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

2021 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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Table of Contents

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.

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 2021 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.

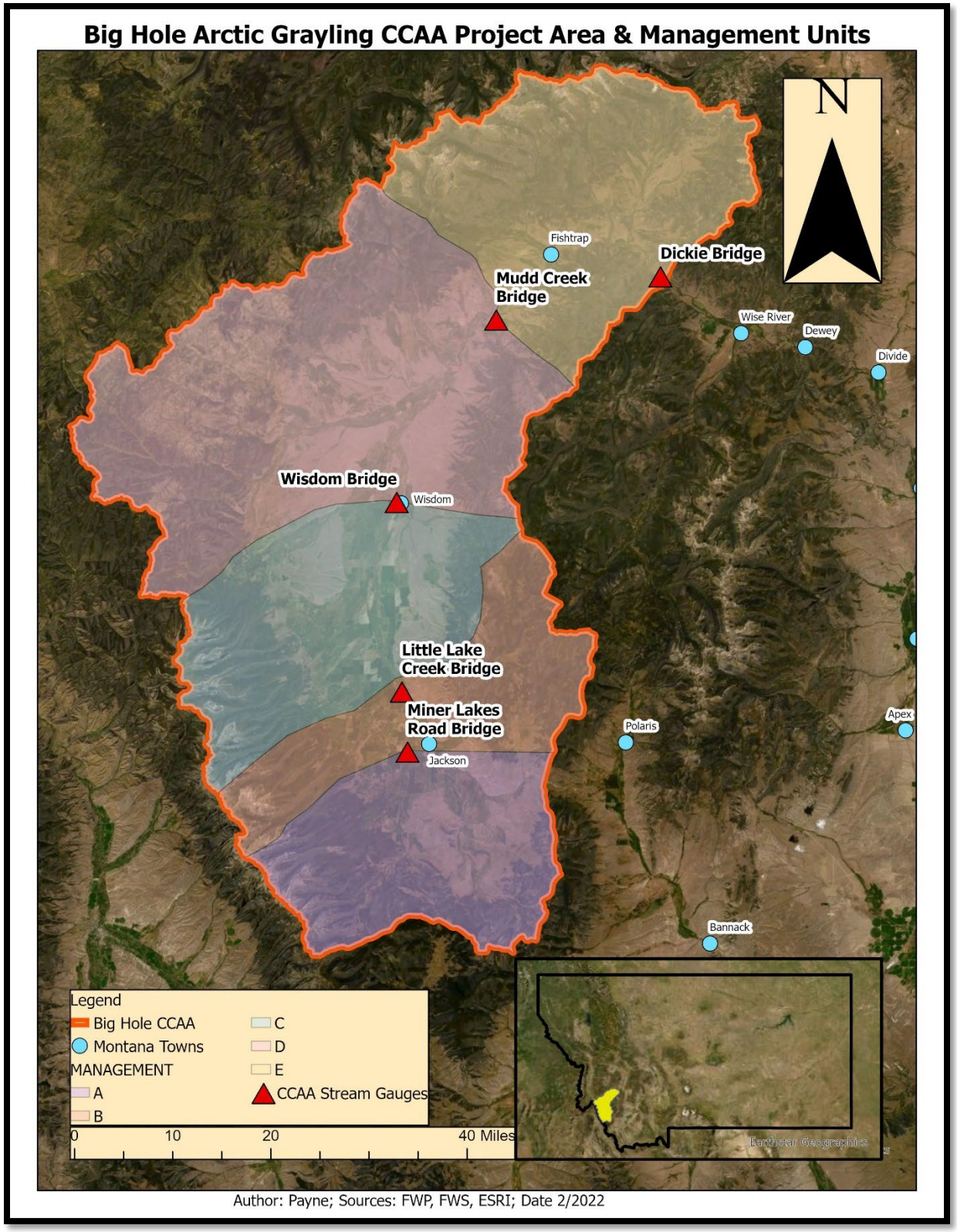

Figure 1. The Big Hole Arctic Grayling CCAA Project Area & Management Segments.

II. Legal Status of Montana Arctic Grayling

On July 23rd, 2020, the USFWS announced that the Upper Missouri River Distinct Population Segment (DPS) of the Arctic Grayling did not warrant protection under the Endangered Species Act (ESA). 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).

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 once the non-federal landowner, FWP, and the USFWS countersign the Certificate of Inclusion and the approved SSP for the enrolled property, if Arctic grayling become listed under the ESA. Currently, there are 32 landowners (Participating Landowners) that have enrolled 161,188 acres of private and 5,590 acres of DNRC leased land into the Big Hole Arctic Grayling CCAA (Figure 2). 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.

