CANDIDATE CONSERVATION AGREEMENT WITH ASSURANCES FOR FLUVIAL ARCTIC GRAYLING IN THE UPPER BIG HOLE RIVER

2025 Annual Report

Montana Fish, Wildlife & Parks

The Candidate Conservation Agreement with Assurances for Fluvial Arctic Grayling in the Upper Big Hole River 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 Fluvial Arctic Grayling in the Upper Big Hole River CCAA Program (Big Hole Arctic Grayling CCAA) began in July 2006 and is up for renewal in 2026.

The conservation goal of the Big Hole Arctic Grayling CCAA is to secure and enhance fluvial (river-dwelling) Arctic grayling (*Thymallus arcticus*) within the upper reaches of their historic range in the Big Hole River drainage. Montana Fish, Wildlife & Parks (FWP) holds an 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). SSP are collaboratively developed by each landowner and an interdisciplinary technical team made up of individuals representing FWP, USFWS, USDA Natural Resources Conservation Service (NRCS), and Montana Department of Natural Resources and Conservation (DNRC; collectively known as the Agencies). The conservation goal of the Big Hole 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 Big Hole 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 Big Hole fish populations, addressing private property concerns, and enhancing the overall health of the upper Big Hole watershed.

The 2025 Big Hole Arctic Grayling CCAA report summarizes current enrollment, approved SSPs, implemented conservation actions, and completed projects as part of the Big Hole Arctic Grayling CCAA.

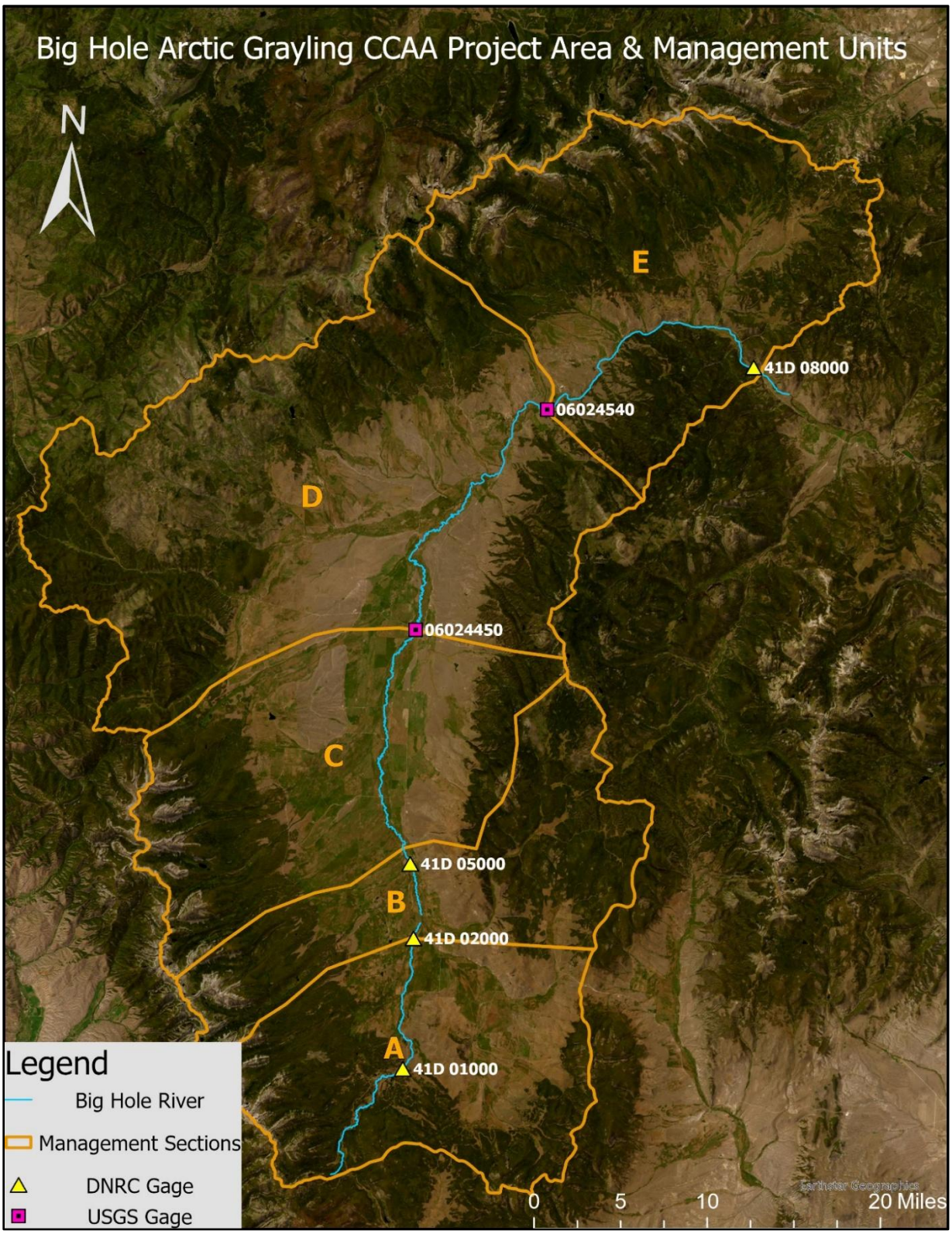

Figure 1. The Big Hole Arctic Grayling CCAA Project Area & Management Segments.

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 August 1, 2006, the USFWS issued FWP an ESA section 10(a) (1) (A) Enhancement of Survival Permit # TE-104415, authorizing the Big Hole Arctic Grayling CCAA. The permit allows enrollment of any non-federal landowner within the Big Hole 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 31 landowners (Participating Landowners) that have enrolled 154,572 acres of private and 6,105 acres of DNRC leased land into the Big Hole Arctic Grayling CCAA (Figure 2). In 2023-2024, one operation was split. The existing property remained

on the original certificate of inclusion and the new property was enrolled on a new certificate of inclusion. Additionally, a new property was enrolled in section D management section in 2024. Enrollment for the Big Hole Arctic Grayling CCAA will remain open until 90 days prior to any final listing rule published by the USFWS in the Federal Register.

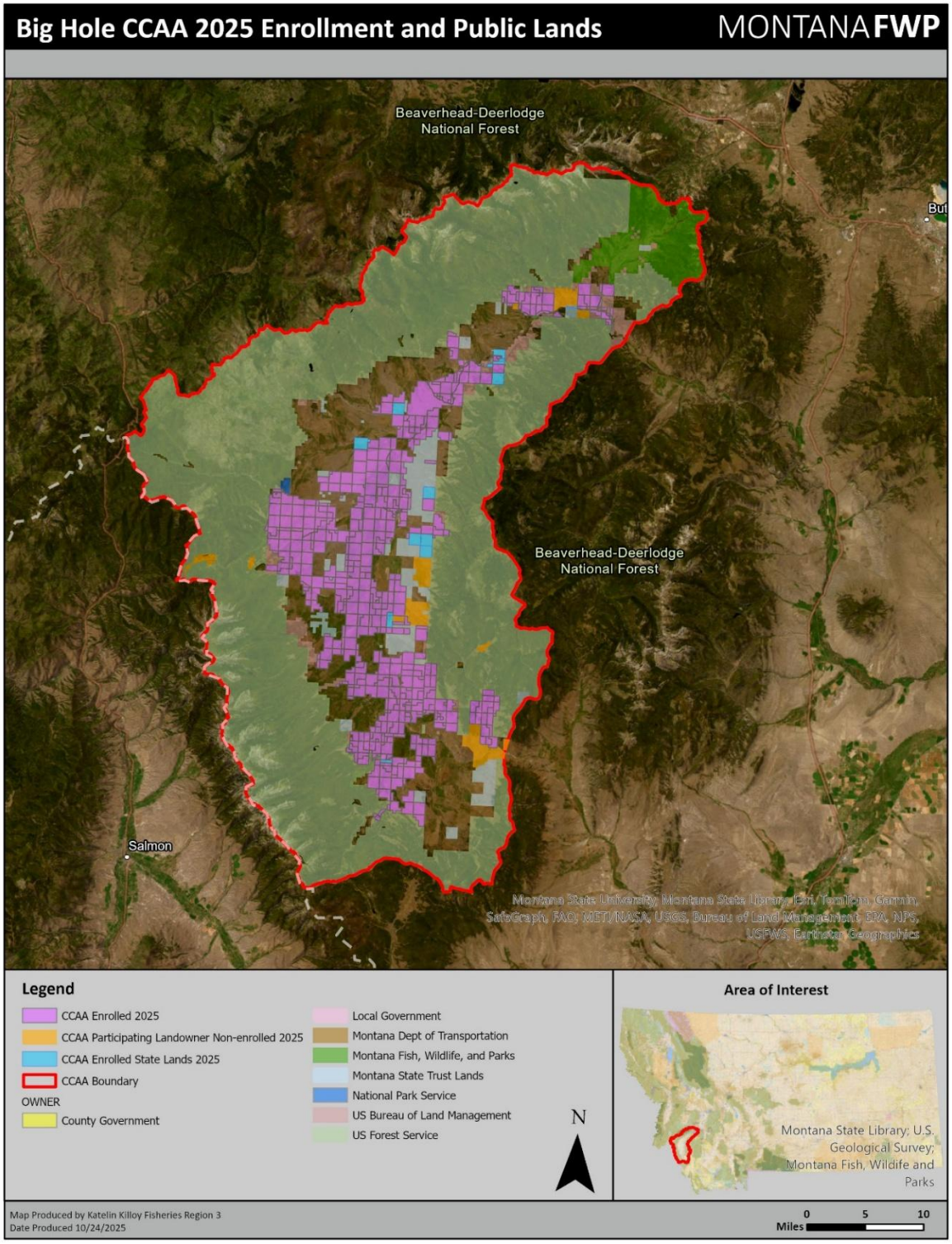

Figure 2. December 31st, 2025, Big Hole Arctic Grayling CCAA Program of private and state land enrolled. Enrolled land includes 31 private landowners and 154,572 acres of private and 6,105 acres of DNRC leased lands.

IV. Big Hole Arctic Grayling CCAA Rapid Assessments and Compliance Monitoring

The Participating Landowners in the Big Hole 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. Water Rights Compliance Evaluation

Water right and irrigation compliance monitoring was completed on the following properties: 1 –2, 4, 6 – 18, and 20-30 (Table 1). These efforts, completed by DNRC and FWP, included site visits to each property to assess compliance of flow rate and period of use with the landowner's water right. Some of the required monitoring for enrolled properties was provided by the District Court–appointed water commissioner. Continuous stage recorders installed in the three major ditches provided flow information for water rights compliance, instream flow conservation projects, and ongoing development of the SSPs. During 2025, all enrolled landowner compliance monitoring and all flow plans were completed and adhered to (Table 1).

C. Streamflow Monitoring Required by CCAA

In concert with two United States Geological Survey (USGS) real-time streamflow gages located at Management Segments C and D (Figure 1), DNRC continued to operate and maintain four real-time streamflow gages located at Management Segments A, B, and E as well as a basin inflow gage and a real time gage on Deep Creek. DNRC also implemented a new real-time stream gage on the North Fork of the Big Hole River (41D 07150). In addition, DNRC continuously monitored flow in at least one tributary within each Management Segment and three key irrigation ditches in 2025. DRNC implemented a total of 11 continuous loggers on tributaries throughout the CCAA in 2025.

