Ladies and Gentlemen:

A draft Environmental Assessment (EA) has been prepared for the proposed removal of nonnative eastern brook trout and hybridized cutthroat trout from the Soda Butte Creek Drainage near Cook City Montana to protect the Lamar River Drainage in Yellowstone National Park from invasion by these species, and to provide a secure area for establishing a population of nonhybridized Yellowstone cutthroat trout in a major drainage to the Lamar River. This will be a joint project involving Montana Fish, Wildlife and Parks, Wyoming Game and Fish, the Shoshone and Gallatin/Custer National Forests, and Yellowstone National Park. It is proposed to use chemical treatment to remove the existing fish population from Soda Butte Creek then restock the stream with pure Yellowstone cutthroat trout from the best available source.

This EA can be viewed on the FWP website (http://fwp.mt.gov) under Public Notices. If you would like a copy mailed to you please contact the Region 5 headquarters at (406) 247-2940. Two public meeting to discuss this project will be held in Livingston on May 18th at the Yellowstone Pioneer Lodge (old Best Western), and in Cooke City on May 27th at the Chamber of Commerce conference room.

Any questions about this project should be directed to Jason Rhoten (328-6160), or Ken Frazer (247-2961). Comments should be addressed to the undersigned by June 19, 2015.

Sincerely,

Gary Hammond

Regional Supervisor

(ghammond@mt.gov)

Soda Butte Creek Yellowstone Cutthroat Trout Conservation Project

Draft Environmental Assessment

May 14, 2015

Montana Fish, Wildlife & Parks
Region 5 Office
2300 Lake Elmo Drive
Billings, Montana 59105

Executive Summary

The proposed action would entail chemical removal of the existing fishery in the upper Soda Butte drainage, which originates in Montana and Wyoming, east of Yellowstone National Park, and enters the park at its northeast entrance (Figure 1). CFT Legumine, a commonly used formulation of rotenone, would be the piscicide used to remove fish. After chemical removal, the proposed action calls for restore native, nonhybridized Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) to upper Soda Butte Creek and its tributaries. This action would also protect the Lamar River drainage from invasion of nonnative brook trout and the continued presence of hybridized trout. After successful removal of fish, Soda Butte Creek would be restocked with native, nonhybridized Yellowstone cutthroat trout from the best available source. Fish availability and genetic status would guide selection of the specific source.