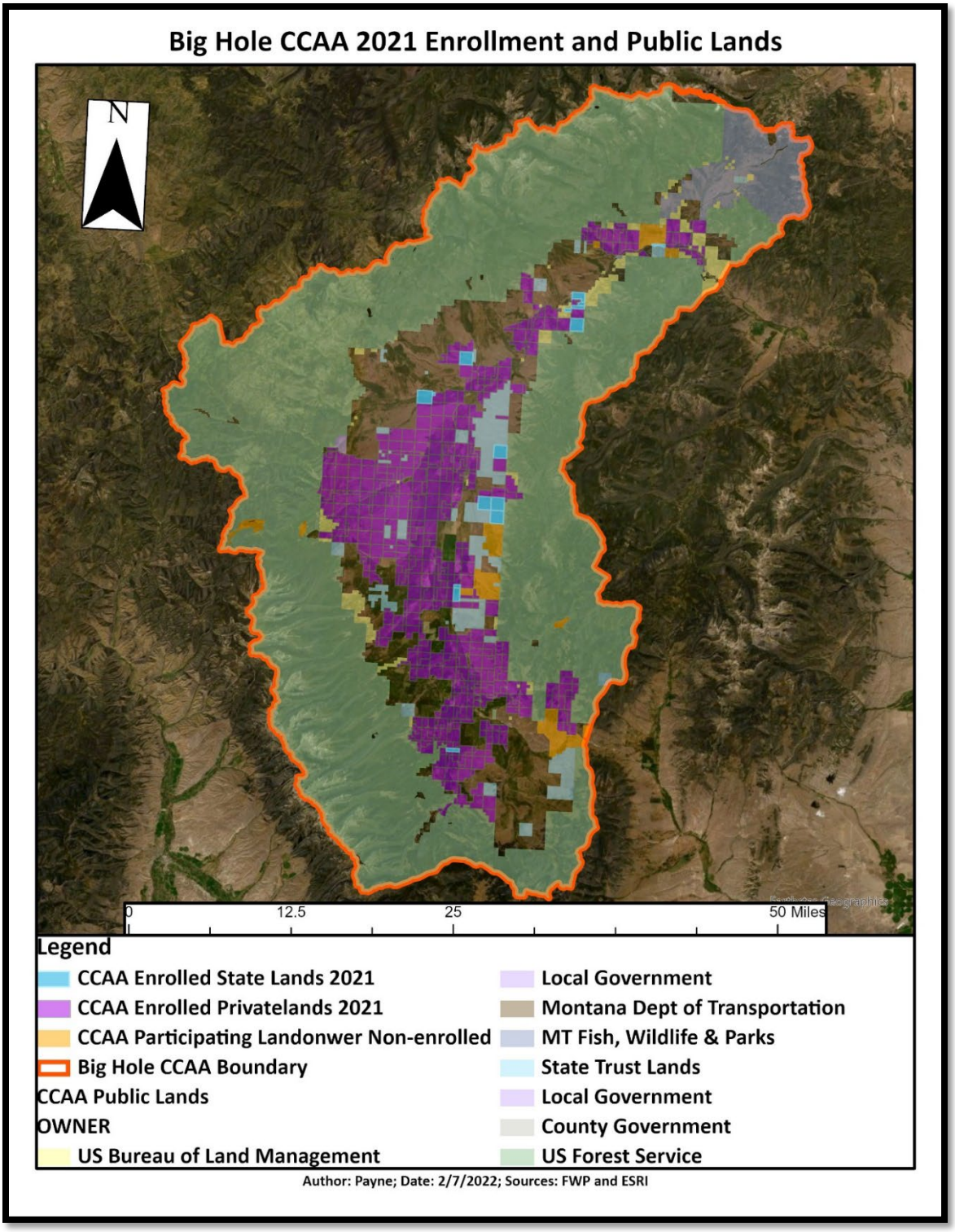

Figure 2. December 31st, 2021, Big Hole Arctic Grayling CCAA Program of private and state land enrolled. Enrolled land includes 32 private landowners and 161,188 private acres and 5,590 acres of DNRC leased lands.

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

All surveys for immediate threats to Arctic Grayling have been conducted on 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 – 12, and 14 – 29. These efforts, completed by DNRC and FWP, included site visits on 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. Also, continuous stage recorders installed in the Spokane, Strowbridge, Ferris, Miller, Huntley, and Montgomery ditches provided flow information for water rights compliance, instream flow conservation projects, and ongoing development of the SSPs. During 2021, 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 the two 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. In addition, DNRC continuously monitored flow in at least one tributary within each Management Segment and six key irrigation ditches.

Table 1. 2021 Irrigation Meeting and Compliance Monitoring.

Property #	2021	
	Compliance Checks Completed	Irrigation Meeting
1	Yes	Yes
2	Yes	Yes
3	Yes	No*
4	Yes	Yes
5	Yes	Yes**
6	Yes	Yes
7	Yes	Yes
8	Yes	Yes
9	Yes	Yes
10	Yes	Yes
11	Yes	Yes
12	Yes	Yes
13	Yes	Yes**
14	Yes	Yes
15	Yes	Yes
16	Yes	yes
17	Yes	yes
18	Yes	Yes
19	Yes	Yes
20	Yes	No*
21	Yes	Yes
22	Yes	Yes
23	Yes	Yes
24	Yes	Yes
25	Yes	Yes
26	Yes	Yes
27	Yes	Yes
28	Yes	Yes
29	Yes	Yes
30	No*	Yes
31	No*	No*
* 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 30 SSPs are being implemented in the Big Hole CCAA program (Table 2). Six SSPs will undergo the 10-year or new ownership updates in 2022. 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. One new property was enrolled in 2021. The associated SSP is being developed; however, conservation efforts are being implemented pending its adoption.

B. Extension Requests Approved by the USFWS

FWP did not submit approval for extensions to complete SSPs in 2021. 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	25,180	0	SSP Completed	2024
2	A	6,327	0	SSP Completed	2029
3	A & B	2,931	0	SSP Completed	2026
4	D and C	2,265	0	SSP Completed	2025
5	D	2,514	640	SSP Completed	2025
6	B and C	2493	0	SSP Completed	2030
7	B	6,975	0	SSP Completed	2030
8	E	2,759	0	SSP in Draft	2032
9	E	1211	70	SSP Completed	2026
10	C	2951	0	SSP in Draft	2032
11	C & D	23,458	560	SSP Completed	2022
12	C & D	2,684	2,240	SSP Completed	2023
13	D	1,118	0	SSP Completed	2024
14	C	209	0	SSP Completed	2022
15	B & C	3,831	0	SSP Completed	2023
16	C	4,487	0	SSP Completed	2026
17	D	8,771	640	SSP Completed	2024
18	A and B	1337	0	SSP Completed	2025
19	C	1,555	0	SSP Completed	2024
20	E	818	0	SSP Completed	2025
21	A, B, C & D	24,343	0	SSP Completed	2023
22	C & D	5,010	0	SSP Completed	2023
23	D & E	6,511	1,280	SSP Completed	2025
24	D	1474	0	SSP in Draft	2032
25	A and B	4186	160	SSP in Draft	NA
26	A	887	0	SSP in Draft	NA
27	A and B	6164	0	SSP Completed	2025
28	A and B	880	0	SSP Completed	2024
29	E	1967	0	SSP Completed	2024
30	E	2473	0	SSP in Draft	2032
31	B	3419	0	SSP in Draft	2032

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 2021 are reported below.

A. Entrainment Surveys

In 2021, FWP completed 7 entrainment surveys on 3.19 miles of irrigation ditches managed by four enrolled landowners (Table 3). No grayling were collected during these surveys. 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 2021 in the upper Big Hole watershed as part of the Big Hole Grayling CCAA requirements.