Table 1. 2025 Irrigation Meeting and Compliance Monitoring.

Property #	Compliance Checks Completed	Irrigation Meeting
1	May/September	Yes, over the phone
2	May/September	No
3*	No	No, new owner
4**	May/September	Yes, over the phone
5	No	No
6	May/September	No
7	May/September	Yes, in person
8	May/September	Yes, over the phone
9	May/September	Yes, in person
10	May/September	Yes, in person
11	May/September	No
12	May/September	Yes, in person
13	May/September	No
14	May/September	Yes, in person
15	May/September	Yes, in person
16	May/September	Yes, over the phone
17	May/September	Yes, over the phone
18	May/September	Yes, over the phone
19	No	No
20	May/September	Yes, over the phone
21	May/September	Yes, in person
22	May/September	Yes, over the phone
23	September	Yes, over the phone and text
24	May/September	Yes, in person
25	May/September	No, unable to reach
26	May/September	Yes, in person
27	May/September	Yes, in person
28	May/September	Yes, over phone
29**	May/September	Yes, by text
30	May/September	Yes, over the phone
31	May/September	Yes, in person and over the phone
* New landowner		
** Property managed leased by differing enrolled landowner that completed irrigation meeting and compliance		

V. Site-Specific Plans

SSPs are developed for each Participating Landowner by the Agencies and the landowner. The SSPs identify conservation actions that will lead to improved streamflow, enhanced riparian and stream channel condition, improved fish passage and reduced levels of entrainment.

A. Completed and Approved

Currently 31 SSPs are being implemented in the Big Hole CCAA program (Table 2). One property was split, and each property received a new site-plan in 2024. One property enrolled in 2024 and received a site-plan. Eleven SSPs will undergo 10-year updates in 2026. All SSPs are 10-year agreements between the Participating Landowners, FWP, and the USFWS. Updates on the implementation of SSPs, including compliance 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 provided additional time to complete the SSP and document past and ongoing conservation actions for Arctic grayling on the property receiving the extension.

Table 2. Property numbers of enrolled landowners and their associated CCAA management segment, enrolled acres, and enrollment status.

Property Number*	Management Segment(s)	Private Land Enrolled (Acres)	State Land Enrolled (Acres)	Enrollment Status	10 Year SSP Update
1	C & D	15,424	0	SSP Complete	2036
2	A	6,300	0	SSP Complete	2029
3	A & B	2,937	0	SSP in Draft	2026
4	D and C	2,265	0	SSP in Draft	2025
5	D	2,518	640	SSP in Draft	2025
6	B and C	2490	0	SSP Complete	2030
7	B	6,790	0	SSP Complete	2030
8	E	2,759	0	SSP Complete	2032
9	C	2911	0	SSP Complete	2032
10	C & D	23,839	560	SSP Complete, Signature Pending	2022
11	C & D	2,684	2,274	SSP Completed	2032
12	D	1,109	0	SSP Complete, Signature Pending	2024
13	C	210	0	SSP Complete	2032
14	B & C	3,744	0	SSP Complete	2035
15	C	3,350	200	SSP in Draft	2026
16	D	8,771	646	SSP Complete	2036
17	A and B	1350	0	SSP Complete	2035
18	C	1,559	0	SSP Complete	2036
19	E	820	0	SSP in Draft	2025
20	A, B, C & D	24,136	0	SSP Complete	2035
21	C & D	6,216	0	SSP Complete	2035
22	D & E	6,336	1,280	SSP in Draft	2025
23	D	1473	0	SSP in Draft	2022
24	A and B	2738	0	SSP Complete	2034
25	A and B	6164	0	SSP in Draft	2025
26	A and B	880	0	SSP Complete	2035
27	E	1987	0	SSP Complete	2035
28	E	2473	0	SSP Complete	2032
29	B	3403	0	SSP in Draft	2032
30	A and B	2474	160	SSP Complete	2034
31	D	4462	132	SSP Complete	2034

VI. Conservation Measures

Through the process of developing SSPs for Participating Landowners, the Agencies identify 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. Projects and related conservation efforts completed in 2025 are reported below.

A. Entrainment Surveys

In 2025, FWP completed nine entrainment surveys on 3.11 miles of irrigation ditches managed by five enrolled landowners (Table 3). Twenty-five grayling were collected from one ditch during these surveys. Other fish species present during entrainment surveys included: Brook Trout (*Salvelinus fontinalis*), Brown Trout (*Salmo trutta*), Mountain Whitefish (*Prosopium williamsoni*), Burbot (*Lota lota*), Longnose Dace (*Rhinichthys cataractae*), Rocky Mountain Sculpin (*Cottus bondi*), and White Sucker (*Catostomus commersonii*).

Table 3. FWP electrofishing entrainment surveys completed in 2025 in the upper Big Hole watershed as part of the Big Hole Grayling CCAA requirements.

Date	Source	Distance (mi.)	Number of Grayling Rescued
7/21/2025	Daniels	0.90	25
7/21/2025	Pintler A	0.10	0
7/21/2025	Lower NF Ditch South	0.10	0
7/23/2025	Deep Creek	0.15	0
7/23/2025	Lower South Steel Creek	0.31	0
7/23/2025	Upper North Steel Creek	0.43	0
7/23/2025	Miller	0.10	0
7/23/2025	Hussel 1	0.60	0
7/25/25	Hussel 2	0.42	0
Total		**3.11**	**25**

B. Projects to Minimize or Eliminate Entrainment of Arctic Grayling

Low channel gradients preclude using fish screens to reduce entrainment in parts of the CCAA area; however, fish screens installed on La Marche and Rock creeks have successfully prevented grayling entrainment. In 2023, the Agencies developed a headgate system with a return channel on a large ditch downstream of Wisdom where entrained grayling YOY were commonly

observed. This project will allow any entrained fish to be flushed back into the Big Hole River at the end of irrigation season. During 2025 no entrainment projects were completed.

C. Projects to Enhance Fish Passage

During 2025 the Agencies completed two fish passage improvement projects on two properties (Table 4). Additionally, beaver dam surveys and notching were continued on important Arctic grayling spawning and refuge tributaries. Seventeen dams on five tributaries were notched in April 2025. Notching dams in certain spawning tributaries (e.g., Steel and Plimpton creeks) has improved the abundance and distribution of young of the year Arctic grayling dramatically. In thermal refuge streams (e.g., LaMarche, Fishtrap, and Deep creeks), open passage allowed fish to access cooler tributary water during hot, summer months. Densities of Arctic grayling in Steel and LaMarche creeks were the highest observed in the past twenty years.

Table 4. Upper Big Hole Watershed fish passage projects completed in 2025 as part of the Big Hole Arctic Grayling CCAA. Projects include installing two bridges.

2025		
Associated Waterbody	**Enrolled Landowner**	**Project Component**
South Branch Big Swamp Creek	14	1 Bridge
North Fork Miner Creek	6	1 Bridge

D. Projects to Enhance Riparian and Stream Channel Habitat

During 2025 the Agencies and Participating Landowners implemented 14 riparian habitat projects to enhance stream function and riparian habitat on 8 properties (Table 5). Construction of the stock water systems from the completed well projects are slated to be all completed Fall of 2026 or Fall of 2027.

Table 5. Upper Big Hole Watershed riparian and stream channel improvement projects completed in 2025 as part of the Big Hole Arctic Grayling CCAA. Projects include improving riparian habitat through stock water development, stock water repairs, stream restoration, pond enhancement, and riparian fencing.

2025		
Associated Waterbody	**Enrolled Landowner**	**Project Component**
Big Hole River and Warm Springs Creek	7 and 29	2 Stock Water Systems from Spring Developments
Big Hole River and Tributaries	1 and 20	3 Stock Water Systems from Wells
Big Hole River	8	Repaired 1 Stock Water System
Big Hole River and Tributaries	1 and 20	2 Wells for Stock Water Systems
Governor Creek	17	Streambank Restoration
McVey Creek Pond	DNRC	Pond Enhancement
Swamp Creek and Steel Creek	16	2 Riparian Fences

E. Projects to Improve Streamflow and Irrigation Water Management

During 2025 the Agencies partnered with participating landowners to implement irrigation repairs on 1 enrolled property to enhance the ability to control and measure irrigation withdrawals (Table 6).

In addition to improvements to irrigation infrastructure, the Big Hole Arctic Grayling CCAA requires reductions of irrigation diversions in response to streamflows dropping below established seasonal flow targets at each of the five gaging stations (Miner Lakes Road (41D 02000), below the mouth of Miner Creek (41D 05000), Wisdom Bridge (06024450), Mudd Creek Bridge (06024540), and Dickie Bridge (41D 08000); Figure 1). A total of 196.01 ft3/s was

returned to the Big Hole or its tributaries in 2025 in accordance with site plans and flow targets. These flows were returned in June through September.

Table 6. Upper Big Hole Watershed streamflow and irrigation management projects completed in 2025 as part of the Big Hole Arctic Grayling CCAA. Projects include repairing irrigation infrastructure.

2025		
Associated Waterbody	**Enrolled Landowner**	**Project Component**
Pintler Creek	31	Irrigation Infrastructure Repairs

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

French Creek is a tributary to Deep Creek which flows into the Big Hole River. A fish barrier was constructed in 2019 which isolated over 40 miles of habitat for native fish restoration. Non-native fish removal occurred in 2020 and 2021 followed by eDNA testing which indicated that non-native fish had successfully been removed. Restocking the stream with Arctic grayling and westslope cutthroat (WCT) trout began in 2022. The last stocking of WCT occurred in 2025. The last stocking of age-0 and older Arctic grayling also occurred in 2025 but stocking Arctic grayling embryos through Remote Streamside Incubators (RSI) continues to occur.

Electrofishing of French Creek or its tributaries did not occur in 2025. Rather, the pond created upstream of the fish barrier was sampled using fyke nets. Two nets were set in the fish barrier pond on 5/25/25 and fished overnight. One of the two nets set collapsed overnight and only caught 3 Arctic grayling. Therefore, the numbers presented are the catch from one net. Arctic grayling were the second most common fish captured in the fish barrier pond behind white suckers which survived the rotenone treatment (Figure 3). At least 2 distinct age classes of Arctic grayling were present. WCT were the least common fish captured which is the opposite of previous electrofishing findings from French Creek upstream. Because of the ongoing embryo introduction to French Creek we are not able to determine if the age-1 Arctic grayling (< 7 in) captured in the pond were wild or from RSI's. Additional monitoring of French Creek and its tributaries is anticipated in 2026. RSIs will be used in French Creek to introduce Arctic grayling in 2026 as well.