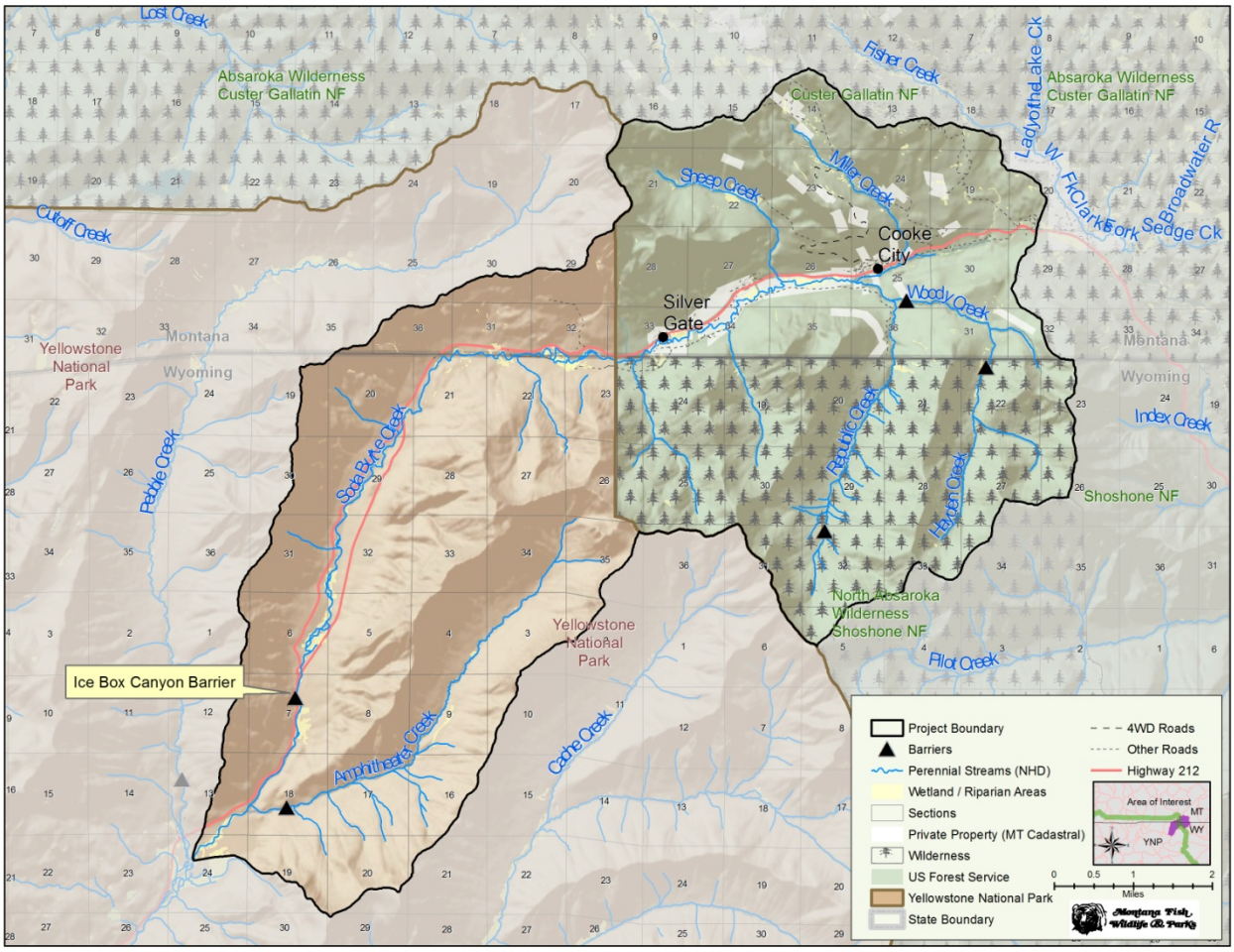

Figure 1. Map of the Soda Butte Creek Yellowstone cutthroat trout conservation project area.

The conservation and intrinsic value of native Yellowstone cutthroat trout is substantial. Unfortunately, Yellowstone cutthroat trout have experienced marked reductions in numbers and

distribution. Securing a population of nonhybridized Yellowstone cutthroat trout within the greater Lamar River watershed would maintain an invaluable component of this special area's natural heritage. Moreover, conservation of native fish brings a range of benefits to residents and visitors, and is required under state and federal law.

Yellowstone cutthroat trout in Soda Butte Creek face several threats. Past mining practices have left contaminated tailings and waste rock that contribute toxic metals to the stream; however, remediation and reclamation of mine wastes have improved water quality. Paradoxically, these actions allowed brook trout to spread from a tributary into Soda Butte Creek. In addition, invasion or historic stocking of nonnative rainbow trout (*O. mykiss*) and nonnative westslope cutthroat trout (*O. clarkii lewisi)* has compromised the genetic composition of the upper Soda Butte population. Recent genetic analyses indicate that the population is a hybrid swarm, with genes contributed from the native Yellowstone cutthroat trout, and nonnative rainbow trout and westslope cutthroat trout. This project would provide an opportunity to restore the project area to native, nonhybridized Yellowstone cutthroat trout.

This collaborative effort includes Montana Fish, Wildlife & Parks (FWP), the Custer Gallatin National Forest (CGNF), the Shoshone National Forest (SNF). Wyoming Department of Game and Fish (WDGF), and the National Park Service (NPS), and focuses on eliminating the threats posed by nonnative species in the Lamar River drainage, which includes Soda Butte Creek. Several actions have preceded this environmental assessment (EA). The NPS created a barrier to upstream movement of nonnative rainbow trout in Soda Butte Creek at Ice Box Canyon. All 4 agencies have conducted mechanical removal (electrofishing) of brook trout. Despite multiple crews and 2 decades of effort, brook trout continue to persist in Soda Butte Creek, and these fish are spreading downstream into YNP at an alarming rate, with nearly 400 brook trout removed from YNP waters from 2008 through 2013.

EAs are a requirement of the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA), which require state and federal agencies to consider the environmental, social, cultural, and economic effects of proposed actions. This EA considers 3 of the potential consequences of 2 alternatives to manage fish in Soda Butte Creek. The third alternative listed is a dismissed alternative that has been proven ineffective in meeting the objective of full removal of brook trout. In-depth evaluation of this dismissed alternative is included to justify its cessation. The 3 alternatives considered are:

1. Alternative 1 (Preferred): Use the piscicide CFT Legumine to remove the existing fishery, and restock with nonhybridized Yellowstone cutthroat trout from the best available source.
2. Alternative 2: No action
3. Alternative 3: Mechanical suppression (current approach).

Alternative 1 is the preferred alternative. It would have short-term, minor effects on wildlife, recreation, and vegetation. This alternative would be highly beneficial to Yellowstone cutthroat trout, and would be a substantial contribution to the long-term conservation of the species in Montana and Wyoming.