Date	Source	Distance (mi.)	Number of Grayling Rescued
7/29/2021	Big Hole River	0.8	0
7/29/2021	Big Hole River	0.57	0
7/30/2021	E.F. Fishtrap Creek	0.4	0
7/30/2021	E.F. Fishtrap Creek	0.16	0
7/30/2021	E.F. Fishtrap Creek	0.42	0
7/30/2021	Fishtrap Creek	0.44	0
7/30/2021	Fishtrap Creek	0.4	0
Total		**3.19**	**0**

B. Projects to Minimize or Eliminate Entrainment of Arctic Grayling

Low channel gradients preclude using fish screens to reduce entrainment in parts of the Study Area; however, fish screens installed on La Marche and Rock creeks have successfully prevented grayling entrainment. The Agencies are developing a new fish screening system for a large ditch downstream of Wisdom that has repeatedly entrained grayling YOY, although no grayling YOY were observed in 2021 during rescue operations. This project is anticipated to be completed in the Fall of 2022. Rescue operations will continue in the ditch downstream of Wisdom until the fish screening system is installed.

C. Projects to Enhance Fish Passage

During 2021 the Agencies completed three fish passage improvement projects on two properties (Table 4).

Table 4. Upper Big Hole Watershed fish passage projects completed in 2021 as part of the Big Hole Arctic Grayling CCAA. Projects include improving or modifying irrigation diversions to provide fish passage, installing fish ladders or installing bridges.

2021		
Associated Waterbody	**Enrolled Landowner**	**Project Component**
Englejard Creek	3	Seven Fish-passage Pools
Englejard Creek	3	Bridge
Fox and Governor Creek	Non-enrolled	Fish Ladder x 2

D. Projects to Enhance Riparian and Stream Channel Habitat

During 2021 the Agencies and Participating Landowners implemented 14 riparian habitat projects to enhance stream function and riparian habitat on seven properties (Table 5).

Table 5. Upper Big Hole Watershed riparian and stream channel improvement projects completed in 2021 as part of the Big Hole Arctic Grayling CCAA. Projects include improving riparian habitat through stock water development, stream restoration, channel activation, riparian pasture fence, etc.

2021		
Associated Waterbody	**Enrolled Landowner**	**Project Component**
Big Hole River	Non-enrolled	Big Hole River Restoration
Big Hole River	11	Riparian Fencing
Big Hole River	21	River Fence Crossing
Big Hole River	17	Riparian Fence

Big Hole River	17	River Fence Crossing
Johnson Creek	Non-enrolled landowner	Riparian Fence
North Fork of Miner Creek	6	Riparian Fence
Governor Creek	18	Riparian Fence
Governor Creek	21	Spring Box Repair
Little Lake Creek	21	Spring Box Development
Big Hole River	8	Spring Box Development
Steel Creek	12	Stock-tank Repair
Seymour Creek	9	Stock-tank Pump Repair
Seymour Creek	9	Stock-tank Pump Repair

E. Projects to Improve Streamflow and Irrigation Water Management

During 2021 the Agencies partnered with participating landowners to implement two projects on two enrolled properties to enhance the ability to control and measure irrigation withdrawals and reduce the need to divert water for livestock watering purposes (Table 6).

Table 6. Upper Big Hole Watershed streamflow and irrigation management projects completed in 2021 as part of the Big Hole Arctic Grayling CCAA. Projects include installing headgates, PODs, ditch maintenance, and stock tank and spring development and maintenance.

2021		
Associated Waterbody	**Enrolled Landowner**	**Project Component**
Big Hole River	8	Headgate
Big Hole River	15	Headgate

In addition to improvements to irrigation infrastructure, the Big Hole Arctic Grayling CCAA requires reductions to irrigation diversions in response to streamflows dropping below established seasonal flow targets at each of the five gaging stations (Miner Lakes Road, the mouth of Miner Creek, the Wisdom Bridge, Mudd Creek Bridge, and Dickie Bridge). A total of 157.84 ft^3/s in 2021 was returned to the Big Hole or its tributaries in accordance with site plans and flow targets. Most of these flows returned to the Big Hole River and tributaries and were implemented in both late spring (June) and the summer months (July, August and September) as below average precipitation and above average temperatures conditions persisted throughout the basin.

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

One of the CCAA Arctic Grayling population goals is for Arctic Grayling to reoccupy or use habitats in historically occupied waters within the Big Hole Arctic Grayling CCAA Project Area (FWP and USFWS 2006).

Arctic grayling were introduced into Van Houten Lake and Twin Lakes. Eggs were collected from Mussigbrod and Miner lakes and eyed at the Big Timber hatchery. They were subsequently introduced into both lakes egg incubators. Eggs were incubated and successfully hatched in 3 consecutive years in both lakes. Adult grayling were also introduced to Van Houten Lake from Miner and Mussibrod lakes. Subsequent monitoring showed no evidence that the eggs incubated produced age-1 or older fish. Adult grayling introduced into Van Houten Lake have thrived, but there has been no evidence of natural reproduction in the lake. Because of the lack of reproduction, age-1 grayling from the Axolotl Lake brood pond were stocked into Van Houten Lake in 2019 and are also thriving. No observations of grayling at Twin Lakes have been made since eggs were introduced, but only angling surveys are conducted at Twin Lakes and no netting has been done because of the presence of a small native lake trout population.

Age-1 Arctic grayling were introduced into McVey Creek in 2018 and 2020. A fish barrier was constructed on McVey Creek in 2011 to block upstream fish passage of non-native fish so that

restoration of westslope cutthroat trout could occur upstream. The fish barrier created a small pond upstream. Grayling were introduced to this pond. Netting in the spring of 2019 indicated the fish introduced in 2018 were thriving. Subsequent electrofishing later that summer revealed that the age-2 grayling had successfully reproduced in the stream upstream of the pond. More than 100 young of the year grayling were counted in the stream. In 2019 a population estimate was done on age-0 grayling upstream of the pond and there were 128 fish/mile in the reach immediately upstream of the pond. Age-1 grayling ranged upstream of the pond more than 1.5 miles. In 2021 grayling were found more than 3 miles upstream of the pond and age-2 grayling were also found in the creek indicating the potential for resident fish to remain in the stream and not just in the impoundment upstream of the fish barrier.

Long Branch Creek also received grayling introductions in 2018, 2019 and 2020. Long Branch Creek was also a stream where westslope cutthroat trout restoration has occurred. The non-native rainbow and Yellowstone cutthroat trout that were present in the stream were removed with rotenone. The lower mile of the stream upstream of the natural fish barrier is low gradient and contains a shallow lake (Long Branch Lake). Arctic grayling from the Axolotl brood were introduced into this lower reach of the stream. Subsequent visual monitoring of the stream from near its confluence to the headwaters did not detect any fish. It appears that this reintroduction effort has not been successful.

