Order now directs USFWS to have a revised Finding on the status of the DPS by February 21, 2027.

III. Landowner Enrollment

On September 19th, 2018, the USFWS issued FWP ESA section 10(a) (1) (A) Enhancement of Survival Permit # TE-06690D-0, authorizing the Centennial Valley Arctic Grayling CCAA. This permit allows official enrollment of any non-federal landowner within the Centennial Valley Arctic Grayling CCAA Project Area. Enrolled non-federal landowners are provided incidental take coverage and regulatory assurances if Arctic grayling become listed under the ESA once the non-federal landowner, FWP, and the USFWS countersign a Certificate of Inclusion and the approved SSP for the enrolled property. Currently, there are 6 landowners (Participating Landowners) that have enrolled 20,876.9 acres of private land and 647 acres of DNRC leased land into the Centennial Valley Arctic Grayling CCAA (Figure 2). Enrollment for the Centennial Valley Arctic Grayling CCAA will remain open until 90 days prior to any final listing rule published by the USFWS in the Federal Register.

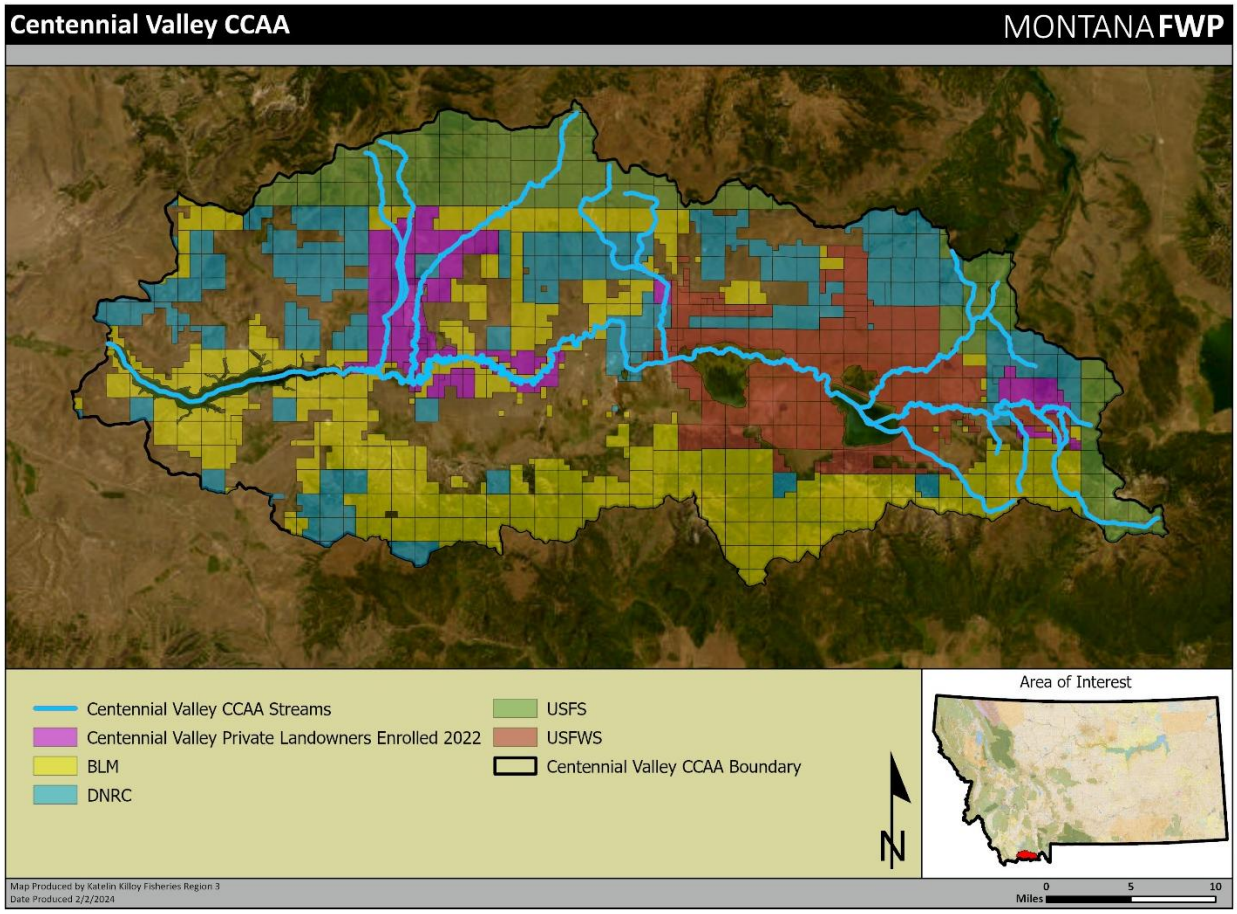

Figure 2. December 31st, 2025, Centennial Valley Arctic Grayling CCAA Program of private land enrolled (six landowners with a total of 20,876.9 private and 647 DNRC leased acres).

IV. Centennial Valley Arctic Grayling CCAA Rapid Assessments and Compliance Monitoring

The Participating Landowners in the Centennial Valley Arctic Grayling CCAA allow the Agencies to complete a "rapid assessment" of the enrolled property within 90 days of enrolling. The rapid assessment focuses on identifying immediate threats to Arctic grayling and validating water rights compliance. Immediate threats to Arctic grayling may include structures, mechanical devices or pollutants that pose a threat of immediate mortality. Examples include unscreened pumping from or toxic effluent entering a stream. Additional information may be gathered during rapid assessments that assist with the development of the SSP with the Participating Landowner (Petersen and Lamothe 2006).