MEPA and NEPA require public involvement and opportunity for the public to comment on projects undertaken by the acts' respective agencies. A public comment period will extend from 5/14/2015 to 6/19/2015. This public comment period meets FWP and the U.S. Forest Services's 30-day public comment requirements. A public meeting will be held in Livingston on May 18, 2015, at the Yellowstone Pioneer Lodge, beginning at 7:00 pm. A second public meeting will be held at the Cooke City Chamber of Commerce conference room on May 27, 2015 beginning at 7:00 pm. Interested parties should send comments to:

Jason Rhoten
Montana Fish, Wildlife & Parks
2300 Elmo Lake Drive
Billings, MT 59105
(406) 698-1905
jrhoten@mt.gov

Comments submitted to the U.S. Forest Service should be sent to:

Susan Stresser
District Ranger
Wapiti Ranger District
203A Yellowstone Ave, Cody, WY 82414,
or by fax at 307-527-7158
or by e-mail at comments-rocky-mountain-shoshone@fs.fed.us.

See chapter 7 Public Participation for full instructions on submitting comments to the U.S. Forest Service.

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List of Abbreviations

CGNF	Custer Gallatin National Forest
DEGEE	diethyl glycol monoethyl ether
DEQ	Montana Department of Environmental Quality
EA	Environmental Assessment
EPT	Ephemeroptera, Plecoptera,Trichoptera (mayflies, stone flies, & caddis flies)
FS	Forest Service
FWP	Montana Fish, Wildlife & Parks
GMU	Geographic management unit
$KMnO_4$	Potassium permanganate
MCA	Montana Code Annotated
MCTSC	Montana Cutthroat Trout Steering Committee
MEPA	Montana Environmental Policy Act
MNHP	Montana Natural Heritage Program
NEPA	National Environmental Policy Act
SNF	Shoshone National Forest
WFGD	Wyoming Fish and Game Department
YNP	Yellowstone National Park
MOU	Memorandum of understanding
MRDG	Minimum Requirements Decision Guide
MSDS	Material data safety data sheet
NPS	National Park Service
USEPA	United States Environmental Protection Agency

1 PROPOSED ACTION and BACKGROUND

1.1 *Need for Proposed Action*

Soda Butte Creek supports a slightly hybridized population of Yellowstone cutthroat trout and nonnative brook trout. Hybridization comes from past stocking or invasion of rainbow trout and westslope cutthroat trout. Brook trout are an invasive species that can eliminate native cutthroat trout within a few decades following invasion. Brook trout originated from fish stocked in Montana; however, they are invading downstream into YNP. Nearly 2 decades of mechanical removal has not eliminated brook trout. Total eradication of brook trout is a desired outcome, given their ability to rapidly increase in numbers and invade new waters. In addition, hybridized fish provide a source of nonnative genes that have potential to spread throughout the Lamar River watershed. The proposed action would eliminate brook trout and hybrids from Soda Butte Creek and prevent invasion of brook trout and hybrids throughout the greater Lamar River watershed.

Conservation plans and strategies developed by state and federal agencies provide the foundation for Yellowstone cutthroat trout conservation. In Montana, the need for the proposed action comes from a memorandum of understanding (MOU) developed to conserve Yellowstone cutthroat trout across its historic range in Montana (MCSTC 2007), and calls for collaboration among agencies to meet these same goals and objectives. Signatories to the MOU include FWP, the U.S. Forest Service, and the NPS, and these agencies, in addition to WDGF, are collaborators on the project.

Conservation goals developed for cutthroat trout conservation in the MOU include:

1. Ensure the long-term, self-sustaining persistence of each subspecies distributed across their historic ranges;
2. Maintain the genetic integrity and diversity of nonhybridized populations, as well as the diversity of life histories represented by remaining cutthroat trout populations;
3. Protect the ecological, recreational, and economic values associated with cutthroat trout.

Objectives developed to meet conservation goals are consistent with the need for the proposed action. The relevant objectives are as follows:

1. Maintain, secure, and/or enhance all cutthroat trout populations designated as conservation populations, especially the nonhybridized components;
2. Continue to survey waters to locate additional cutthroat trout populations and determine their distribution, abundance, and genetic status;
3. Seek collaborative opportunities to restore and/or expand populations of cutthroat trout into selected suitable habitats within their historical ranges.

Soda Butte Creek presents an opportunity to work towards several goals and meet some objectives. By removing nonnative brook trout from the upper Soda Butte Creek watershed, project partners are working to ensure the long-term, self-sustaining persistence of Yellowstone cutthroat trout within its historic range. Brook trout pose a threat to the Soda Butte Creek population and they are spreading downstream into YNP. Given the ability of brook trout to displace Yellowstone cutthroat trout, they are a risk to not only Soda Butte Creek, but the entire Lamar River watershed. Removing brook trout would contribute to securing Yellowstone cutthroat trout throughout the Lamar River watershed, which is among the conservation objectives in the MOU.