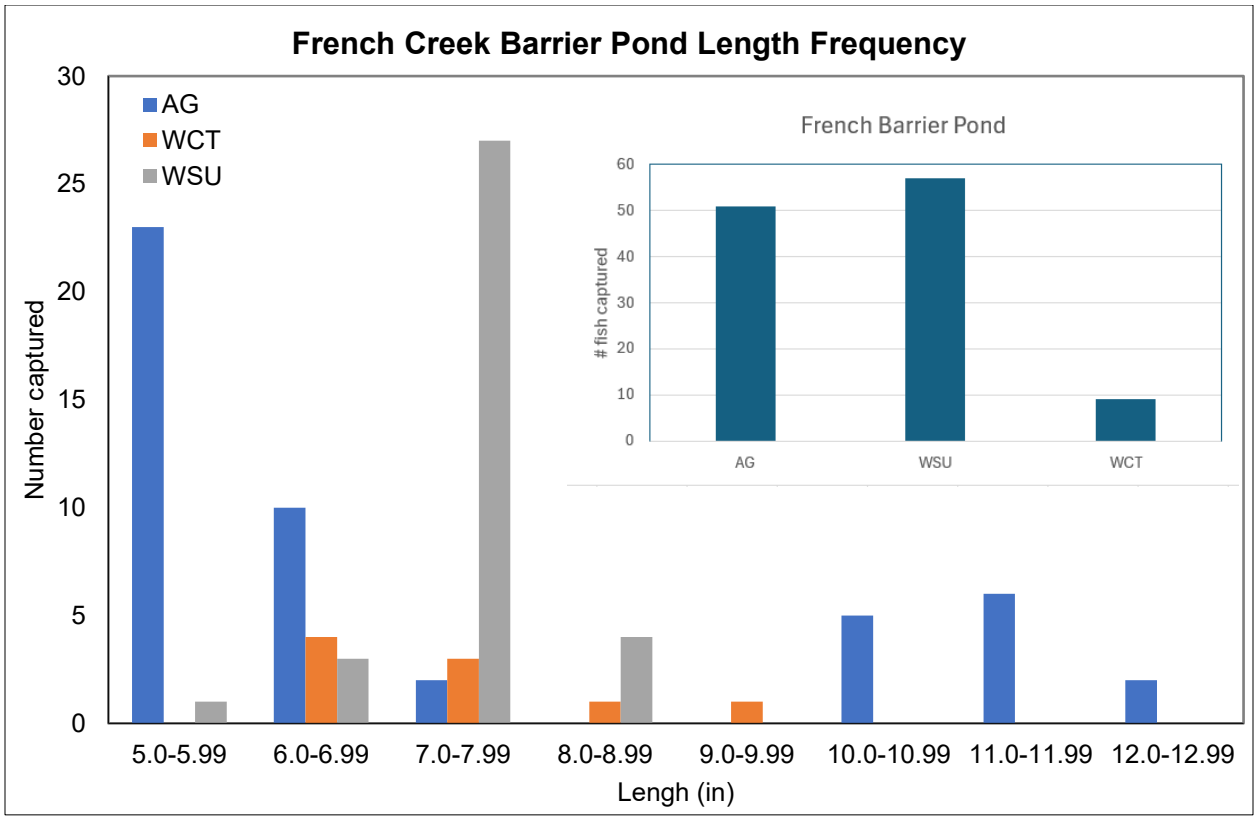

Figure 3. Fisheries survey data from French Creek from the fish barrier pond where fish were captured using fyke nets. The fish species sampled were: AG = Arctic grayling, WSU= white suckers, WCT = westslope cutthroat trout.

The fish barrier pond on McVey Creek was enhanced in 2025. The 2-acre pond, which had a maximum depth of 4 ft, had eutrophied since its construction in 2011, becoming chocked with aquatic vegetation. In the winter when the pond was covered in ice and snow, this vegetation would die and decompose resulting in low oxygen conditions that are unsuitable for fish. In June of 2025 McVey Creek was diverted around the fish barrier pond and the pond was pumped dry. Using an excavator and multiple dump trucks the pond was deepened within its existing footprint. The fill generated through excavation was deposited to the northeast adjacent to the irrigation ditch in an excavated repository. The pond was dug to a depth of 16 ft. Depths beyond 10 ft should limit rooted aquatic vegetation growth which should reduce oxygen demand in the winter and slow the eutrophication process. Additionally, the added volume of water in the pond should buffer winter oxygen conditions. Shallow littoral areas were left in the pond near the fish barrier and at the inlet of the pond.

Brook trout were also discovered in McVey Creek which pose a threat to the long-term conservation of WCT. McVey Creek was retreated with rotenone in 2024 to remove brook trout. At the time of retreatment, no Arctic grayling were found in the fish barrier pond or stream upstream of the pond. Arctic grayling extirpation was thought to be due to low overwinter oxygen conditions. Arctic grayling are slated to be restocked into McVey Creek in

2026. The source of these Arctic grayling will be the Axolotl Lake brood stock that was created and maintained through time from the Big Hole River.

As part of the restoration of WCT to Trapper Creek in the East Pioneer Mountains, non-native trout were removed from Trapper Lake in 2025. Arctic grayling are proposed for restocking into Trapper Lake in the summer of 2026. The source of these Arctic grayling will be Mussigbrod and Miner lakes in the Big Hole drainage.

VII. Monitoring

The Big Hole Arctic Grayling CCAA requires monitoring of Arctic grayling population response to conservation measures implemented under this agreement. In 2016, FWP began using genetic monitoring to document population trends in Big Hole grayling under the guidance of geneticists and with the approval of USFWS (Kovach et al. 2020). Genetic monitoring was justified for two reasons, 1) Determining trends in population abundance of rare or highly migratory fish species can be difficult, and 2) Genetic analysis is an effective alternative or supplemental method to determine the health and long-term persistence of fish populations (Schwartz et al. 2007). Genetics are used to analyze the structure of an Arctic grayling population and determine its long-term viability by estimating genetic diversity in a population (A_r), effective number of breeding individuals that produced a given cohort (N_b), and ultimately the overall genetic effective population size (N_e). 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 ensure 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, in preparation].

Additionally, stream temperature and discharge are monitored on each of the 10 reaches (FWP and USFWS 2006). Mainstem reaches are located near the lower boundary of each management segment (A through E) and tributary reaches include Governor Creek, Miner Creek, Rock Creek, Steel Creek and Deep Creek. Additional monitoring is conducted to evaluate restoration projects.

A. Fish Population Monitoring

In 2025, a total of 166 young-of-year (YOY) were captured during fall monitoring, and 146 genetic samples were used to calculate N_b. Our 2025 estimate of N_b was 171.8, which is very similar to the estimates from 2023 and 2024 (Figure 4). This estimate is close to the median value across the time-series (181.9). The 2025 estimate of N_b was used in conjunction with previous N_b estimates to update our estimate of the genetic effective population size (N_e). Our estimate for N_e based on N_b estimates over the entire time series (2007- 2025) was 348.9. However, if we take a 3-year harmonic mean of the N_e estimates derived from N_b (close to the generation interval, see below), it's apparent that the overall estimate across the entire time-

series is strongly influenced by the lower values of N_b and N_e that were observed in the late 2000s (Figure 4, Figure 5). The 3-year harmonic mean has been greater than 400 since 2019. The estimate of N_e over the last two generations (seven years; DeHaan et al. 2013) was 466.0. Together, the N_b and resulting N_e estimates suggest the following: (1) N_e was approximately 200 at the start of the CCAA program; (2) N_e was >500 during non-drought periods in the last ~20 years; and (3) N_e is currently twice the size it was at the initiation of the CCAA program despite some of the most-extreme drought conditions on record.

Additionally, 57 Age 1+ Arctic grayling were captured during fall surveys, primarily in thermal refuge tributaries on the lower end of the CCAA boundary (Table 7). Maintaining access by notching beaver dams since 2022 has allowed older Arctic grayling access to cool habitat during warm summers. Genetic samples collected from older Arctic grayling in 2024 and 2025 were used to update our time series describing genetic variation. The 2024/2025 estimates for allelic richness and expected heterozygosity were relatively consistent with previous estimates, though it does appear like there has been a very small decrease in allelic richness, a result that is consistent with the observed estimates of the genetic effective population size for this population (Allendorf et al. 2024). Other species sampled included brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), burbot (*Lota lota*), mountain whitefish (*Prosopium williamsoni*), Rocky Mountain sculpin (*Cottus bondi*), longnose dace (*Rhinichthys cataractae*), white suckers (*Catostomus comersonii*), and longnose suckers (*Catostomus catostomus*).

Table 7. Arctic grayling captured during 2025 electrofishing surveys in the Big Hole River watershed.

Reach Name	Reach Length (mi.)	Arctic Grayling YOY Samples Collected	Age 1+ Arctic Grayling
Christiansen Creek Side Channel	0.8	3	0
Daniels Ditch	0.6	24	0
Deep Creek	2.1	0	13
Fishtrap Creek	1.0	0	24
Howell Creek Side Channel	1.2	5	1
LaMarche Creek	0.8	0	18
Pintler Creek South Channel	0.5	1	0
Pintler/Doolittle Side Channel	0.5	9	0
Plimpton Creek	2.9	42	0
Seymour Creek	0.7	0	1
Steel Creek	2.7	71	0
Steel Creek Side Channel	0.8	7	0
Swamp Creek	3.0	4	0
Total	**17.6**	**166**	**57**

Table 8. Estimates of N_b for Arctic grayling from the Big Hole River. 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	N_b	LCI	UCI
2007	50	107.1	76.2	171.7
2008	30	77.2	47.6	175.7
2009	128	96.4	83.9	111.9
2010	46	92.4	66.1	146
2011	66	81.9	64.5	108.9
2012	56	289	142.8	5050.9
2013	49	432.7	171.7	∞
2014	88	268.4	166.8	614.1
2015	56	181.9	109.2	465.5
2016	51	96.1	68	155.3
2017	63	155.4	103.3	289.7
2018	128	187.3	149.1	246.5
2019	145	452.1	304.5	830.7
2020	119	225.9	181.8	293.6
2021	119	185.5	154.5	229.1
2022	144	144.7	127.4	166.0
2023	137	187.3	159.3	224.7
2024	123	189.3	157.9	233.6
2025	146	171.8	149.2	200.9

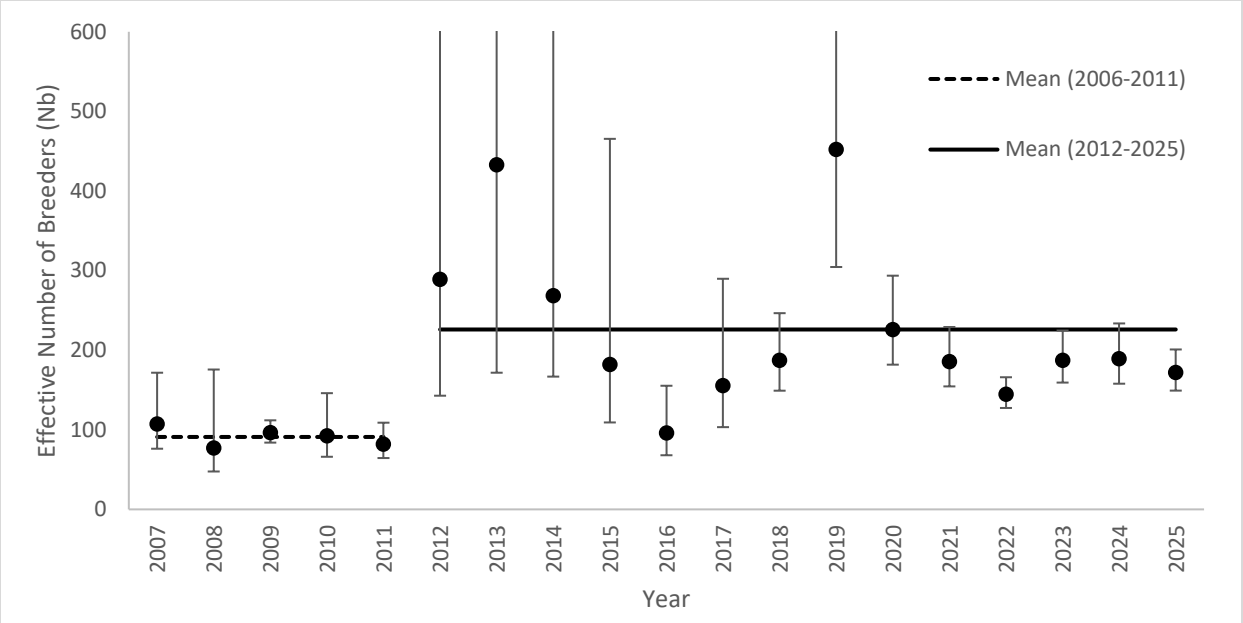

Figure 4. Estimates of the number of effective breeders (N_b) in Arctic grayling from the Big Hole River over time. Error bars indicate 95% confidence intervals.