A. Surveys for Immediate Threats to Arctic Grayling

Rapid assessment surveys for immediate threats to Arctic grayling have been conducted on all enrolled properties. No immediate threats to Arctic grayling were identified during the surveys.

Monitoring of enrolled properties for immediate threats continues as SSPs are being developed by the Agencies.

B. Flow and Water Right Compliance Monitoring

FWP completed flow and water right compliance monitoring for all Centennial Valley CCAA streams (FWP and USFWS, 2018). Flow monitoring was completed on Corral Creek, Antelope Creek, Red Rock Creek, Tom Creek, Odell Creek, Metzel Creek, Long Creek, Red Rock River, West Creek, and Middle Creek. FWP with the assistance of Centennial Valley Association and The Nature Conservancy staff checked headgates 23 times throughout the summer of 2025 across these streams to keep flows at or above target levels. Streamflow monitoring included 83 flow measurements to monitor streamflow and maintain rating curves for stream gages and 13 separate staff gage readings to monitor compliance. Streamflow gage data collected by FWP can be found at https://gis.dnrc.mt.gov/apps/StAGE/# by zooming in on the map to the Centennial Valley and clicking on the black and white square indicating the gage location. Six enrolled landowners have associated water rights that were monitored for irrigation compliance on Corral Creek, Red Rock Creek, Long Creek, Red Rock River, West Creek and Middle Creek. All landowners generally followed flow agreements, reducing diversions when requested. Flow and compliance monitoring of all Centennial Valley CCAA streams are summarized in Table 1 of Appendix 1 along with a more detailed description of compliance monitoring.

V. Site-Specific Plans

Site-Specific Plans (SSPs) are developed for each Participating Landowner by FWP and the landowner. The SSPs identify conservation measures that will lead to improved streamflow, enhanced riparian and stream channel condition, improved fish passage and reduced levels of entrainment.

A. Completed and Approved

Two SSPs have been completed for the Centennial Valley CCAA program (Table 1). The remaining SSPs will be developed during 2026 and 2027. All SSPs are 10-year agreements between the Participating Landowners, FWP, and the USFWS. Updates on the implementation of these SSPs, including compliance and monitoring results, will be included in future reports.

B. Extension Requests Approved by the USFWS

FWP did not submit approval for extensions to complete SSPs in 2025. Extensions provide additional time to complete SSPs and document past and ongoing conservation actions for Arctic grayling on the property receiving the extension.

Table 1. Property numbers of enrolled landowners and their associated enrolled acres and enrollment status.

Property Number	Private Land Enrolled (Acres)	State Land Enrolled (Acres)	Enrollment Status	10 Year SSP Update
1	696.21	0	SSP completed	2031
2	2227.7	0	SSP in draft	NA
3	4713.67	0	SSP in draft	NA
4	466.2	0	SSP in draft	NA
5	972.32	0	SSP completed	2032
6	11,801	647	SSP in draft	NA

VI. Conservation Measures

Through the process of developing SSPs for Participating Landowners, projects that reduce or eliminate entrainment of Arctic grayling, eliminate barriers to fish passage, maintain adequate streamflow and protect and/or improve riparian and stream habitat quality are identified. Projects and related conservation measures completed in 2025 are reported below.

A. Entrainment Surveys

Entrainment surveys were conducted on five ditches in 2025 in the Centennial Valley with no Arctic grayling observed. Previous surveys in 2017, 2018, and 2021 did not document Arctic grayling entrainment. Future entrainment surveys will occur as new SSPs are created.

B. Projects to Minimize or Eliminate Entrainment of Arctic Grayling

Currently no Arctic grayling entrainment has been observed and is not believed to be a threat on any of the monitored CCAA specific streams.

C. Projects to Enhance Fish Passage

During 2025 no fish passage projects were completed.

D. Projects to Enhance Riparian and Stream Channel Habitat

In the Spring of 2024, a pond and spawning enhancement project was completed on a 4-acre private pond to establish a self-sustaining population of Centennial Valley-origin Arctic grayling in the upper Red Rock Creek watershed. The pond was deepened to a depth of approximately 20 feet, 1,900 linear feet of spawning channel was constructed, primarily in an existing ditch, and an outlet channel was constructed by integrating into the existing pond spillway. In the fall of 2024, 95 containerized willows were planted along the inlet and outlet channels to increase channel stability and riparian shading. Following planting, 1,020 linear feet of browse protection fencing were constructed along the outlet channel and inlet channel to protect willow plantings during establishment. Lastly, upland and wetland seed mixtures were planted on disturbed areas in the spring of 2025.

In the spring of 2025, access was opened to a well site in the uplands nearby Red Rock Creek and then in the fall of 2025, the well was drilled to 140 feet deep producing over 60 gallons per minute. This well will tie into a solar stock water system to provide a way to water cattle away from the stream. This will improve grazing distribution in the upland pasture and reduce reliance of Red Rock Creek for stock water.

Table 2. Centennial Valley CCAA riparian and stream channel habitat management projects completed in 2025. Projects include seeding and two phases of stock water development.

2025		
Associated Waterbody	**Landowner #**	**Project Component**
Corral Creek (Pond)	1	Seeding
Red Rock Creek	2	Well drilled and road developed as part of stock water system development

E. Projects to Improve Streamflow and Irrigation Water Management

During 2025 no streamflow projects were completed.