Removal of the existing hybridized fish is also consistent with goal of maintaining genetic integrity. Although existing fish are slightly hybridized, they remain a source of nonnative genes to Soda Butte Creek and the Lamar River watershed.

The third objective of the MOU calls for a collaborative approach to restocking Soda Butte Creek to restore a population of nonhybridized Yellowstone cutthroat trout. Collaborators include FWP, WDGF, the CGNF, the Shoshone National Forest (SNF), and YNP. Personnel from each entity have participated in the planning efforts that resulted in this EA and appendices addressing NEPA compliance. Furthermore, each agency would contribute staff to execute the fish removal, should it occur.

1.2 *Objective of Proposed Action*

The objective of the proposed action is to use CFT Legumine, a commonly used formulation of rotenone, to remove the existing fishery upstream of a fish passage barrier at Ice Box Canyon, and then to restore the project area to its historic condition of supporting native, nonhybridized Yellowstone cutthroat trout (Figure 2). After successful removal of nonnative and hybridized fish, nonhybridized Yellowstone cutthroat trout from the best available source would be reintroduced in Soda Butte Creek. This project is a component of a larger conservation effort with the goal of restoring and protecting nonhybridized Yellowstone cutthroat trout in the Lamar River watershed (Figure 3). Protecting and securing Yellowstone cutthroat trout in the Lamar River watershed is a high conservation priority with the NPS and all the cooperating agencies.