In 2020 grayling were introduced into lower reaches of Bender Creek which is a tributary to Johnson Creek which flows into the North Fork of the Big Hole River. Brook trout were removed from Bender Creek upstream of a fish constructed fish barrier. Similar to Long Branch Creek, the habitat immediately upstream of the fish barrier is low gradient. There are multiple beaver dams and age-1 grayling were introduced to the stream immediately upstream of these beaver ponds. No subsequent monitoring of Bender Creek has occurred.

Between 2018 and 2020, approximately 4,000 age-0 grayling were planted in Mitchell Pond on Engeljard Creek. Follow-up surveys indicate that some fish have survived multiple winters. Future surveys will document recruitment and establishment of a self-sustaining population.

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; Table 8). 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 Fall 2021, FWP completed electrofishing surveys to determine Nb in the Big Hole River drainage. Surveys were conducted on 11 reaches over a total of 14.1 miles. A total of 156 young of year (YOY) and 102 Age 1+ grayling were captured during these surveys (Table 7). One hundred-nineteen YOY grayling genetic samples were used to calculate Nb. Nb for the 2021 grayling cohort was 172 (95% CI: 145-210; Figure 3). Although point estimates for Nb were lower than the estimate from last year (208), they are consistent with the ongoing positive trend in Nb for the Big Hole grayling population. 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. Grayling captured during 2021 Fall one-pass electrofishing surveys in the Big Hole River watershed.

Reach Name	Reach Length (mi.)	Grayling YOY Samples Collected	Age 1+ Grayling
Deep Creek	2.06	0	8
Fishtrap Creek	0.99	0	0
La Marche Creek	0.7	0	0
Seymour Creek	0.07	2	0
Squaw Creek Side Channel	0.8	8	84
Howell Creek Side Channel	1.2	20	1
Pintler Creek North	0.19	1	0
Pintler Creek South	0.51	18	0
Plimpton Creek	2.9	58	5
Steel Creek	2.7	41	4
Swamp Creek	3.03	8	0
Big Hole River-Daniels	0.54	0	0
Total	**15.69**	**156**	**102**

Table 8. Estimates of family summary statistics and N_b for Arctic Grayling from the Big Hole River. N is number of individuals genotyped. N_b shows estimates of the effective number of breeders, based on 12 microsatellites. 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	77.6	66.7	91.4
2010	46	92.4	66.1	146.0
2011	66	81.9	64.5	108.9
2012	56	289.0	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	68.0	155.3
2017	63	155.4	103.3	289.7
2018	128	145.2	115.1	191.3
2019	145	332.8	203.7	510.1
2020	119	208.0	166.6	271.3
2021	119	172.0	144.6	209.6

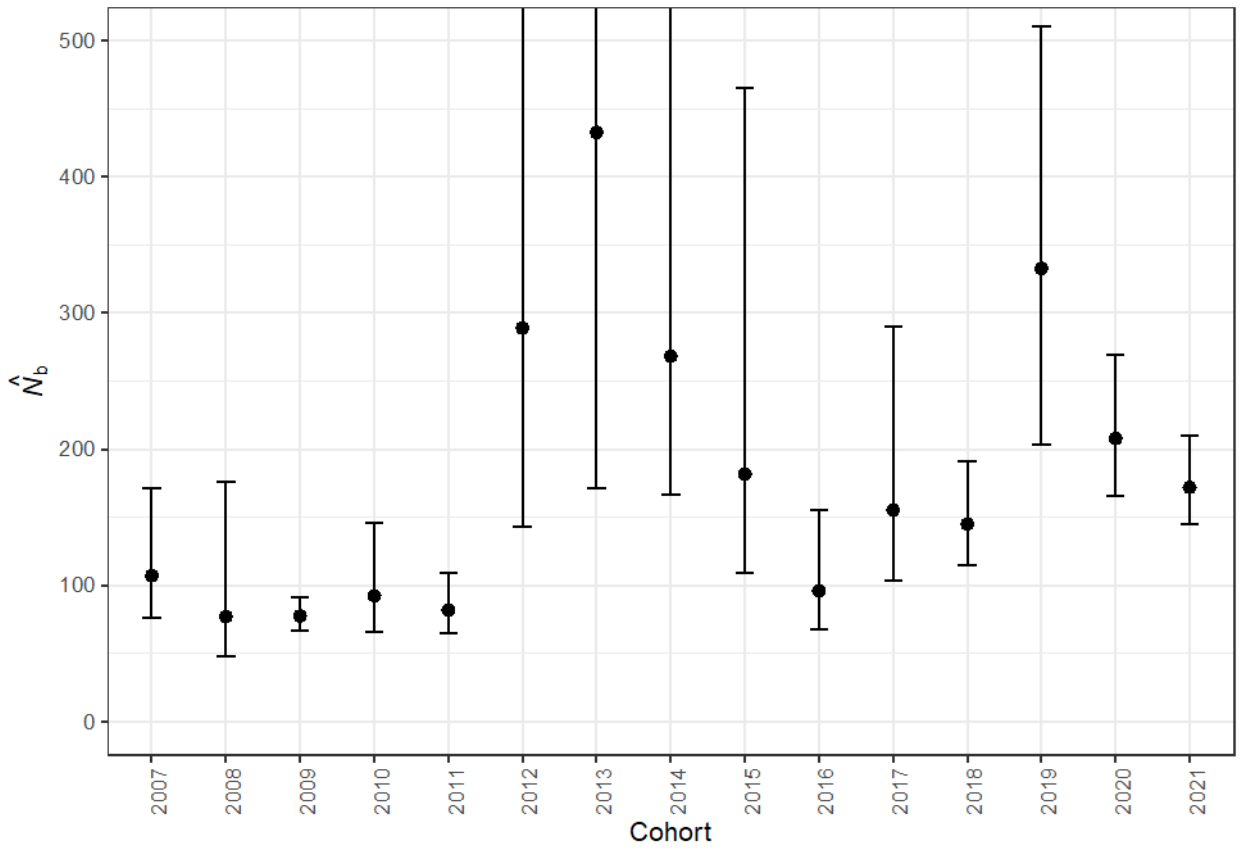

Figure 3. Estimates of the number of effective breeders (N_b) in Arctic grayling from the Big Hole River over time. Error bars indicate 95% confidence intervals.