F. Projects to Expand Arctic Grayling Distribution into Historically Occupied Waters

Beginning in 2017, attempts to create a Centennial Valley Arctic grayling genetic reserve were initiated in Handkerchief Lake in the South Fork Flathead River drainage. From 2017 to 2019, 12,000 Arctic grayling which were the progeny of wild spawned Red Rock Creek fish in 2014 and 2016 were stocked into Handkerchief Lake. Yet by 2021, very few Arctic grayling had been observed in the lake. To supplement these initial stocking efforts, FWP began a spawning project at four mountain lakes containing self-sustaining populations of Arctic grayling with Centennial Valley ancestry. Between 2022-2026, an additional 255,000 Arctic grayling and

420,000 Arctic grayling eggs were stocked in Handkerchief Lake. These fish were the progeny of over 2,000 Arctic grayling spawned at these mountain lakes over four years.

In 2024 and 2025, approximately 4,000 Arctic grayling from the above spawning efforts were stocked into Selway Lake. Selway Lake is a 1.5-acre lake which was treated with rotenone in 2022 as part of a large fish removal project (Selway Creek) in the Medicine Lodge Valley for westslope cutthroat trout conservation. The lake will be stocked for a final time in 2026. Once established, the Selway Lake Arctic grayling population will serve as another Centennial Valley genetic reserve for Arctic grayling. Additionally, introductions of Arctic grayling into Selway Creek began in 2025 and will continue into 2026.

Finally, the Corral Creek Pond project (described above) was stocked with 2,000 Arctic grayling in 2025 and 1,000 in May, 2026. These fish were the progeny of the same mountain lake spawning events. The goal of this project is to establish a self-sustaining population of Arctic grayling of Centennial Valley ancestry in the headwaters of Red Rock Creek. It is expected that a small portion of these fish will likely move downstream and spawn with wild Red Rock Creek fish. The result will be similar to "genetic rescue" methods currently employed in southwest Montana for westslope cutthroat trout conservation. The purpose of this effort is to offset losses in genetic variation to the Red Rock Lake population while it remains at low abundance due to poor overwinter conditions in Upper Red Rock Lake. This project is intended to improve viability of the extant population while a long-term solution is being developed to address overwinter habitat in Upper Red Rock Lake. All fish destined for Corral Creek Pond received a Visual Elastomer tag prior to stocking in March 2025 and the proportion of stocked Arctic grayling to wild fish in Red Rock Creek will be monitored by FWP's Region 3 staff and conservation geneticist to determine if appropriate numbers of Corral Pond fish are interacting with wild fish. Additionally, annual genetic monitoring of the Red Rock population will determine the success of this project. If it is determined that too many fish are exiting the pond, tagged fish may be removed from the population.

VII. Monitoring

A. Population Monitoring

Abundance Estimation:

The estimated number of Arctic grayling in the 2025 Red Rock Creek spawning population was 308 fish (95% CI = 170–616), statistically similar to the previous year ($\hat{N}$ = 150, 95% CI = 108–192; Figure 3). The consistently low Arctic grayling abundances experienced since 2016 has resulted in loss of genetic variation, some of which is irreversible (Kovach et al. 2023). Suitable habitat the prior winter within Upper Red Rock Lake (i.e., water depth below the ice ≥ 1 m and dissolved oxygen ≥ 4 ppm) reached a minimum during March 2025 sampling at an estimated 29 ha.

Suitable spawning habitat has been quantified biennially since 2015 and most recently in 2025. The most recent estimate of weighted area of suitable habitat (*At*) in Red Rock and Elk Springs creeks were 6.1 ha. Barriers precluding grayling from accessing suitable spawning habitat, i.e., beaver dams, were notched prior to spawning again in 2025.

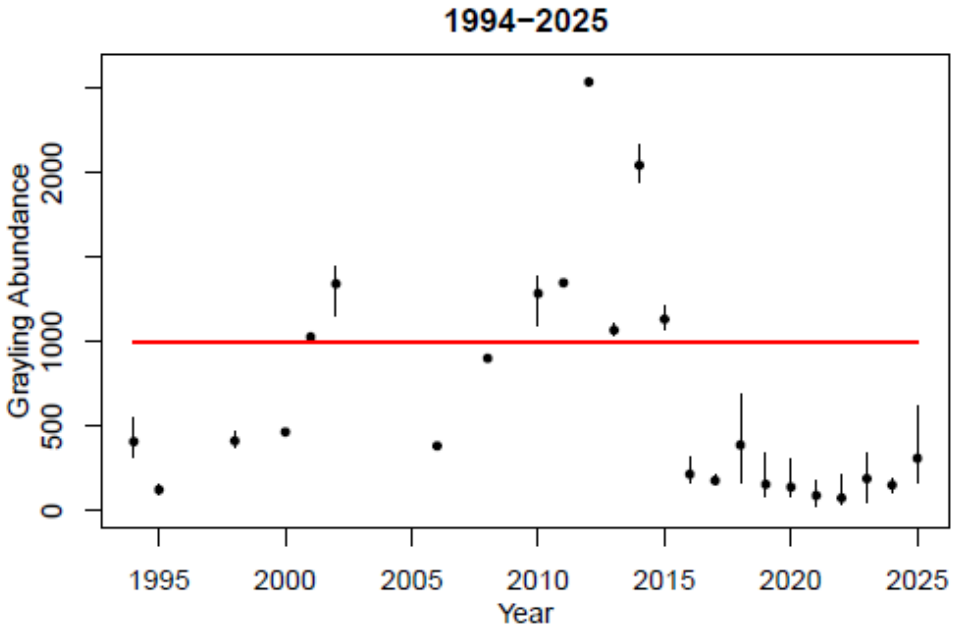

Figure 3. Estimated annual Red Rock Creek Arctic grayling spawning population abundance and 95% confidence intervals (when available), 1994–2025. The red line indicates the current Arctic grayling population objective of 1000 fish for Upper Red Rock Lake and tributaries.