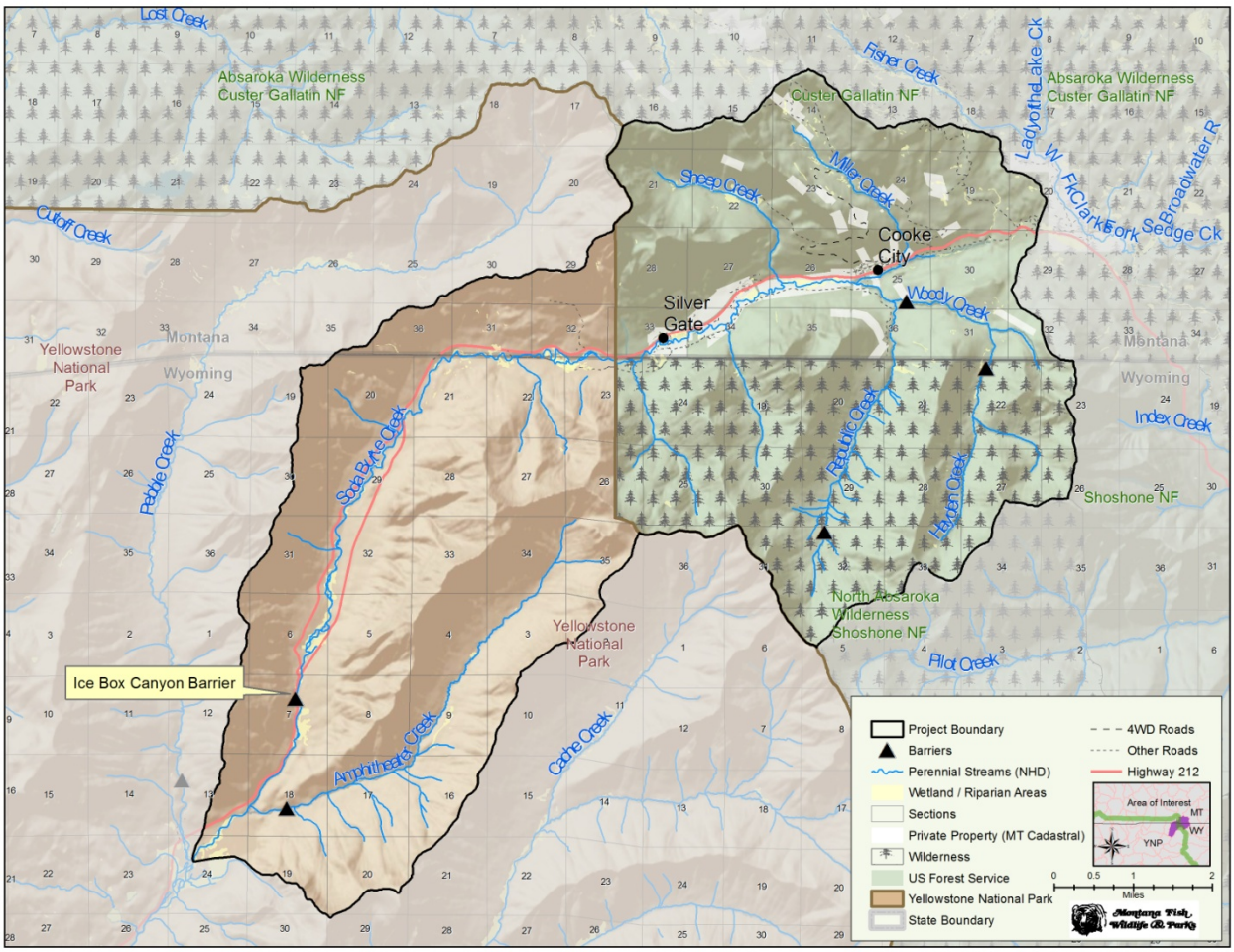

Figure 2. The upper Soda Butte Creek watershed.

The project area would encompass the majority of the upper Soda Butte Creek watershed (Figure 2), which originates in Montana and Wyoming east of the northeast entrance to YNP. A fish barrier in Ice Box Canyon marks the downstream extent of the proposed project area. This steep canyon had been a partial barrier; however, the NPS modified it to be a complete barrier that prevents invasion of fish from downstream. The project area encompasses lands managed by several different jurisdictions, including the CGNF, the SNF, and the NPS, Montana and Wyoming. Private lands are around Cooke City and Silver Gate.