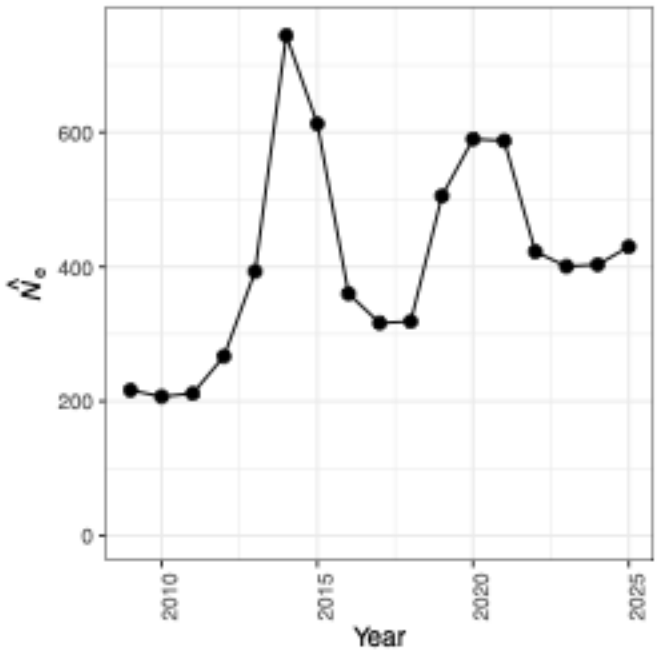

Figure 5. The three-year harmonic mean of the genetic effective population size (N_e) in Arctic grayling from the Big Hole River. Biologically, the three-year harmonic mean is, in essence, the generational N_e for each year.

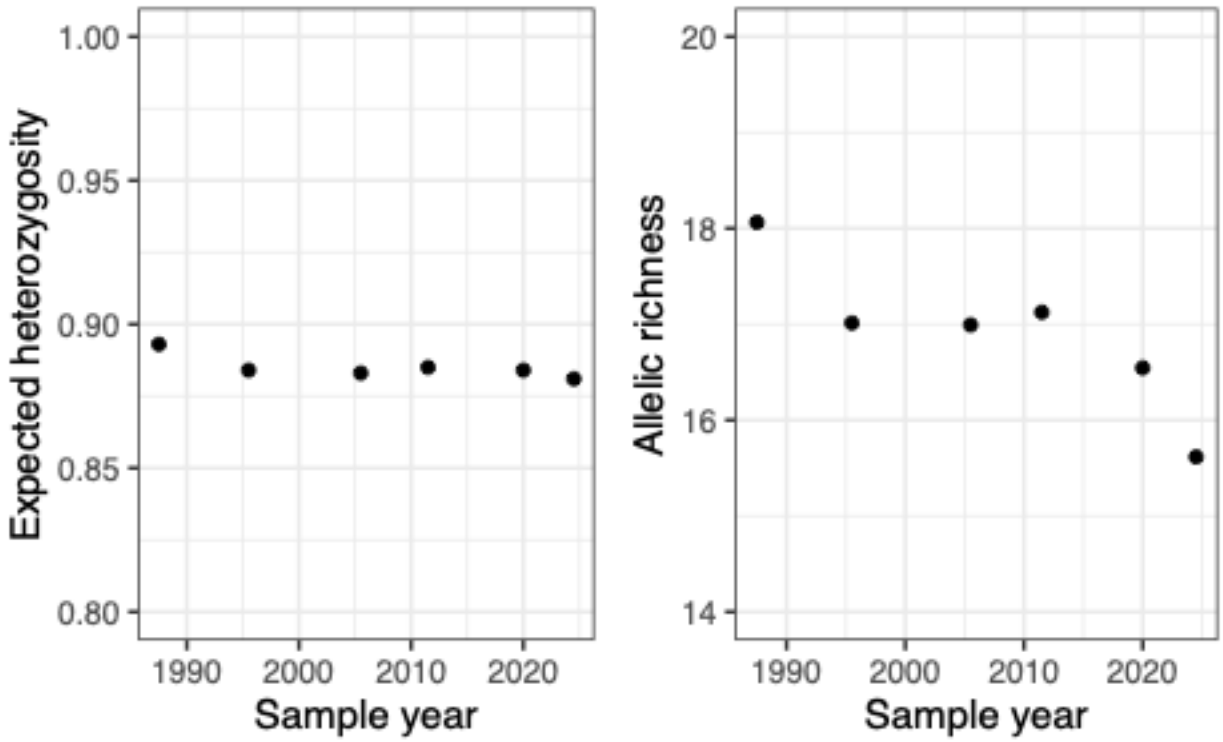

Figure 6. Temporal trends in measures of genetic variation for Arctic grayling in the Big Hole River.

B. Stream Temperature Monitoring

In 2025, stream temperature data were collected from May 1st to October 1st at 29 sites within the Big Hole drainage (Figure 7). Monitoring was conducted at 6 sites on the Big Hole River (including the North Fork of the Big Hole) and at 23 significant tributary sites. Stream temperature data loggers deployed in McVey Creek, Pintler Creek, and a side channel of Pintler Creek were determined to be unusable because the devices were either lost or exposed to ambient air temperatures for a majority of the monitoring period. Data for the Dickie Bridge and Saginaw Bridge monitoring sites were obtained from USGS real-time discharge monitoring stations.

During the five-month monitoring period, temperature data were recorded hourly by the logging devices (thermographs). 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 9). 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 approximate stress and lethal limits for Arctic grayling.

Table 9. 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)
Big Hole River Dickie Bridge	14.6 (58.2)	24.3 (75.8)	39	5.13	0	0.00
Big Hole River Miner Confluence	13.8 (56.9)	23.1 (73.5)	22	3.09	0	0.00
Big Hole River Miner Lakes Rd	12.7 (54.9)	21.6 (70.8)	2	2.50	0	0.00
Big Hole River Mudd Creek Bridge	15.9 (60.5)	25.7 (78.2)	50	6.36	3	3.00
Big Hole River Saginaw Bridge	11.1 (51.9)	20.6 (69.0)	0	0.00	0	0.00
Big Hole River Christiansen Side Channel	13.9 (56.9)	20.7 (69.3)	0	0.00	0	0.00
Big Hole River Wisdom	15.0 (59.0)	24.3 (75.7)	45	4.76	0	0.00
Big Lake Creek	14.1 (57.4)	24.4 (75.9)	32	4.75	0	0.00
Deep Creek	13.5 (56.4)	23.9 (75.0)	33	3.94	0	0.00
Fishtrap Creek	11.9 (53.4)	20.6 (69.1)	0	0.00	0	0.00
French Creek Lower	13.7 (56.6)	23.2 (73.8)	26	3.92	0	0.00
French Creek Upper	13.5 (56.3)	24.4 (76.0)	41	4.39	0	0.00
Governor Creek	12.6 (54.6)	22.7 (72.9)	4	3.25	0	0.00
Howell Creek	13.5 (56.3)	23.0 (73.4)	14	3.29	0	0.00
LaMarche Creek	11.0 (51.8)	20.3 (68.5)	0	0.00	0	0.00
McVey Lower	n/a	n/a	n/a	n/a	n/a	n/a
McVey Upper	n/a	n/a	n/a	n/a	n/a	n/a
North Fork BHR LNF Rd	14.8 (58.7)	24.4 (75.8)	34	4.88	0	0.00
North Fork BHR Upper	14.2 (57.6)	24.2 (75.5)	26	4.62	0	0.00
Pintler Creek Mouth	n/a	n/a	n/a	n/a	n/a	n/a
Pintler Grayling Side Channel	n/a	n/a	n/a	n/a	n/a	n/a
Plimpton Creek LNF Rd	14.7 (58.5)	24.1 (75.3)	24	4.58	0	0.00
Rock Creek	13.7 (56.7)	21.8 (71.2)	5	2.80	0	0.00

Seymour Creek	11.7 (53.1)	21.4 (70.5)	4	2.50	0	0.00
Steel Creek 1	15.1 (59.3)	25.5 (77.9)	43	5.88	2	3
Steel Creek 2	14.9 (58.8)	25.6 (78.0)	41	5.51	1	3.00
Steel Creek 3	12.5 (54.5)	20.5 (68.9)	0	0.00	0	0.00
Steel Creek 4	10.0 (49.9)	16.6 (61.8)	0	0.00	0	0.00
Swamp Creek	14.4 (58.0)	22.9 (73.2)	21	3.95	0	0.00