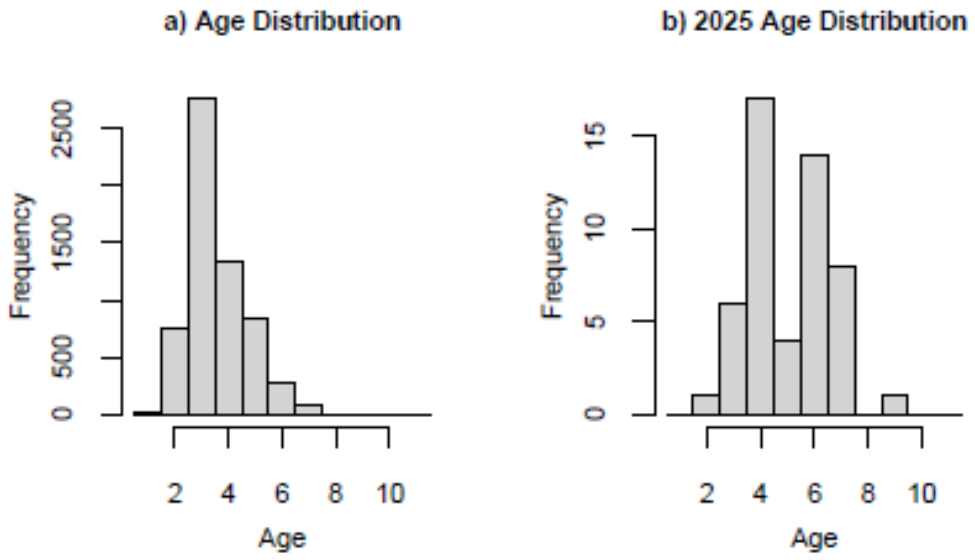

Figure 4. Age distribution of the spawning population of Arctic grayling in Red Rock Creek for a) all years of data (1950–2025, with missing years), and b) 2025.

Genetic Monitoring:

Determining trends in population abundance of rare or highly migratory fish species can be difficult. Genetic analysis is an effective alternative or supplemental method to determine the health and long-term persistence of fish populations (Schwartz et al. 2007). Using non-lethal sampling techniques geneticists can analyze the structure of an Arctic grayling population and determine its long-term viability by estimating genetic diversity in a population (Allelic richness and average expected heterozygosity), effective number of breeding individuals that produced a given cohort (*Nb*), and ultimately the overall genetic effective population size (*Ne*). These estimates provide important population information on potential rate of loss of genetic variability and inbreeding depression, population dynamics, and the efficacy of management actions. Moreover, genetic data ensures that conservation efforts maintain the historic diversity found within and among Arctic grayling populations, and thus, the continued evolutionary legacy of the species [Upper Missouri River Arctic Grayling Conservation Strategy 2022].

Fifty-three individuals of mixed age were sampled in upper Red Rock Creek in 2025 (Table 3). We assigned individuals to cohort based on scale aging prior to estimating N_b. We used the samples to update N_b estimates for the 2017-2021 cohorts. The updated N_b estimates for cohorts born from 2017 to 2021 were generally consistent with estimates from previous years, with all N_b estimates less than 75 except for 2021 (Table 4, Figure 5). The current estimate for 2021 is somewhat higher (112.4), but the sample size is small, and the confidence intervals

include infinity. As such, this result is highly uncertain until more samples are collected from this cohort in subsequent years. Based on the N_b estimates from the 2010 to 2021 cohorts, the N_e of the upper Red Rock Creek population was approximately 126.2 over that period of time.

We used the mixed age sample of fish collected in 2025 to update our time-series of genetic variation (expected heterozygosity and allelic richness). The 2025 estimates for allelic richness and expected heterozygosity were consistent with the long-term decline in genetic variation in this population, and were the lowest on record (Figure 6). These results again emphasize that conservation measures are needed to arrest the loss of the genetic legacy of this Arctic grayling population.

Table 3. Number of genetic samples by year and population. 'N (mix)' is the number of mixed age samples collected in a given year, while 'N (cohort)' is the number of genetic samples for the cohort produced in a given year. N (mix) were used for estimating genetic variation, whereas N (cohort) samples were used for estimating N_b and N_e.

Population	Year	N (mix)	N (cohort)
Red Rock Creek	1998	98	
	2005	48	
	2010		34
	2011	228	63
	2012	100	51
	2013		88
	2014	57	97
	2015	80	36
	2016	97	35
	2017	132	29
	2018	52	30
	2019	29	81
Red Rock Creek	2020	26	24
	2021	17	21
	2022	25	
	2023	50	
	2024	42	
	2025	53	

Table 4. Estimates of N_b for Arctic grayling from upper Red Rock Creek. N is number of individuals genotyped, LCI and UCI are the lower and upper (respectively) 95% confidence intervals for the N_b estimate from each year

Year	N	Nb	LCI	UCI
2010	34	273.1	86.1	∞
2011	63	207.1	106.4	544.1
2012	51	406.3	131	∞
2013	88	356.7	167.1	1714.4
2014	97	362	202.5	1262.1
2015	36	48	38.1	63.1
2016	35	47.6	34.1	73.7
2017	29	74.5	43.4	204.3
2018	30	60.6	39.0	119.8
2019	81	70.1	55.2	92.4
2020	24	61.5	37.8	142.0
2021	21	112.4	49.0	∞