B. Stream Temperature Monitoring

In 2021, stream temperature data were collected in the Big Hole River at Saginaw Bridge, Miner Lakes Road, the confluence with Miner Creek, Wisdom Bridge, and Dickie Bridge. The 2021 Big Hole River tributary sites included Deep Creek, Governor Creek, Howell Creek, Miner Creek, the Confluence of Plimpton and Howell Creeks, Plimpton Creek, Rock Creek, Smith Spring, and Steel Creek. Stream temperature data were recorded at 60-minute intervals from May 1st through October 1st. The 2021 data were summarized as maximum and mean temperature for the monitoring period and hours and days exceeding 21.1º C (70º F) and 25º C (77º F; Table 9). The thermal stress threshold for salmonid species is considered 21.1º C (70 º F; Behkne 1992), and 25º C (77º F) represents the upper incipient lethal temperature for Arctic Grayling (Lohr et al. 1996).

Table 9. Stream temperature monitoring results for 2021.

Monitoring Site (Big Hole Arctic Grayling CCAA Management Section	Mean Seasonal Temperature °C (°F)	Maximal Seasonal Temperature °C (°F)	Cumulative Hours Exceeding 21.1° C (70° F)	Cumulative Hours Exceeding 25° C (77° F)
Big Hole River Dickie Bridge	10.62 (51.1)	24.1 (75.4)	231	0
Big Hole River Miner Creek Confluence	8.35 (47.0)	24.4 (76.0)	178	0
Big Hole River Miner Lakes Road	12.2 (54.0)	23.2 (73.7)	36	0
Big Hole River Saginaw Bridge	10.8 (54.5)	20.0 (67.9)	0	0
Deep Creek	12.8 (55.1)	23.9 (74.9)	158	0
Governor Creek	13.0 (55.4)	24.2 (75.6)	240	0
Howell Creek	11.9 (53.5)	24.2 (75.5)	117	0
Miner Creek	13.6 (56.6)	25.9 (78.7)	289	14
Plimpton – Howell Confluence	14.6 (58.3)	26.8 (80.2)	385	15
Plimpton Creek	14.6 (58.3)	26.7 (80.1)	374	0
Rock Creek	12.1 (53.75)	17.65 (63.78)	0	0
Smith Spring	24.0 (51.1)	35.2 (95.28)	46	386
Steel Creek (1)	14.6 (58.2)	25.23 (77.4)	291	6
Steel Creek (2)	13.5 (56.2)	25.2 (77.3)	126	2
Steel Creek (3)	11.5 (52.78)	21.3 (70.3)	6	0
Steel Creek (4)	9.58 (49.24)	15.8 (60.4)	0	0

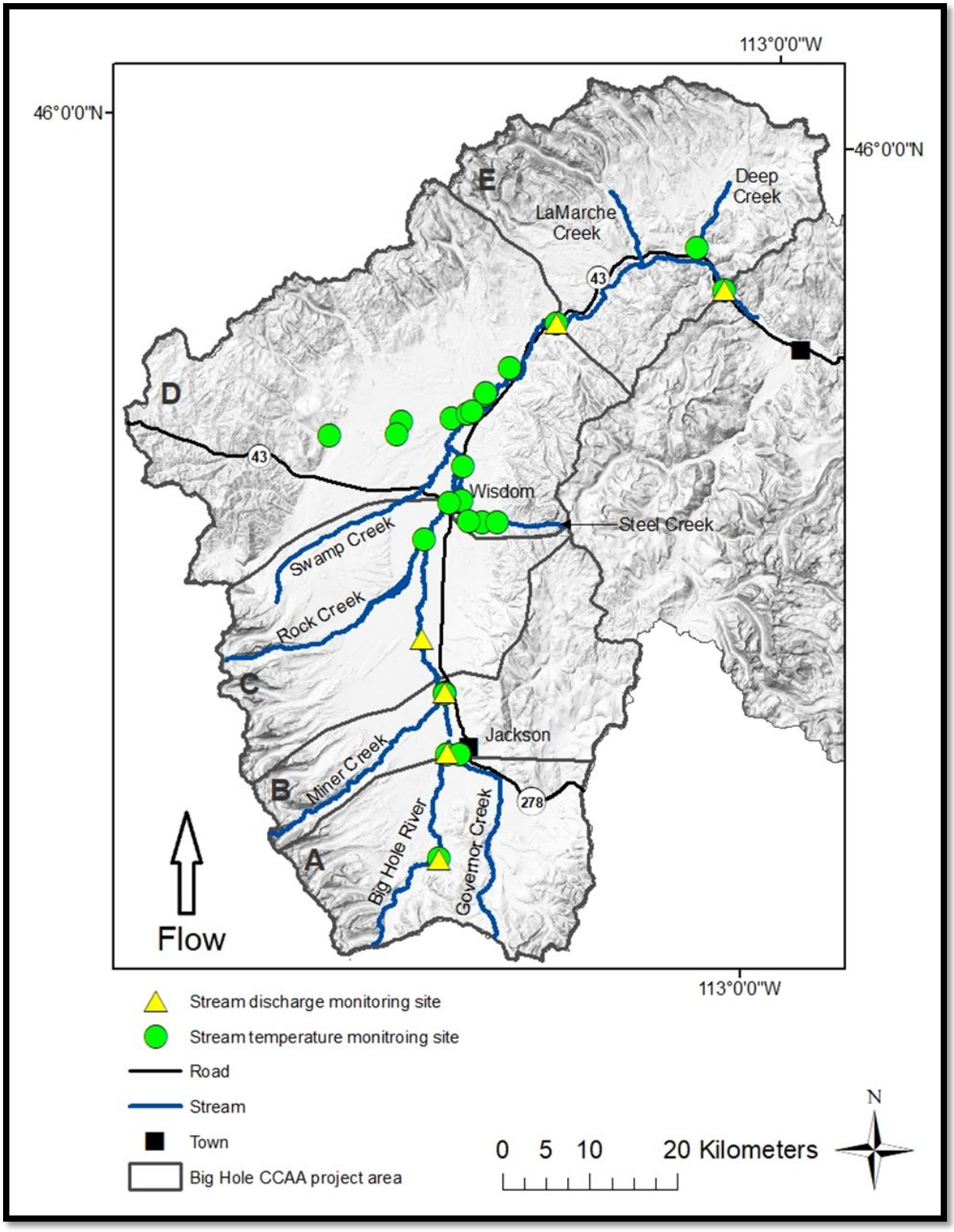

Figure 4. Stream temperature (green circle) and stream discharge (yellow triangle) monitoring sites in the Big Hole Arctic Grayling CCAA Project Area.

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 3) 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 at least one tributary within each management segment and six key irrigation ditches.