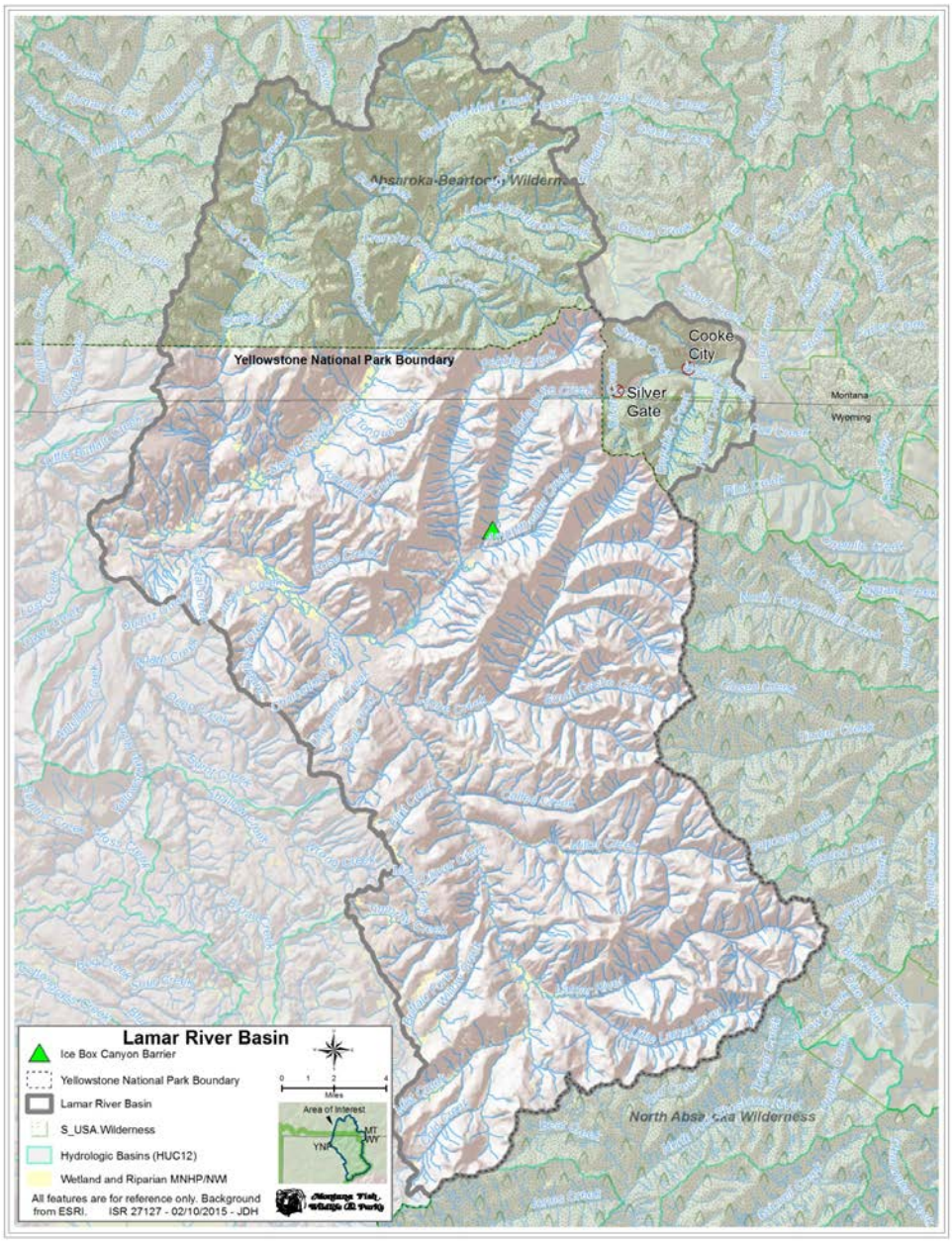

Figure 3. The Lamar River watershed

The conservation and intrinsic values of nonhybridized Yellowstone cutthroat trout are considerable. Unfortunately, Yellowstone cutthroat trout have experienced substantial reductions in numbers and distribution across their historical range (Figure 4). Securing a population of nonhybridized Yellowstone cutthroat trout, within the greater Lamar River watershed, would maintain an invaluable component of this special area's natural heritage. Moreover, conservation of native fish brings a range of benefits to residents and visitors and is required under state and federal law.

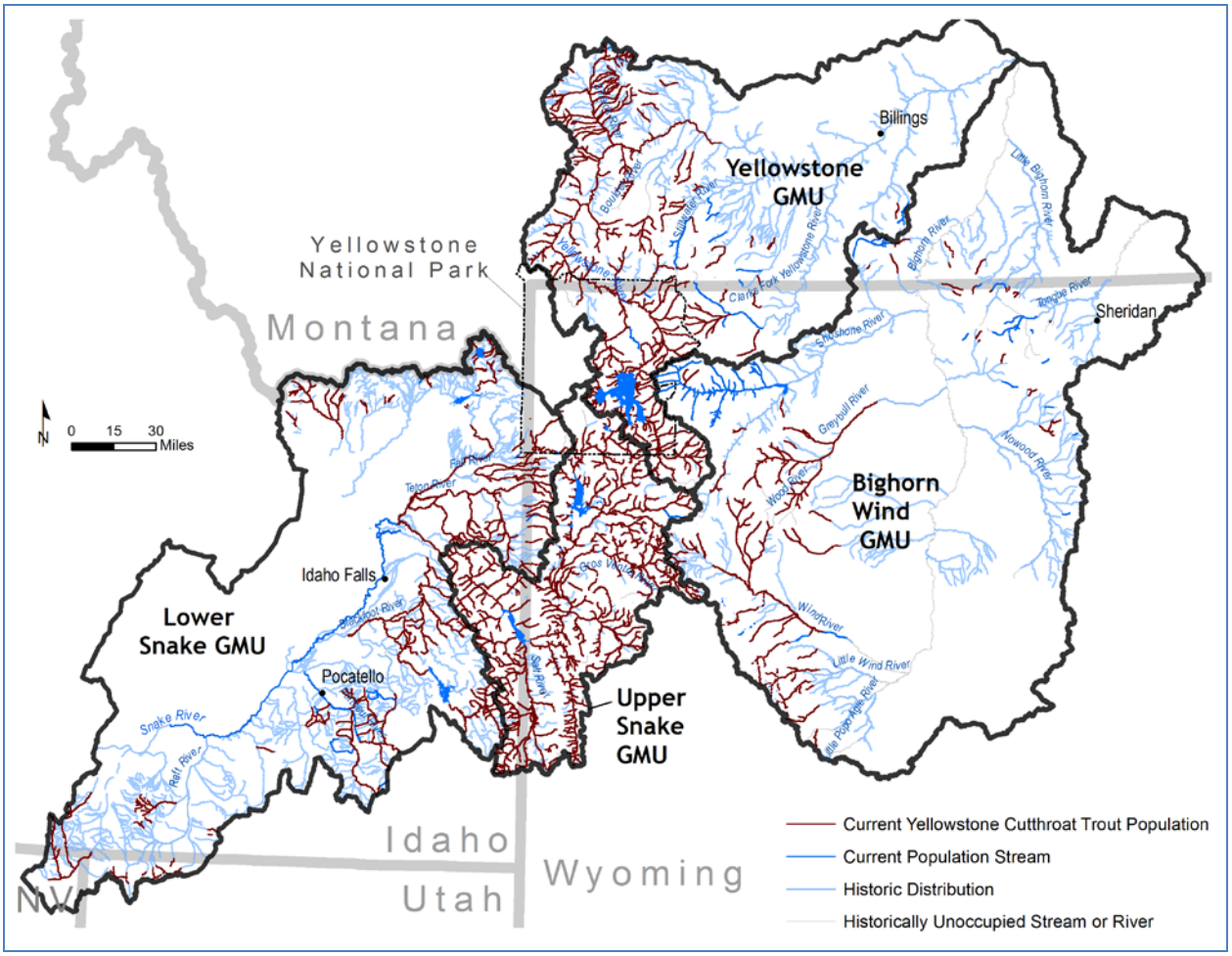

Figure 4. Historic and current distribution of Yellowstone cutthroat trout within its historic range,