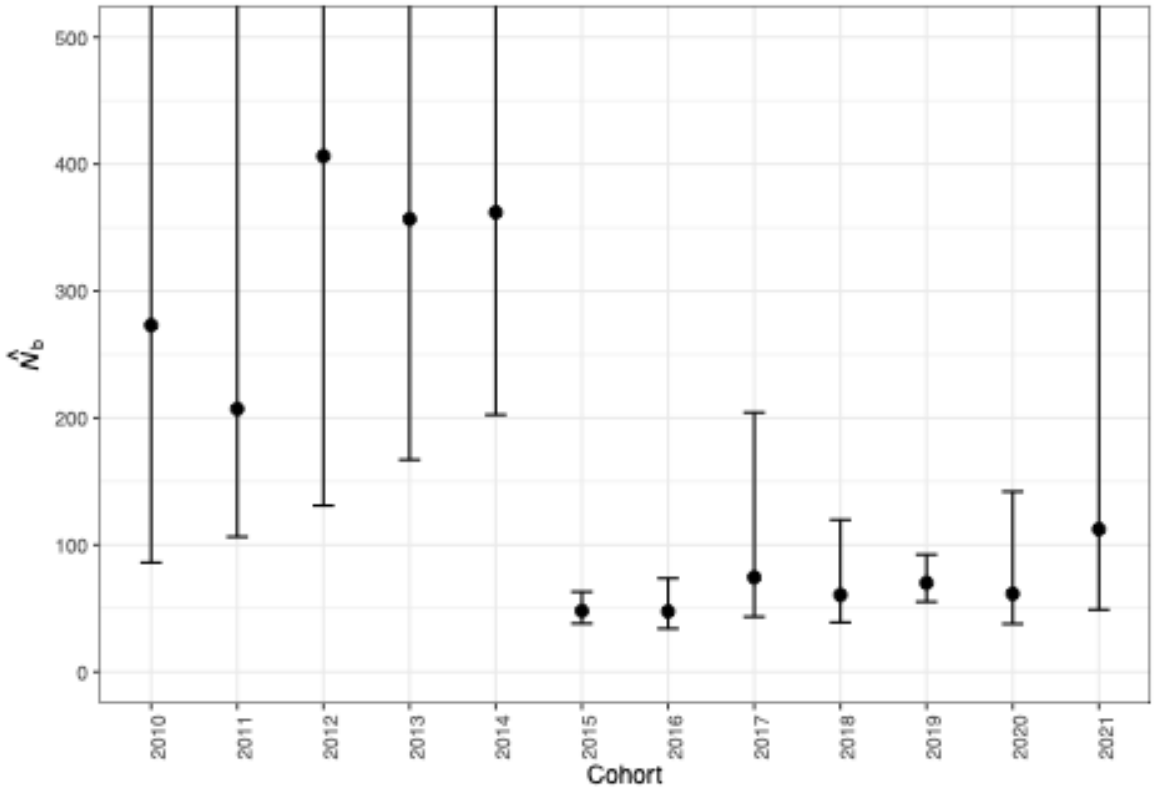

Figure 5. Temporal patterns in the number of effective breeders (N_b) in Arctic grayling from the upper Red Rock Creek. Error bars that surpass the limit of the y-axis can be found in Table 4.