Snowpack and precipitation data were monitored by NRCS (available at www.nrcs.gov), and results are based on the period-of-record (1981–2010).

In 2021, the Big Hole basin snowpack peaked below median values, and snowpack receded faster than normal resulting in overall well below average snowpack. Total precipitation in the Big Hole basin was 84% of average. Precipitation percentages during the irrigation season dipped into the 10th percentile and remained there for the rest of WY 2021. Air temperatures in the Big Hole were well above average throughout the summer. Beaverhead County reported the warmest average temperature on record during June-July, with a +7.0 °F departure from normal. Below average snowpack conditions and well below average total precipitation resulted in Big Hole Arctic Grayling CCAA stream discharge targets being met 38% of the time (Figures 5-10).

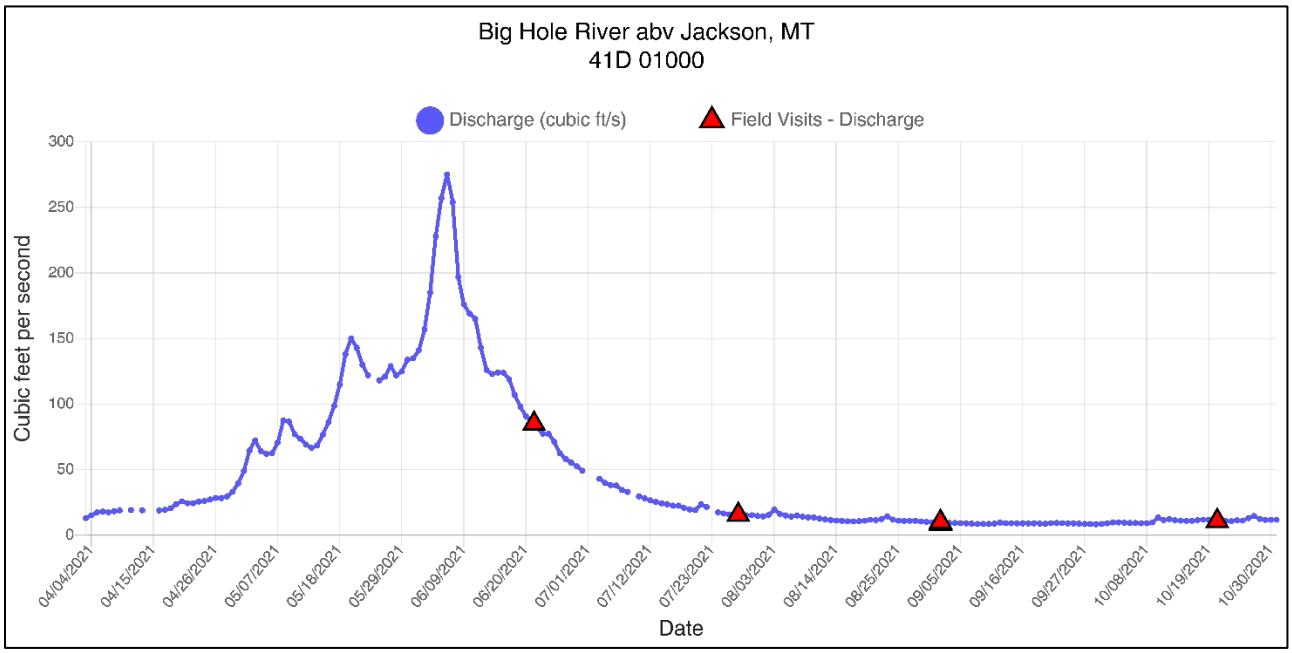

Figure 5. 2021 DNRC stream discharge data collected from the Big Hole River at the real-time gaging station located at the upper Big Hole Arctic Grayling CCAA project area boundary (Saginaw Bridge).

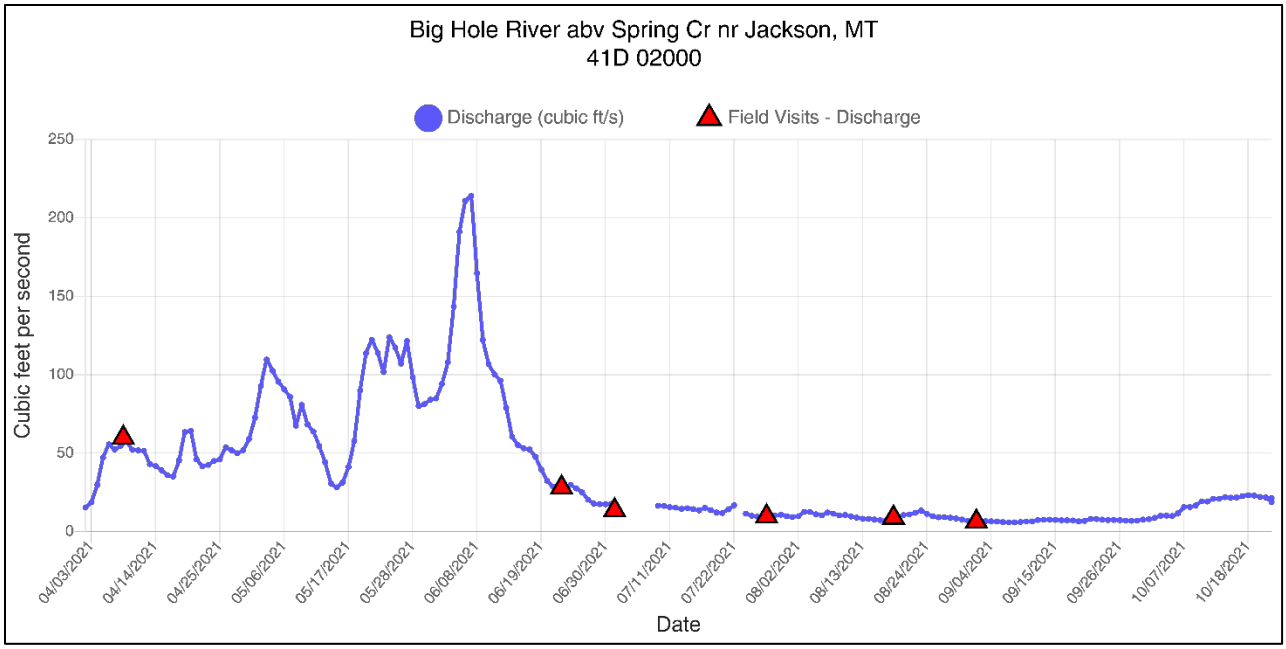

Figure 6. 2021 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach A boundary (Miner Lakes Road).