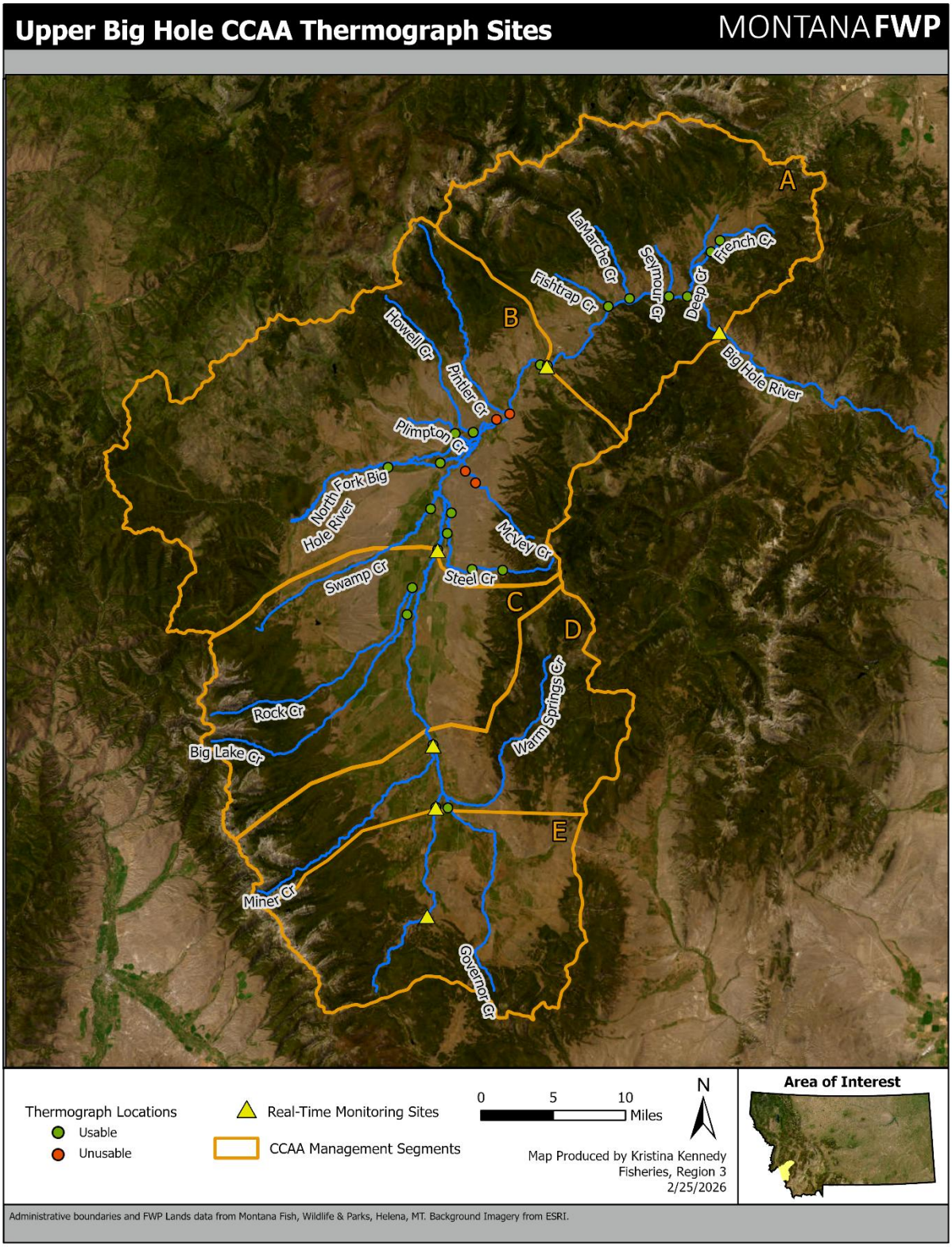

Figure 7. Stream temperature (green circle) and stream discharge (yellow triangle) monitoring sites in the Big Hole Arctic Grayling CCAA Project Area.

C. Streamflow Monitoring

Along with two USGS real-time streamflow gages located at management segments C and D, DNRC continued to operate and maintain four real-time streamflow gages located at the upper project boundary and at management segments A, B, and E (Figure 1) as part of a Furnished Record Policy with the USGS. Ownership of the Furnished Record gages was transferred to DNRC on July 1st, 2021. DNRC continues to operate and maintain these four gages in a real-time capacity. In addition, DNRC continuously monitored flow in 11 tributaries with at least one tributary within each management segment and three key irrigation ditches.

Snowpack and precipitation data were monitored by NRCS (available at NWCC iMap (usda.gov)), and results are based on the period-of-record (1991–2020).

In 2025, the Big Hole basin snowpack peaked at 96% of median values on April 5th. Above average temperatures and below average precipitation in May and June receded snowpack until diminished in mid-June, roughly 3 weeks earlier than median melt out for the Big Hole Basin. Total precipitation in the Big Hole basin averaged 89% of median values throughout water year 2025. Air temperatures in the Big Hole were average or above average throughout the summer.

The CCAA program implemented the CCAA Drought Flow Plan in 2025 (Appendix A). Big Hole Arctic Grayling CCAA stream discharge targets (in all reaches with both spring and summer target thresholds) were met 51% of the time in 2025 (Figures 8-13). Spring targets in combined reaches A-C were met 87% of the time in 2025.

The CCAA team coordinated with landowners in reaches A-C. Under the Drought Flow Plan, CCAA reaches A-C are combined with a single flow target at the bottom of reach C (Wisdom Bridge USGS gage) and the spring target is lowered from 160 CFS to 60 CFS. These changes engaged conservation from enrolled landowners in Reaches A, B and C to avoid shortfalls from non-enrollees and natural losses in losing reaches of the Big Hole River. The changes were implemented to allow landowners to have adequate irrigation flow during critical growing periods while maintaining minimum short-term habitat needs of Arctic grayling. In addition, the 60 CFS target provided more flexibility for irrigators to coordinate timing and amounts of diverted flow and move water more effectively between reaches. The agencies notified and coordinated with landowners with current conditions and water conservation in person, through phone calls, and emails. The agencies coordinated with larger irrigators on potential opportunities to “swap” water to avoid large withdrawals simultaneously from the river. Following July 1st, the flow target remained at the initial 60 CFS at Wisdom until October 31st.

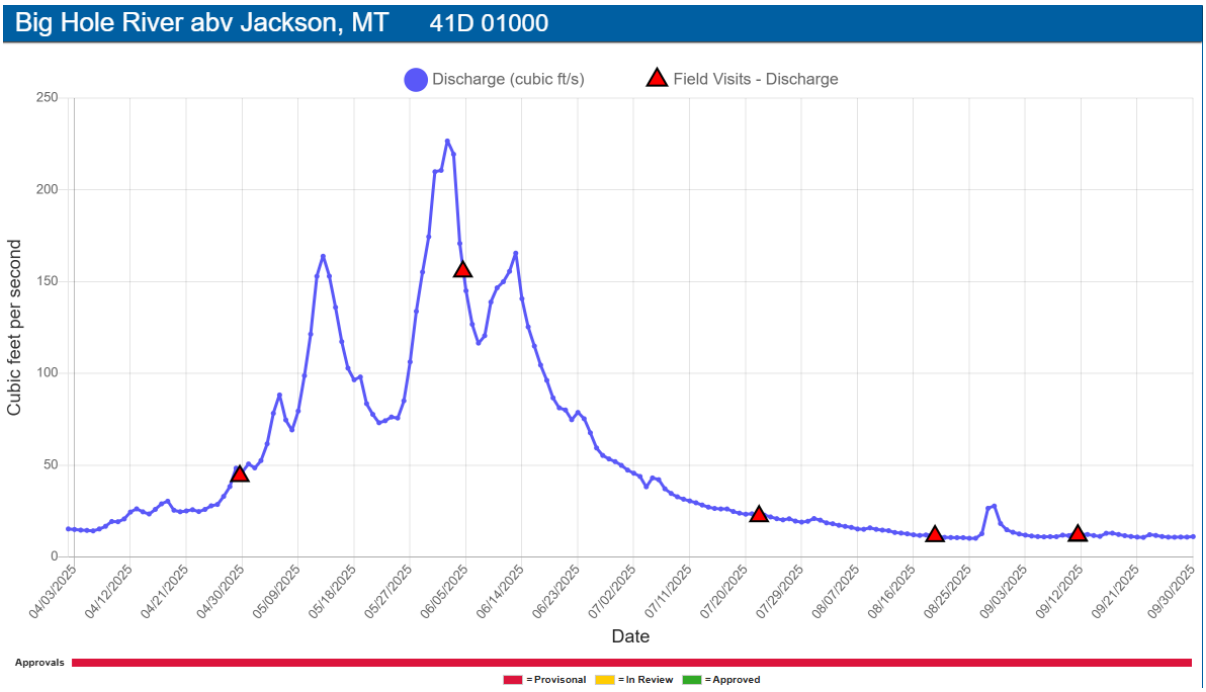

Figure 8. 2025 DNRC stream discharge data collected from the Big Hole River at the real-time gaging station located at the upper Big Hole Arctic Grayling CCAA project area boundary (Saginaw Bridge).

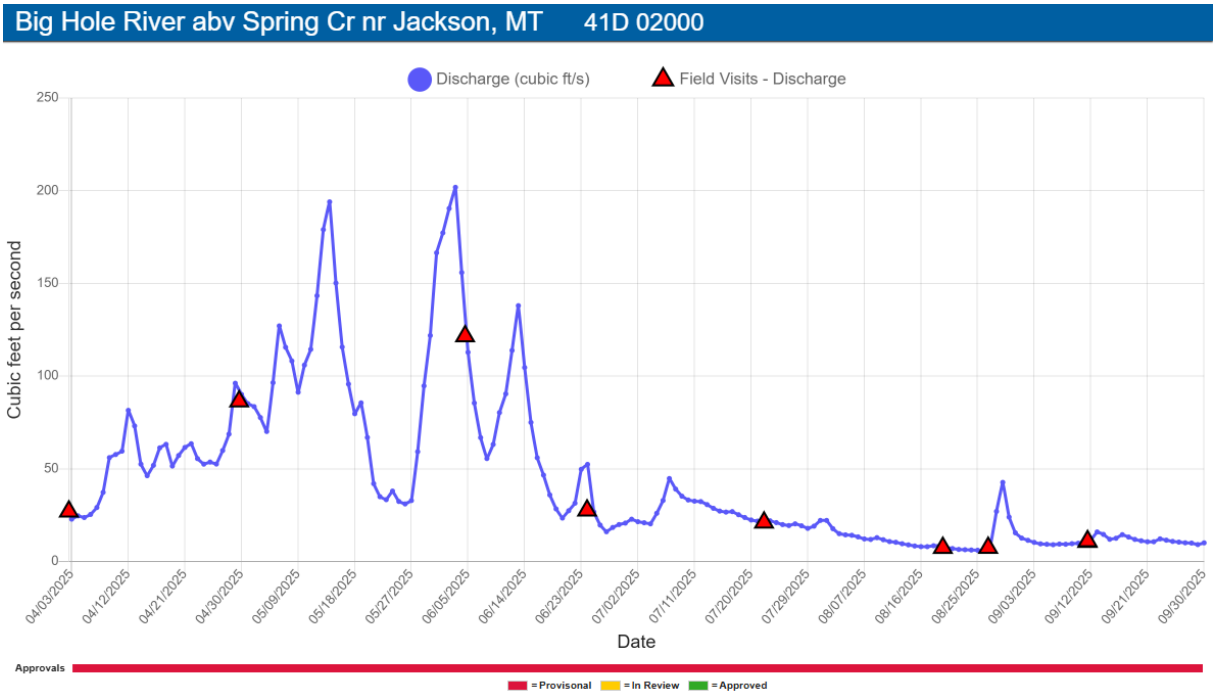

Figure 9. 2025 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach A boundary (Miner Lakes Road).