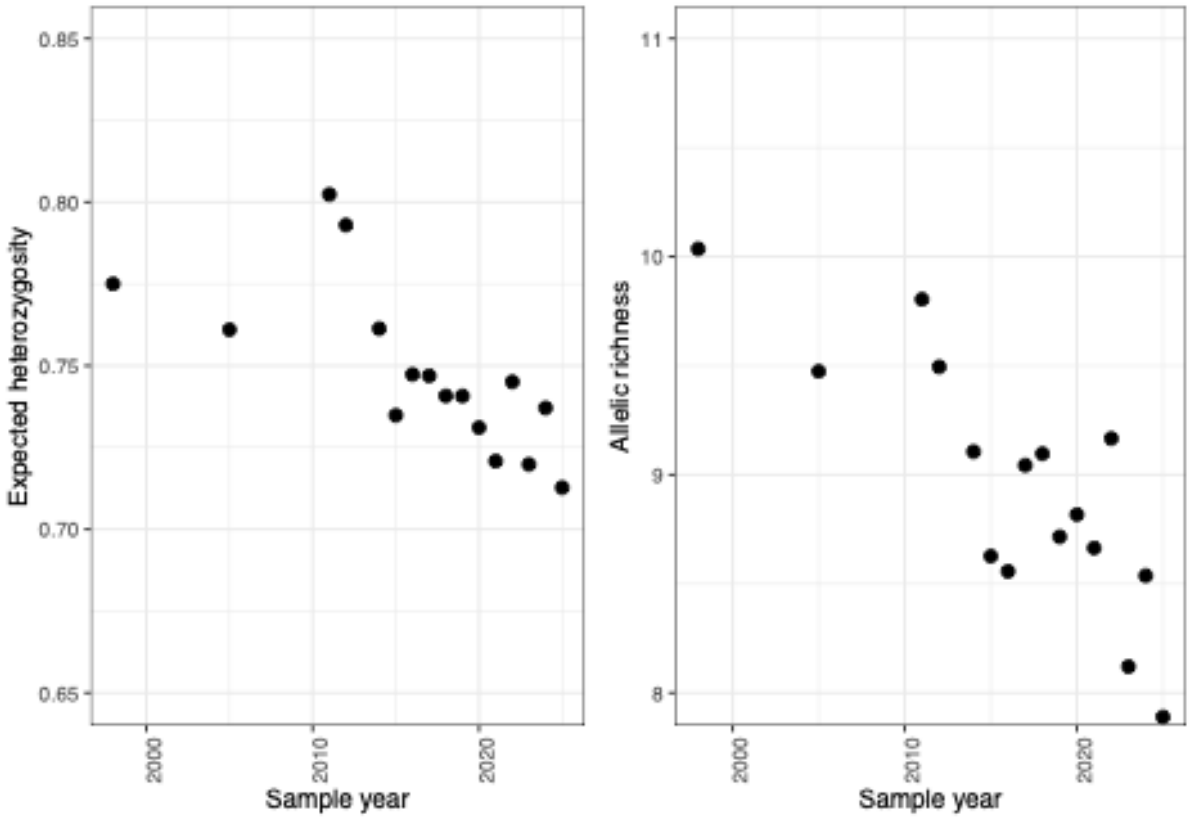

Figure 6. Temporal trends in measures of genetic variation in upper Red Rock Creek

Centennial Valley Arctic Grayling Adaptive Management Plan:

A workgroup comprised of agencies with land and population management responsibility and authority developed the following objectives to meet the conservation goal for Arctic grayling within the CV:

1) Conserve existing Centennial Valley Arctic grayling genetic diversity.
2) Establish or maintain Arctic grayling spawning and/or refugia in at least two tributaries up and downstream of Upper Red Rock Lake and connectivity among tributaries.
3) Maintain at least 1000 spawning fish in the Upper Red Rock Lake Arctic grayling population.

The Centennial Valley CCAA was developed to improve spawning conditions and migratory access to tributaries on private land and was specifically designed to address Objective 2, which will establish and maintain additional spawning and rearing tributaries for Arctic grayling above and below Upper Red Rock Lake.

To elucidate how to best address Objective 3, FWP and USFWS implemented an Adaptive Management Plan (AMP) for the Centennial Valley in 2013 to evaluate the hypothetical drivers that govern the Arctic grayling population and inform future management actions (Warren and

Jaeger 2017). The AMP evaluated the following three hypothesized drivers of the Arctic grayling spawning population:

1) Quality and quantity of tributary spawning habitat.
2) Predation by, and competition with, adult non-native hybrid Yellowstone cutthroat trout.
3) Quality and quantity of overwinter habitat in Upper Red Rock Lake.

On an annual basis, a series of management actions (e.g., non-native fish removal, restoration, beaver dam removal) and data collection (e.g., population estimates, Upper Lake dissolved oxygen measurements, spawning habitat availability) are used to inform hypothesis-specific models in the AMP and best identify limiting factors for the population.

Through 2025, AMP modeling indicates overwinter habitat in Upper Red Rock Lake is the primary population driver for Arctic grayling in the Centennial Valley (Warren et al. 2025). The Spawning Habitat model is somewhat well supported and likely describes a secondary population driver. As such, the Centennial Valley CCAA addresses a potential limiting factor by improving quality and quantity of tributary spawning habitat and is expected to ultimately contribute to maintaining genetic diversity.

B. Stream Temperature Monitoring

In 2025, stream temperature data loggers (thermographs) were deployed from May to October at 8 sites within the Centennial Valley CCAA management section (Figure 7). Data from the Long Creek confluence site was unavailable due to a dead battery, which prevented data retrieval. Stream temperature loggers were deployed at Red Rock Creek, Elk Springs, and Corral Creek Mouth on May 14, 2025, and at Long Creek BLM, Long Creek State, Long Creek TNC, and West Creek Mouth on May 22, 2025. At each site, temperature data were recorded hourly by logging devices through September 30, 2025, except at Long Creek TNC, where a faulty battery caused data recording to stop on May 31.

At the end of the season, data were summarized to determine mean and maximum seasonal temperatures, number of days exceeding each temperature threshold, and the average daily duration (in hours) on days when temperatures exceeded 21.1°C (70°F) and 25°C (77°F; Table 5). Behkne (1992) found the point at which salmonid species begin to experience physiological stress due to temperature conditions outside of their preferred range (thermal stress threshold) was 21.1°C. In a lab-controlled study, Lohr et al. (1996) found the highest water temperature at which an Arctic grayling could survive long-term after acclimation was 25°C (upper incipient lethal temperature). Additionally, Carrillo-Longoria et al. (2023) reported that Arctic grayling exposed to a constant temperature of 26°C (78.8°F), without nocturnal fluctuations, began experiencing mortality after 20 days (480 hours), with complete mortality occurring by day 25 (600 hours). Collectively, these thermal benchmarks informed our

evaluation of stream temperature patterns in relation to stress and lethal limits for Arctic grayling

Table 5. 2025 stream temperature monitoring results.