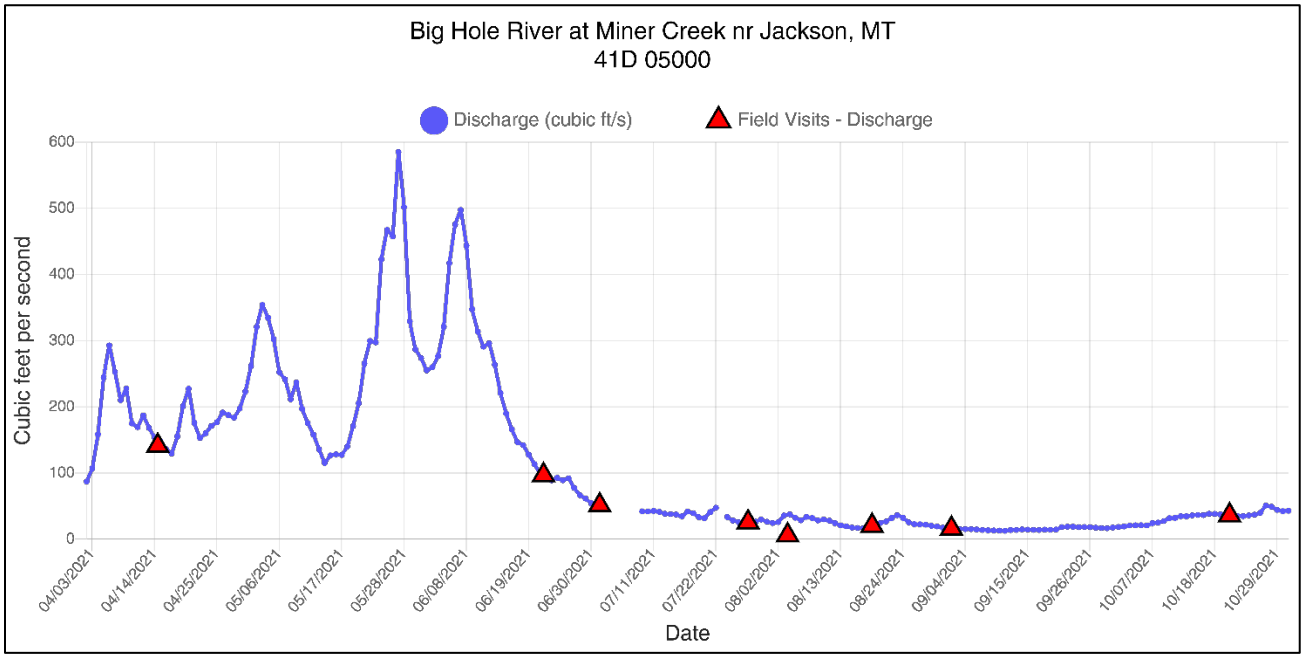

Figure 7. 2021 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach B boundary (confluence with Miner Creek).

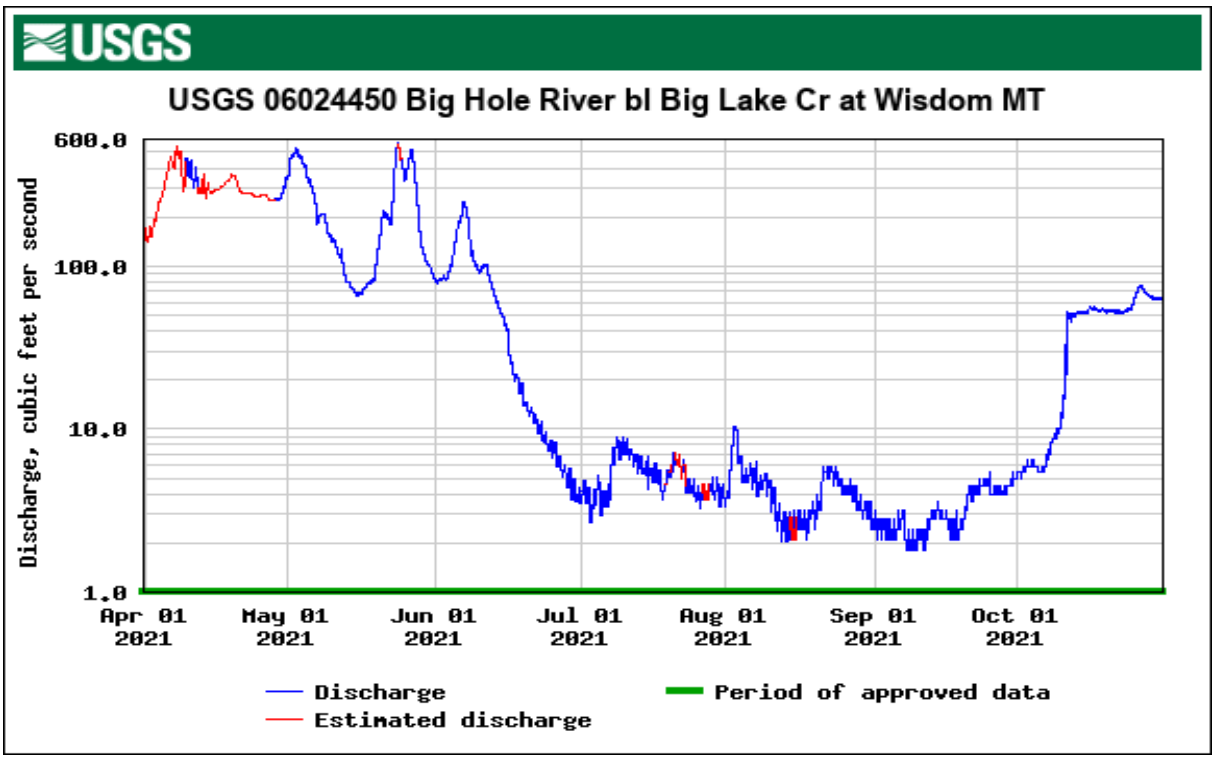

Figure 8. 2021 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach C boundary (Wisdom Bridge).