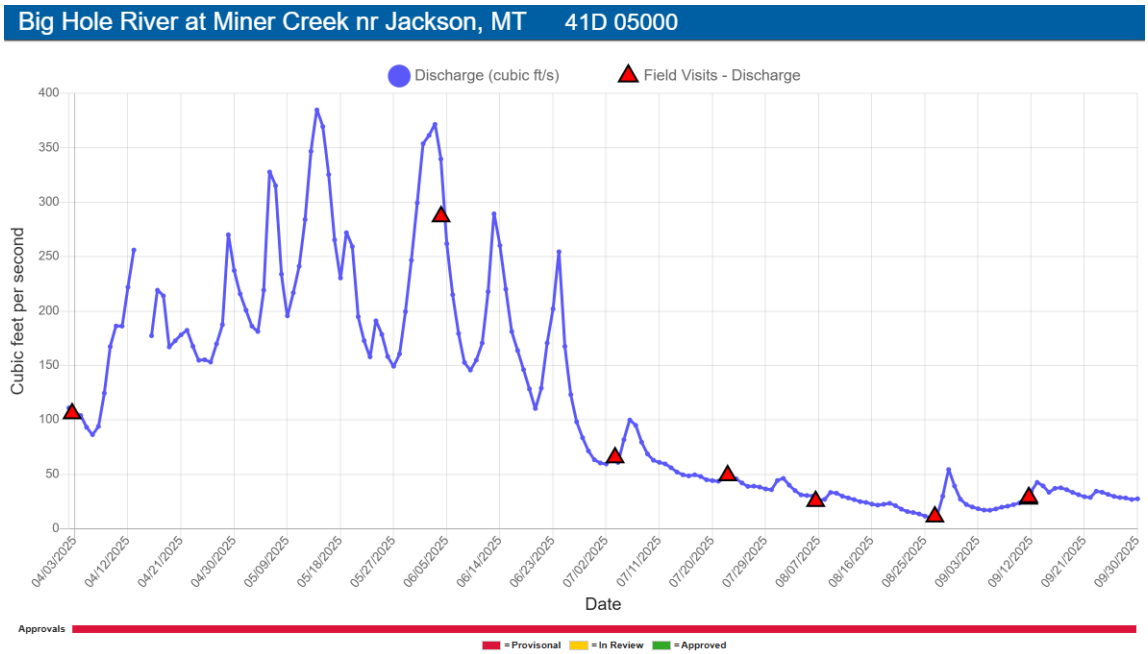

Figure 10. 2025 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach B boundary (confluence with Miner Creek).

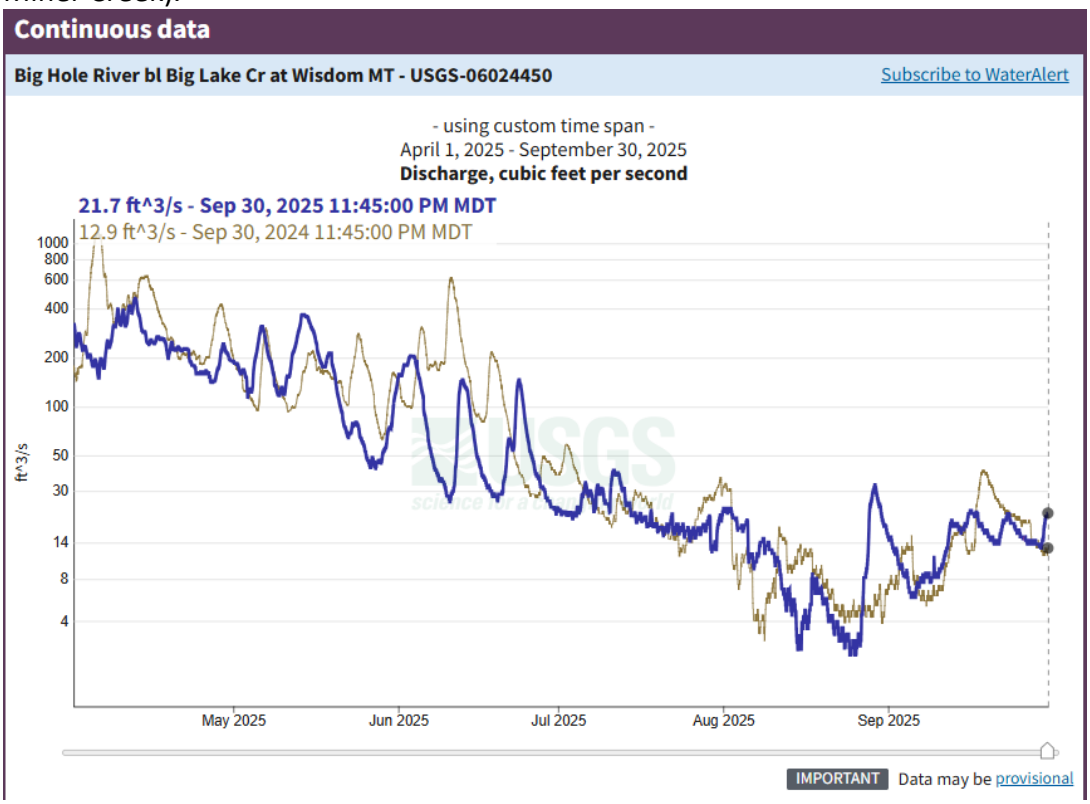

Figure 11. 2025 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach C boundary (Wisdom Bridge).

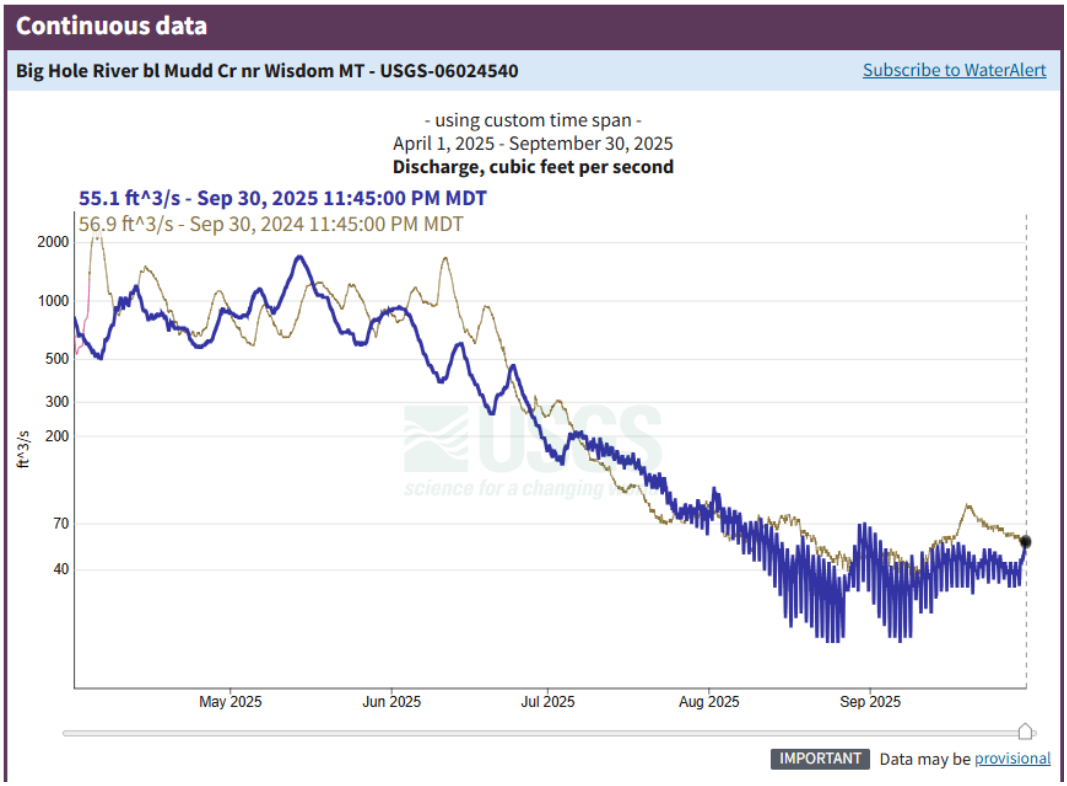

Figure 12. 2025 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach D boundary (Mudd Creek Bridge).

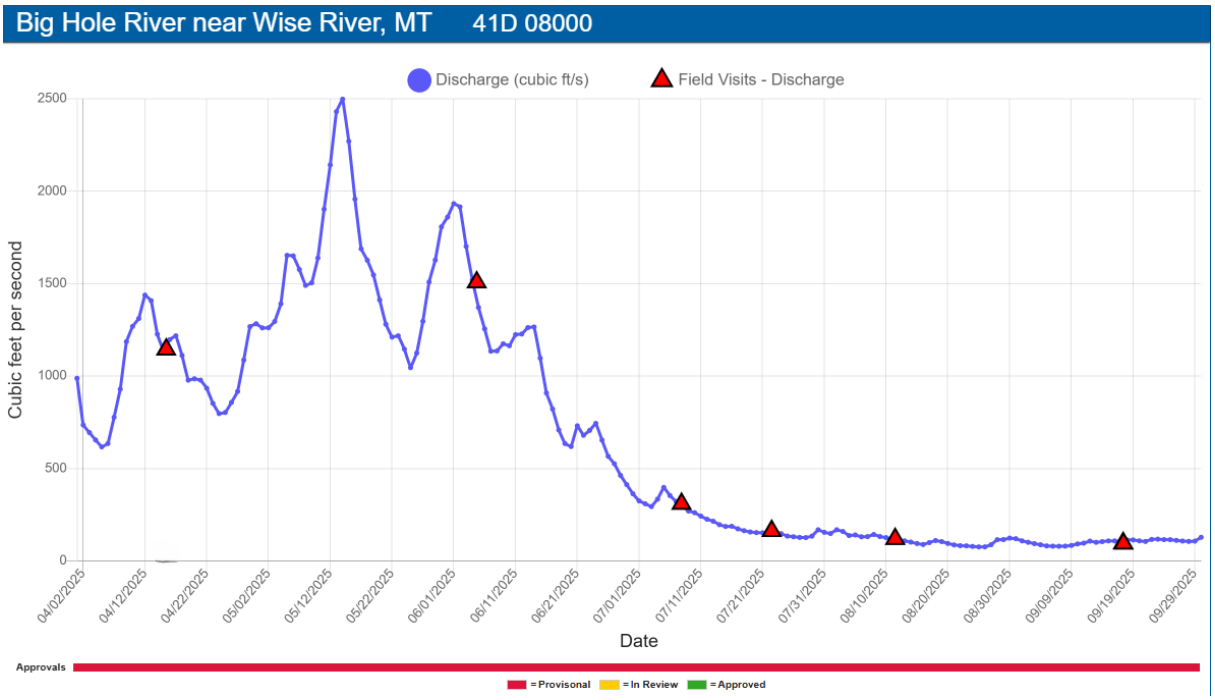

Figure 13. 2025 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach E boundary (Dickie Bridge).

D. FWP Monitoring of Compliance with Approved Site-Specific Plans

The monitoring of compliance with approved SSPs has occurred annually on the following Properties: 1 –2, 4, 6 – 18, and 20-30. All landowners with approved SSPs followed their plan in 2025, except for Property 3, which was attributed to new ownership and did not have an approved SSP for 2025. DNRC and FWP field personnel checked the amount of water being diverted by the landowners, the trend of riparian areas under a grazing or riparian management plan, the ability of fish to access fish passage structures and for any evidence of immediate threats of harm or mortality to on the enrolled properties. The initial compliance meetings focus on expectations for monitoring the riparian management and irrigation diversion agreements in the approved SSP.