Nonnative trout pose significant threats to Yellowstone cutthroat trout. Hybridization with rainbow trout is the leading cause of decline in Yellowstone cutthroat trout (Kruse et al. 2000), and stocked westslope cutthroat trout are a threat. Soda Butte Creek supports a hybrid swarm of Yellowstone cutthroat trout, rainbow trout, and westslope cutthroat trout, and brook trout. Brook trout are a highly invasive species and pose a major threat to native cutthroat trout, especially in headwater streams (Dunham et al. 1997; Petersen et al. 2008; Shepard 2010). Brook trout have considerable niche overlap with cutthroat trout and outcompete cutthroat trout in these waters (Shepard 2010). This trend appears to be true for all subspecies of cutthroat trout, including Yellowstone cutthroat trout.

Yellowstone cutthroat trout currently occupy about 44% of their historic range, with 22% of the range supporting core (<1% hybridization) populations (Endicott et al. draft). As nonnatives are among the major threats to Yellowstone cutthroat trout, evaluation of the number of stream miles supporting tested or potential core populations allows evaluation of the extent of the threat posed

by nonnative fishes. Of the 4,061 total stream miles with potential or tested core populations, Yellowstone cutthroat trout occupy 3,681 stream miles in sympatry with other species. Only 380 stream miles of proposed or tested core population support Yellowstone cutthroat trout without the presence of nonnative species. These data suggest that a substantial majority of the remaining core populations are at risk of extirpation because of the presence of nonnative species.

Until the early 1990s, brook trout were restricted to an unnamed tributary within the McLaren mining district. Reclamation of the McLaren mine removed a chemical barrier that had prevented brook trout from invading other streams. FWP and the CGNF tried chemical and mechanical removal of brook trout to stem this early invasion but were unsuccessful. In 2004, another source of brook trout emerged, and chemical removal from this unnamed tributary occurred soon after.

To protect the stream's Yellowstone cutthroat trout from brook trout, mechanical removal efforts increased substantially from 2004 through 2013. Most efforts focused on Soda Butte Creek and its tributaries near Cooke City and Silver Gate (Figure 5). These annual removal events have been unsuccessful in removing brook trout, or appreciably reducing their numbers in most reaches (Table 1). Alarmingly, brook trout spread to YNP by 2008. Invading further downstream would put brook trout into the Lamar River drainage. Brook trout invasion is contrary to the conservation goal for the Lamar River watershed, which is to return it to a native Yellowstone cutthroat trout fishery (Koel et al. 2011).