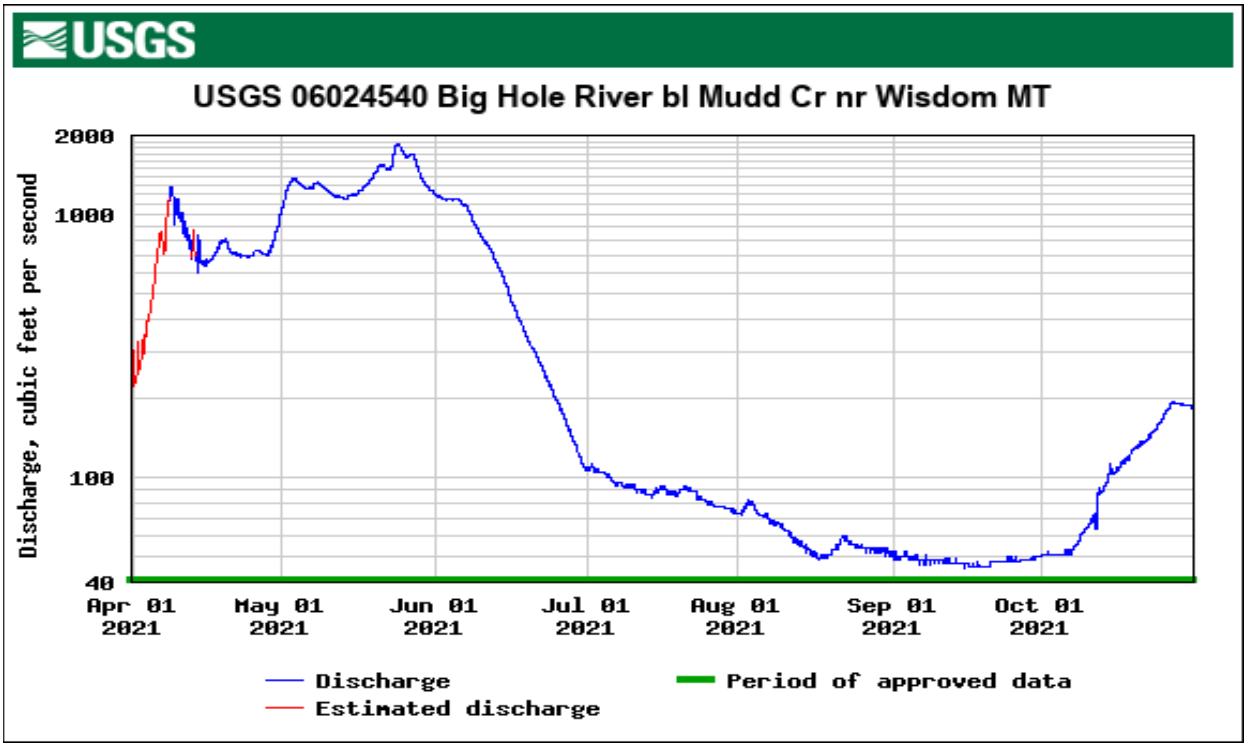

Figure 9. 2021 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach D boundary (Mudd Cr Bridge).

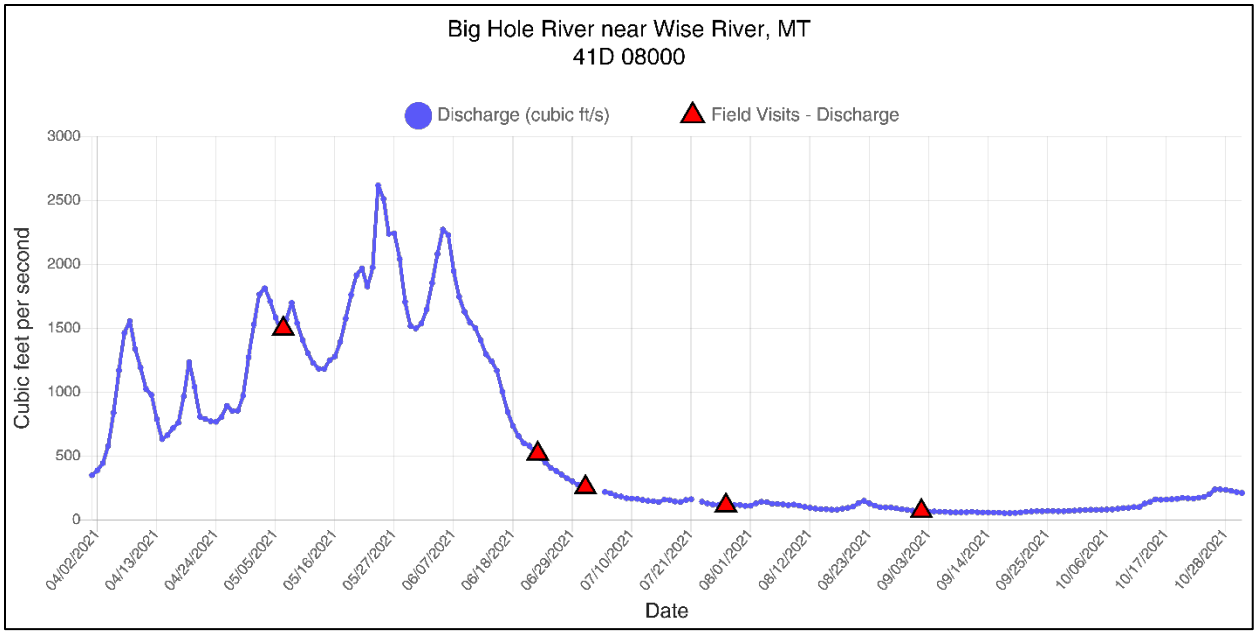

Figure 10. 2021 stream discharge data collected from the Big Hole River at the real-time gaging station located at the lower Big Hole Arctic Grayling CCAA Reach E boundary (Dickie Bridge).

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

The monitoring of compliance with approved SSPs has occurred annually on the following Properties: 1–31. All landowners with approved SSPs followed their plan in 2021. 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. The necessary field forms for documenting actions are provided to the landowners at that time.

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 2020.

IX. NRCS Special Funding

In 2018, the NRCS secured funding for a 4-year, permanent technician position in cooperation with FWP and DNRC. The position is managed by FWP to assist with CCAA irrigation compliance

and riparian monitoring. This position was hired in the spring of 2018–2019 through FWP and DNRC, and again filled in March of 2020. The technician position will remain filled through the duration of the grant. The NRCS will continue to pursue and meet the obligations of existing EQIP contracts with enrolled landowners in 2021, develop TIP proposals during the Winter of 2021/2022, and secure funding for the permanent technician position in 2022.

X. Literature Cited

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