VIII. Summary of Estimated Take Associated with the Big Hole 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 the Big Hole Arctic grayling in 2025.

IX. NRCS Special Funding

In 2022, the NRCS secured funding a permanent technician position in cooperation with FWP and DNRC until at least 9/30/2027. The position is managed by FWP to assist with CCAA irrigation compliance and riparian monitoring. This position was hired in June of 2022, rehired in April 2024, and rehired again in December of 2025. The technician position will remain filled through the duration of the grant. In addition, NRCS will continue to pursue and meet the obligations of existing EQIP contracts with enrolled landowners in 2026, develop and implement stock water TIP proposals for Wisdom Reach and Wisdom Extension Reach landowners.

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Appendix A: 2025 Big Hole Arctic Grayling CCAA Drought Flow Plan Implementation
May 5th, 2025

Luke Lutz-Montana Department of Natural Resources and Conservation

The CCAA Team propose to utilize the flexibility outlined in Section XIV "Changed and Unforeseen Circumstances" of the CCAA through a modified flow strategy based on the irrigation needs of the enrolled landowners and the biological needs of Arctic grayling in the upper reaches of the Big Hole River and its tributaries. This modified strategy is based on extreme drought conditions, **is not meant to be a long-term strategy**, and is consistent with Section XIV "Changed and Unforeseen Circumstances" of the CCAA.

The CCAA Team will utilize the temporary interim flow management plan in the event of unimproved conditions. This flow management plan was first utilized during the summer of 2024. A combination of criteria was considered to determine whether implementation is appropriate, although all criteria do not need to be satisfied for implementation. The decision to implement the temporary interim flow management plan is decided annually on May 1st.

Implementation criteria are as follows:

- <80% Average Snow-water equivalent (SWE) for the Water Year
- <80% Average snowpack for valley floor to mid-elevations
- <80% Average snowpack for high elevations
- <80% Average Precipitation for the Water Year
- Higher than average air temperatures before May 1.
- Peak spring runoff starting earlier than May 1. Average peak is ~June 1.
- Climate forecast for May and June with less than average precipitation predictions.

Continued drought will stress available resources and reliance on irrigation withdrawals to irrigate pastures for forage shortfalls on summer grazing lands. This compounding effect of the drought will potentially have large ramifications for landowners to successfully navigate and avoid substantial economic losses (e.g., purchasing hay, lower weaning weights). To balance the economic needs of the enrolled CCAA landowners and the biological needs of Arctic grayling, the CCAA team developed the following drought-based instream flow strategy in response to the exceptional drought conditions in 2021 and first implemented it in 2024.

Current and Historic Conditions

Drought Plan implementation was decided on May 1st, 2025. Persistent drought conditions were prevalent throughout the majority of the Big Hole River Watershed in 2025. The NOAA National Weather Service U.S. Seasonal Drought Outlook for the Big Hole River Watershed was predicting persistent drought tendencies through August of 2025 (Figure 1). UMRD Drought Indicators Dashboard predicted a 30-day Standardized Precipitation Index (SPI) range of D1-D3 drought persistence for much of the surrounding higher elevation basin conditions within the

Big Hole Watershed (Figure 2) as of May 1st, 2025. Snow Water Equivalent (SWE) was 75% of average and Precipitation is 87% of average on May 5th, 2025 (Figure 3). Peak SWE for 2025 occurred on April 4th, which is two weeks earlier than median conditions. Only a few of the drought implementation criteria were met, however climate forecasts looked unforgiving for the for the season and 2025 trends had similarities to 2021 (Figures 4 & 5). The CCAA team ultimately decided to enact the drought plan again in 2025 due to the following rationale:

- SWE is at or near implementation criteria.
- Seasonal temperature and precipitation outlooks look were not likely to improve or maintain conditions.
- Conditions during summer and fall in 2024 did not provide adequate precipitation to recharge and restore soil moisture levels.
- Current conditions and trends were similar to prior drought years (2021).
- The Arctic grayling population showed a positive response to implementation of the drought plan in 2024, despite warm, dry conditions that year.

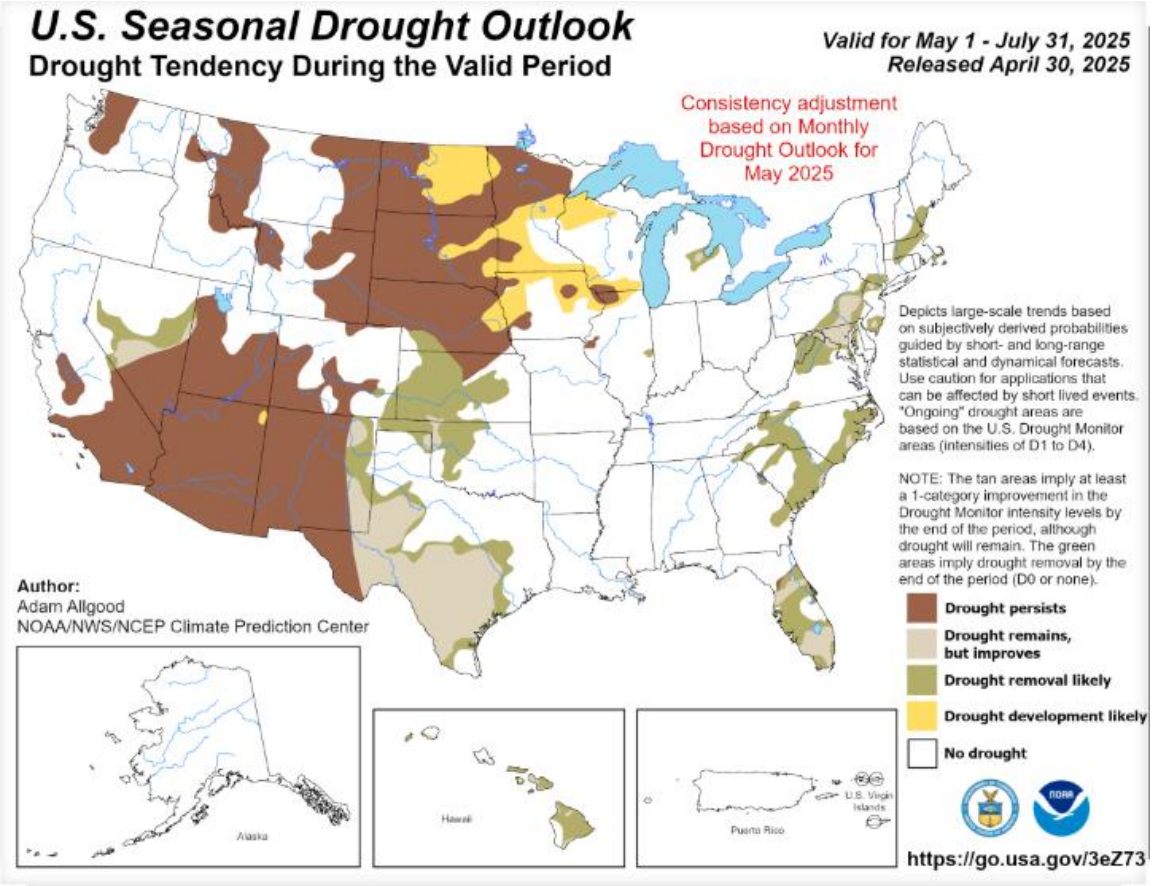

Figure 1. NOAA National Weather Service Climate Prediction Center Seasonal Drought Outlook.

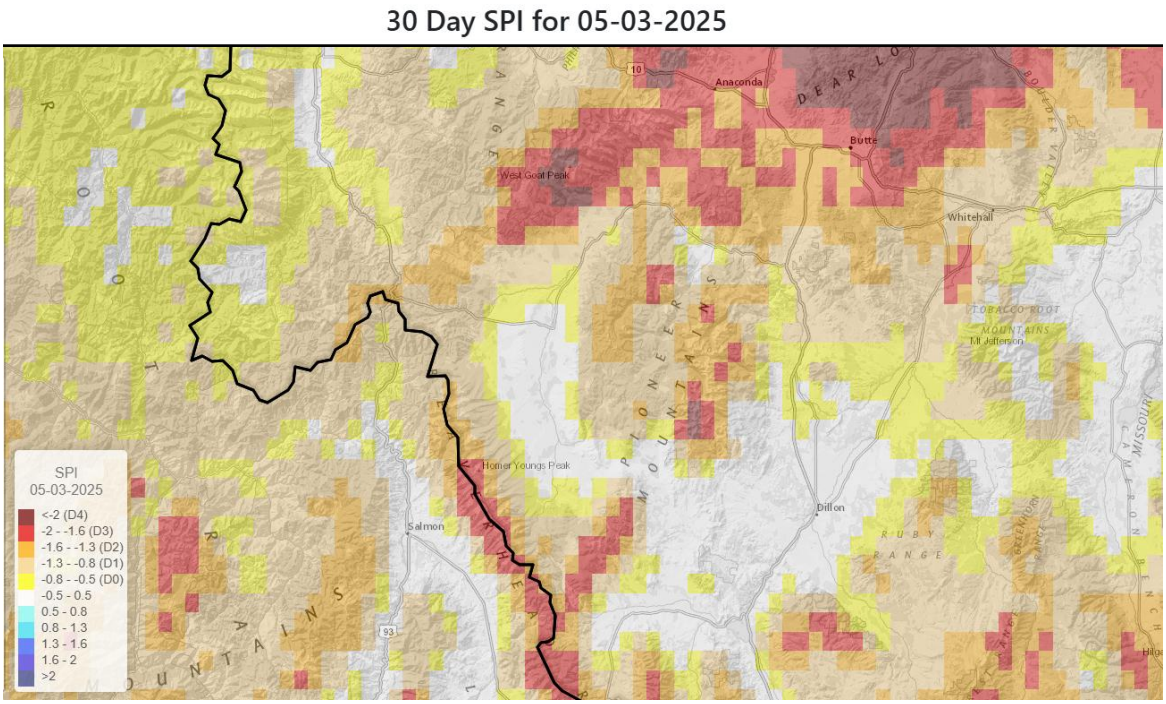

Figure 2. Montana Climate Office UMRB Drought Indicators Dashboard 30 Day SPI.