Monitoring Site	Mean Seasonal Temperature °C (°F)	Maximum Seasonal Temperature °C (°F)	Number of Days Exceeding 21.1°C (70°F)	Avg. Daily Duration (hrs.) Exceeding 21.1°C (70°F)	Number of Days Exceeding 25°C (77°F)	Avg. Daily Duration (hrs.) Exceeding 25°C (77°F)
Corral Creek Mouth	9.6 (49.2)	16.0 (60.7)	0	0.00	0	0.00
Elk Springs	11.3 (52.4)	13.8 (56.9)	0	0.00	0	0.00
Long Creek BLM	13.8 (56.8)	22.2 (72.0)	8	2.38	0	0.00
Long Creek Confluence	N/A	N/A	N/A	N/A	N/A	N/A
Long Creek State	14.2 (57.6)	21.2 (70.2)	1	2.00	0	0.00
Long Creek TNC	13.6 (56.5)	17.9 (64.3)	0	0.00	0	0.00
Red Rock Creek	12.6 (54.6)	19.7 (67.4)	0	0.00	0	0.00
West Creek Mouth	13.0 (55.4)	22.0 (71.1)	1	2.00	0	0.00

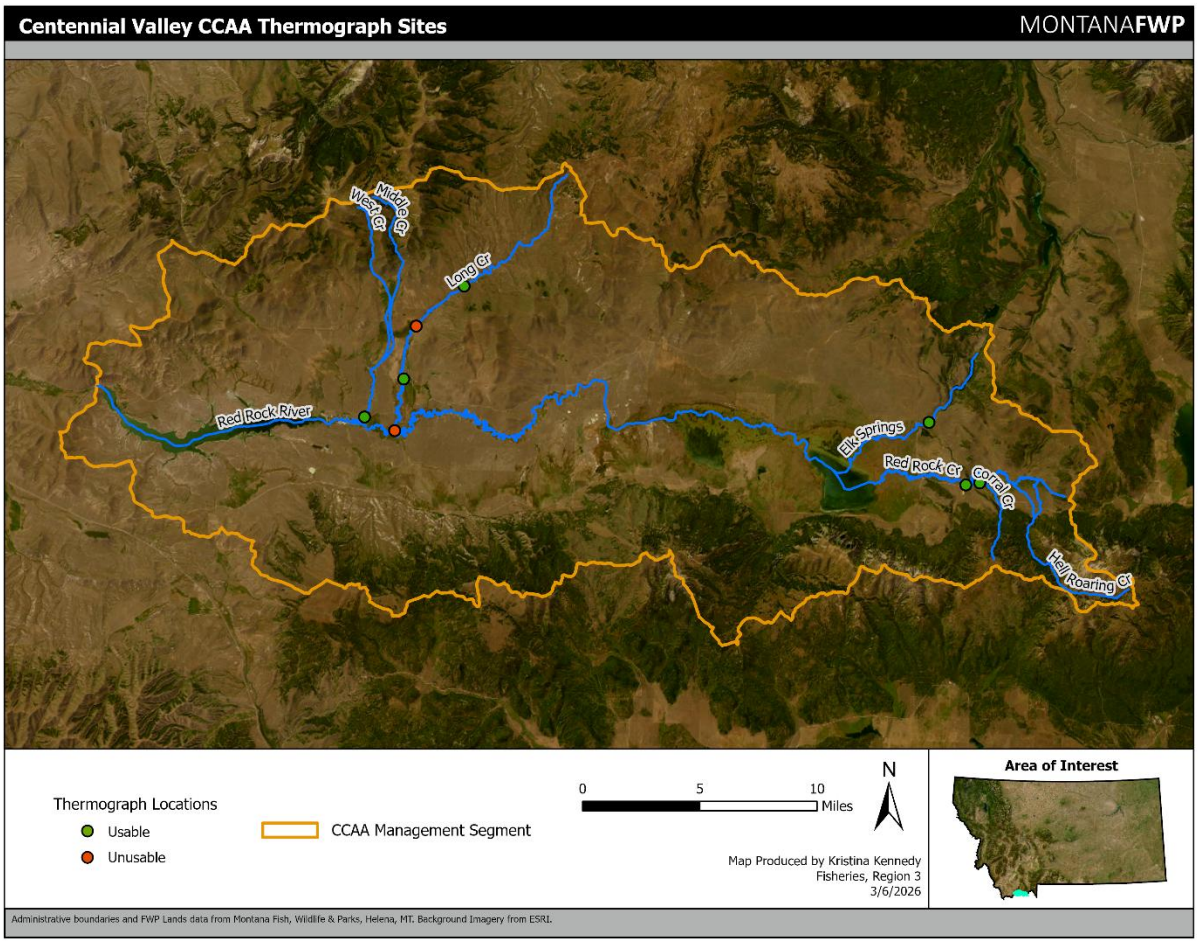

Figure 7. Stream temperature monitoring locations (denoted by green and red circles) in the Centennial Valley Arctic Grayling CCAA Project Area.

C. Compliance Monitoring of Approved Site-Specific Plans

Compliance monitoring for the two enrolled landowners with approved SSPs indicated they were in general compliance with their plan. CCAA staff monitored the amount of water being diverted and enrolled landowners with SSPs in development and they generally followed their interim flow conservation plans in 2025.

VIII. Summary of Estimated Take Associated with the Centennial Valley Arctic Grayling CCAA

In 2020, the USFWS determined that listing the upper Missouri River Basin Distinct Population Segment of Arctic grayling as threatened or endangered under the Endangered Species Act was not warranted. Due to the current legal status of Arctic grayling, ESA-defined take (harm, harass or kill) did not apply to the implementation or monitoring of Centennial Valley Arctic grayling in 2025.