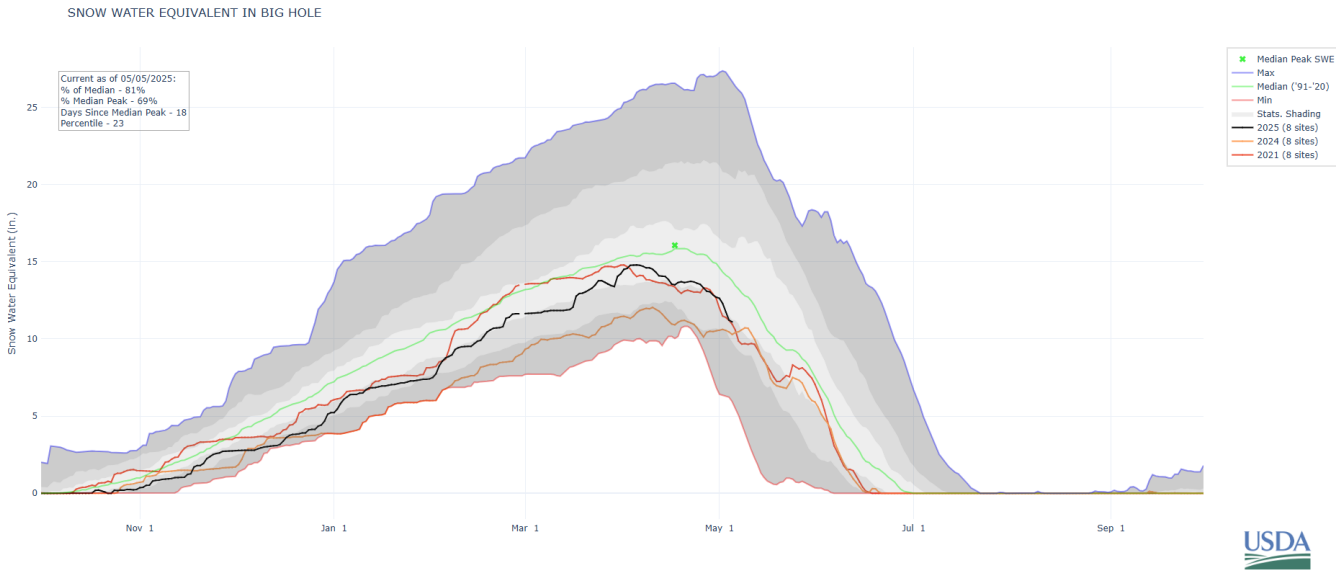

Figure 3. NRCS Snow Water Equivalent in Big Hole River Watershed. Black line shows 2025 conditions, green line is median conditions, orange line is 2024 conditions, red is 2021 conditions.

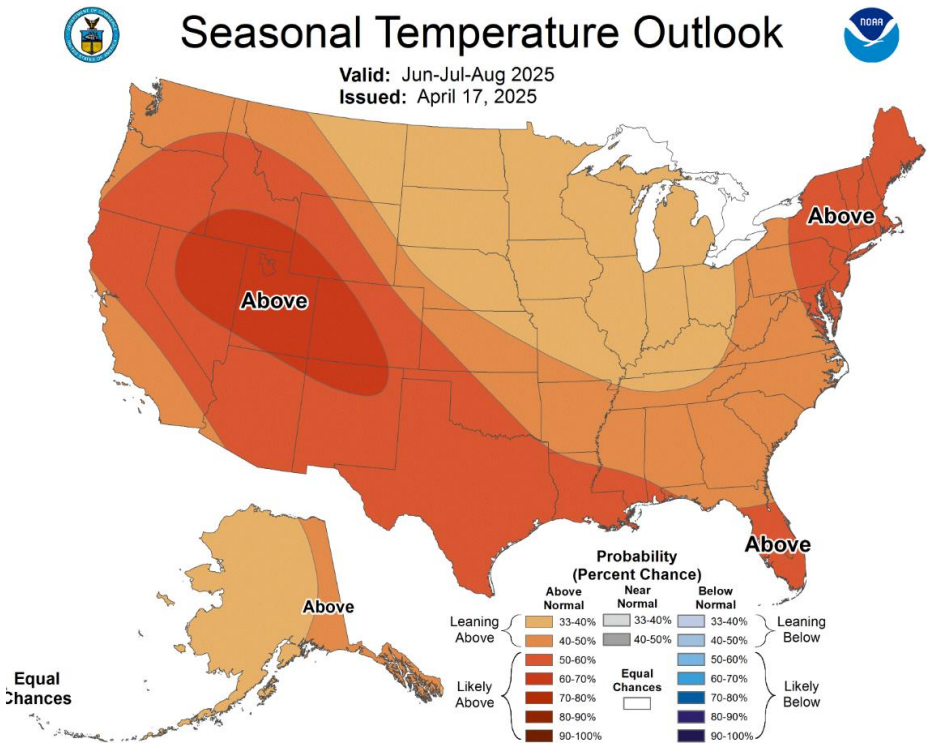

Figure 4. NOAA Climate Prediction Seasonal Temperature Outlook June – August 2025.

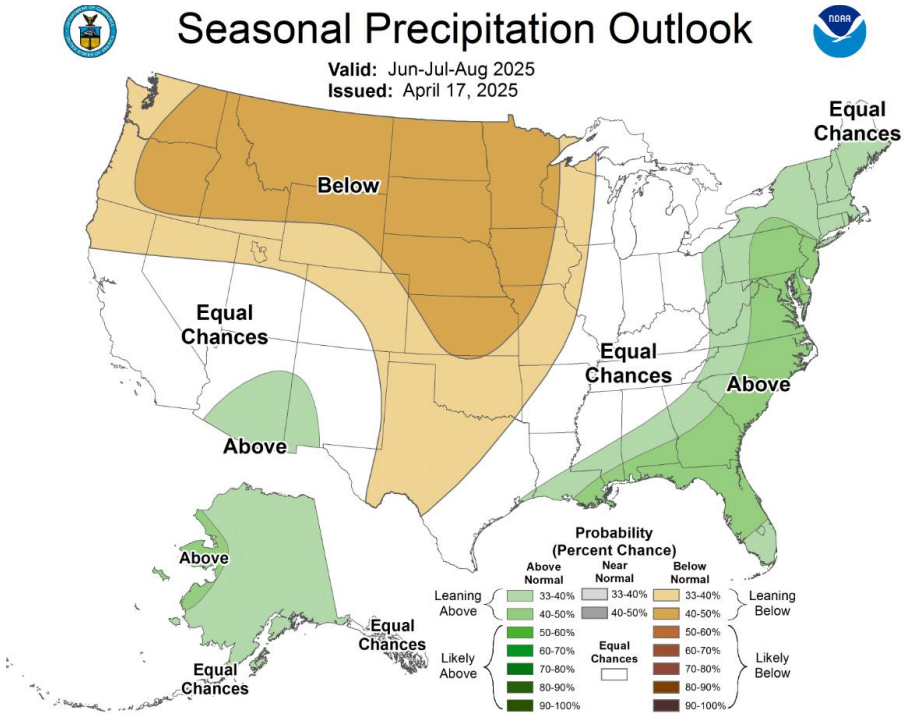

Figure 5. NOAA Climate Prediction Precipitation Outlook for June-August 2025.

Table 1. Drought flow plan spring flow targets (May 1st to June 30th). Changes from regular flow plan include combing Reaches A, B, and C to one Flow Target of 60 CFS at Wisdom Bridge.

Reach	Spring Target	Location	Drought Plan Target	Location
A	60 CFS	Miner Lakes Road 41D 0200	60 CFS	Wisdom Bridge
B	100 CFS	Below the mouth of Miner Creek (Hirschy Bridge) 41D 0500	60 CFS	Wisdom Bridge
C	160 CFS	Wisdom Bridge 06024450	60 CFS	Wisdom Bridge

Table 2. Drought flow plan summer flow targets (July 1st to October 31st). Changes from regular flow plan include combing Reaches A, B, and C to one Flow Target of 60 CFS at Wisdom Bridge.

Reach	Summer Target	Location	Drought Plan Target	Location
A	20 CFS	Miner Lakes Road 41D 0200	60 CFS	Wisdom Bridge
B	40 CFS	Below the mouth of Miner Creek (Hirschy Bridge) 41D 0500	60 CFS	Wisdom Bridge
C	60 CFS	Wisdom Bridge 06024450	60 CFS	Wisdom Bridge

The CCAA Team agreed to maintain the lower inflection point (minimum wetted "P" or perimeter), which is 60 CFS at the Wisdom Bridge during the May 1st to July 1st flow period by focusing efforts on maintaining the habitat most essential to grayling during exceptional drought. This flow will provide adequate habitat for Arctic grayling spawning and rearing within the mainstem Big Hole River and will allow access to important spawning and refugia tributaries. Reaches D and E are excluded from this modified flow plan due to higher inflows and lower irrigation outflows that do not significantly affect spring targets. For example, in 2021, conditions were met 89% of the time in reaches D and E, but only 38% of the time in

reaches A-C. Reaches D and E will remain under normal flow target conditions for spring and summer with the drought plan implementation.

To maintain 60 CFS at the Wisdom Bridge the Drought Flow Plan combines reaches A, B and C to the one spring Target of 60 CFS at Wisdom Bridge (Table 1). These changes will engage enrolled landowners in reaches A, B and C to avoid shortfalls from non-enrollees and natural losses in losing reaches of the Big Hole River. The changes will provide landowners with adequate irrigation flow during critical growing periods while maintaining minimum short-term habitat needs of grayling. In addition, the 60 CFS target will provide more flexibility for irrigators to coordinate timing and amounts of diverted flow and move water more effectively between reaches. The agencies will notify landowners on a weekly basis of flow, precipitation and temperature conditions through phone calls and emails and coordinate with larger irrigators on potential opportunities to "swap" water to avoid large withdrawals simultaneously from the river. Following July 1st, the target will be to maintain the initial 60 CFS at Wisdom Bridge (Table 2); the Agencies will maintain the most available flow to Wisdom possible with the site-specific flow plan agreements in place for landowners upstream of Wisdom.

Table 3: Drought Year Conditions on May 1st, 2025.

Year	SWE May 1 (average %)	Precipitation May 1 (average %)	Flow Targets Met (average %)
2021	74%	85%	38%
2024	69%	75%	54%
2025-Current	80%	87%	N/A

Arctic Grayling Response

In 2021, flow targets were met approximately 38% of the time. Poor snowpack and below average precipitation in combination with irrigation withdrawals from non-enrolled landowners limited instream flows in the Big Hole River and its tributaries. However, instream flow conservation efforts specified in the landowner Site-Specific Plans were sufficient to provide adequate habitat for Arctic grayling spawning and rearing. The 2021 estimates of the number of effective breeders (Nb) slightly declined from 2020, however, the Nb and direct observation of young-of-year (YOY) Arctic grayling indicated successful spawning and recruitment despite the poor flow conditions. Arctic grayling recruitment in 2021 can be attributed to improved habitat quality and connectivity to thermal refugia over the last 15 years throughout the CCAA program. Based on the observed Arctic grayling recruitment in 2021 and during subsequent years, it is evident Arctic grayling can persist under periodic exceptional drought conditions.

In 2022, lower than average numbers of Arctic grayling were captured in most tributaries. Beaver dams were abundant after several years of lower-magnitude spring run-off which likely impacted Artic grayling access to a majority of spawning habitat. In several important streams,

distribution of YOY Arctic grayling was limited to 10-46% of the normally available habitat. As a result, beaver dams were notched on four streams and available habitat for spawning was increased by over four miles in 2023. In fall 2023, numbers of Arctic grayling captured in three of these streams was near or above long-term averages and distribution of fish was greater.

In 2024, the CCAA implemented the Drought Flow Plan for the first time and access to spawning habitat was again maintained through beaver dam notching. The flow targets for the combined reaches (A-C), D, and E were met approximately 54% of the time in 2024. Arctic grayling sampling in the fall of 2024 showed another slight increase in the Nb estimate from 2023.