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APPENDIX 1

Streamflow targets were developed for the spawning period (mid-April through late June) and the base flow period (remainder of year) measured below active diversions from the respective streams. For each period a normal and dry condition target was established for both periods except for Red Rock, Tom and Odell creeks where only a normal base flow target was established, matching the minimum flow requirement of the Red Rock Lakes Compact. The dry targets apply when available streamflow not including diversions drops below the estimated 80th percentile exceedance flow for the stream (trigger flows). This is the flow that would be expected to be met or exceeded in 8 out of 10 years. As streamflow data continues to be collected and a sufficient period of record is established to calculate 80th percentile exceedance values instead of using estimated values from regional regression equations, triggers will be adjusted accordingly.

Targets for both periods were established based on riffle wetted perimeter data for streams where data was available. Where wetted perimeter data was not available, targets from streams with data were translated to those without data using the ratio of the estimated mean annual flow between the streams. The normal spawning target was based on the flow necessary to provide an 0.5 ft. average depth of passage for the most restrictive riffle transect while the dry target is based on the average flow of all the riffle transects. The base flow normal target was based on the higher inflection point of the streamflow-wetted perimeter curve above which increases in flow result in very little increase in riffle coverage. The base flow period dry target was based on the lower inflection point of the streamflow-wetted perimeter curve below which decreases in flow result in large losses in riffle coverage. Subsequently the spawning period targets for West and Middle creeks were adjusted based an additional study of the depth of passage measured in several transects to better refine the needed flow to allow for 0.5 ft. depth of passage. Also, trigger flows were adjusted for Red Rock, Antelope and Tom creeks based on actual long-term measurement data for Red Rock Creek.

Streamflow measurement began in late April, except on Tom Creek where drifted snow delayed monitoring until May. Table 1 shows the percentage of time that the applicable spawning or base flow target was attained during 2025 based on average daily streamflow. Percentage attainment is given for both the full target as well as 80% of the full target to provide an indicator of the relative extent stream flow was below target. If for example the full attainment percentage is low while the 80% attainment is high, it means that the flow generally was close to the target level most of the time even though it fell short. Low values in both categories indicates streamflow was quite low with respect to the target.

For a given stream if there is a value in both the “Normal” and “Dry” category it means that the trigger flow was initially met during the period but then streamflow fell below the trigger level

causing a shift from a normal to dry target. For example, Long Creek was above the trigger level from the beginning of measurement until mid-June when it fell below the trigger level, after which the dry spawning target applied both during the remaining spawning period and the subsequent baseflow period. Once a dry year target is established it remains in effect for the remainder of the period regardless of whether available flow increases above the trigger level.

Table 1 also indicates the number of enrolled and non-enrolled water users along with the number in each category diverting water in 2025. These values provide an indicator of the influence of water users enrolled and not enrolled.

Table 1. Flow and Water Right Compliance Monitoring General Summary for Centennial Valley CCAA 2025.

2025		Spawning Period Target Attainment		Base Flow Period Target Attainment		CCAA Enrollees				Other Water Users	
Stream		Full	80%	Full	80%	#	# Diverting	# Full Compliance	# Partial Compliance	#	# Diverting
Corral Creek	Normal	N/A	N/A	N/A	N/A	1	1	1	0	0	0
	Dry	90%	94%	100%	100%						
Antelope Creek	Normal	N/A	N/A	N/A	N/A	0	0	NA	NA	1	unknown
	Dry	4%	10%	92%	92%						
Red Rock Creek	Normal	100%	100%	100%	100%	2	2	1	1	0	0
	Dry	100%	100%								
Tom Creek	Normal	0%	0%	23%	55%	0	0	NA	NA	1	0
	Dry	0%	0%								
Odell Creek	Normal	60%	100%	32%	75%	0	0	NA	NA	1	unknown
	Dry	89%	95%								
Long Creek	Normal	100%	100%	N/A	N/A	3	2	3	NA	1	1
	Dry	98%	98%	8%	10%						
Red Rock River	Normal	N/A	N/A	N/A	N/A	1	0	1	NA	0	0
	Dry	78%	91%	34%	73%						
Middle Creek	Normal	100%	100%	N/A	N/A	1	1	1	0	0	0
	Dry	69%	73%	82%	100%						
West Creek	Normal	N/A	N/A	0%	0%	2	1	1	1	0	0
	Dry	13%	28%	98%	100%						

If the cell indicates “N/A” or “not applicable” it means that the dry or normal target was not in use during the period. In other words, the target did not shift during the period. For example, during the base flow period, only the dry target was applicable as the inflow was below the trigger level at the beginning of the period. Red Rock, Tom and Odell creeks do not have dry target values for the baseflow period as indicated by the darkened cells. This is because the Red Rock Lakes Water Compact established minimum flow levels that correspond to the normal base flow targets. A lower dry target would be contrary to the terms of the Compact.

Failure to meet the prescribed target may result from a lack of available flow in the stream as opposed to being caused by diversion of water. Both Tom Creek and Antelope Creek provide an example of this situation as no known diversion occurred during the spawning and base flow

periods, but the targets were not being met. In other cases, such as Long Creek diversion by non-enrolled water users influences target attainment.

Table 1 indicates two circumstances where CCAA enrollees were found to be in partial compliance. In the case of Red Rock Creek, the partial compliance was due to the diversion of water somewhat exceeding the authorized amount, but at no time did flow drop below the target levels due to diversion. The spawning target was not early in the period due to late snowmelt at which time no diversion was occurring.

Partial compliance on West Creek resulted from bypass structures at diversions not allowing sufficient flow past diversions. These new structures will be investigated and adjusted in 2026 to ensure the correct flow is being bypassed. West Creek did not approach going dry with the lowest daily flow for West Creek at 1.7 ft^3/s, an appreciable flow for this small stream.