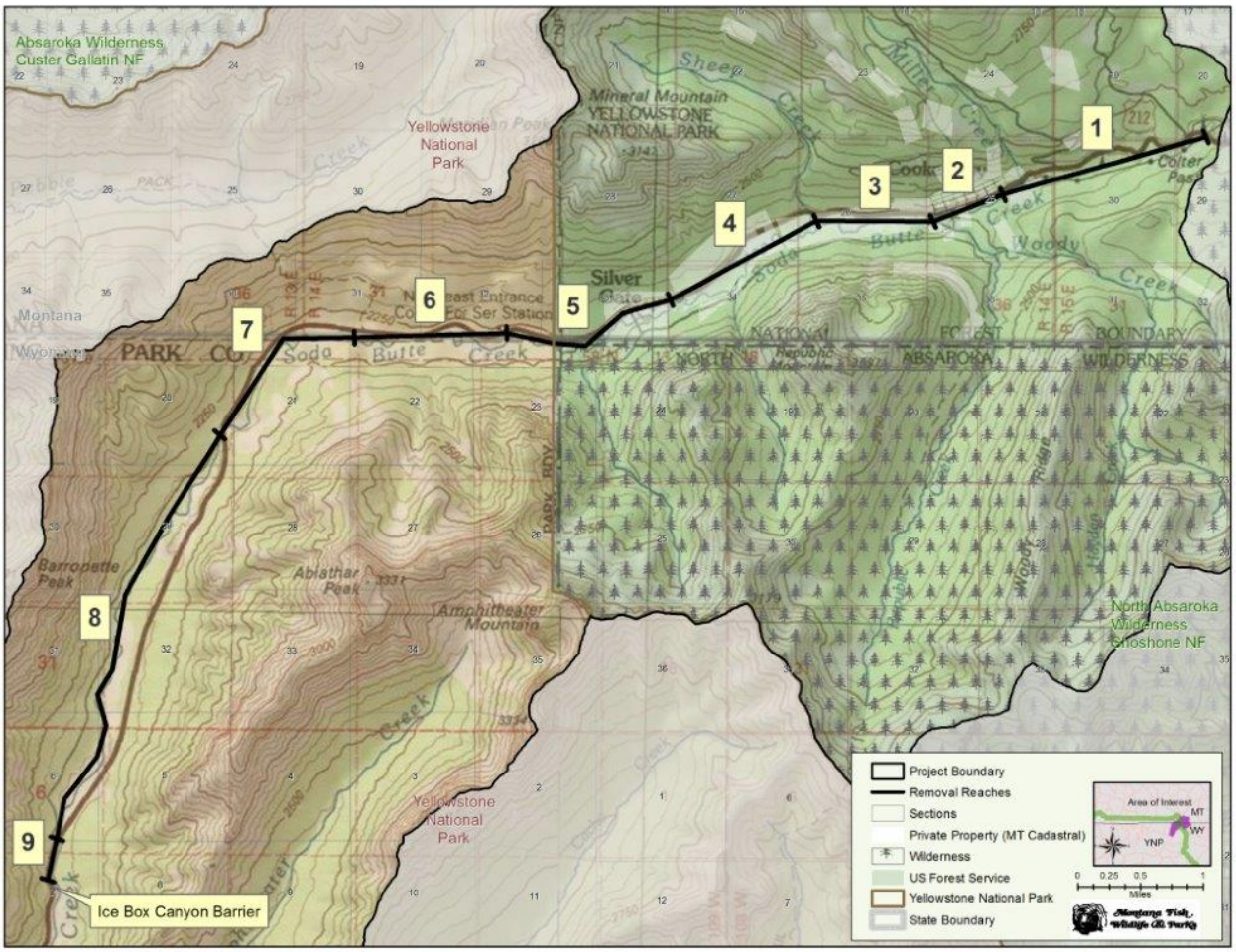

Figure 5. Removal reaches on Soda Butte Creek (see Table 1 for brook trout removed from each reach).

Table 1. Total (and young-of-year) brook trout mechanically removed from Soda Butte Creek within the CGNF, State of Montana, and YNP (see Figure 5 for locations of removal reaches).

Site	*Removal Reach*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
1	HWY 212 to McClaren Mine Tailings	19(1)	3(0)	0(0)	0(0)	0(0)	NS	NS	NS	0(0)	0(0)	1(0)
2	McClaren Mine Tailings to Woody Creek	15(0)	17(0)	3(0)	3(0)	2(0)	NS	NS	NS	NS	NS	0(0)
3	Woody Creek to Sheep Creek	8(2)	43(0)	16(0)	0(0)	1(0)	NS	NS	2(0)	0(0)	0(0)	1(0)
4	Sheep Creek to Silver Gate	251(79)	932(51)	142(6)	45(8)	5(0)	6(0)	NS	30(1)	5(0)	4(0)	2(0)
5	Silver Gate to Yellowstone Park Boundary	9(3)	80(9)	54(2)	48(19)	13(0)	30(2)	16(0)	22(2)	10(0)	2(0)	30(3)
6	Yellowstone Park Boundary to Warm Creek	7(0)	11(0)	0(0)	50(27)	23(2)	56(10)	43(2)	15(0)	29(9)	35(0)	8(0)
7	Warm Creek to Road Bridge	0(0)	1(0)	0(0)	0(0)	3(1)	51(12)	68(29)	35(6)	53(10)	54(23)	55(4)
8	Road Bridge I to Road Bridge II	NS	NS	NS	NS	0(0)	1(0)	7(0)	2(0)	11(2)	16(3)	3(0)
9	Road Bridge II to Ice Box Canyon	NS	NS	NS	NS	0(0)	0(0)	NS	0(0)	NS	NS	NS
T	Tributaries	0(0)	17(0)	15(0)	4(0)	1(0)	8(0)	NS	NS	0(0)	54(19)	2(0)
	Total	309	1,104	230	150	48 (3)	152(24)	134(31)	106(10)	108(21)	165(45)	102(7)

*NS= Not Sampled

Consideration of the potential consequences of using rotenone to remove the existing fishery follows nearly 2 decades of unsuccessful attempts to use electrofishing to eradicate brook trout from Soda Butte Creek and several tributaries. Although full mechanical removal can be possible in limited cases (Shepard and Nelson 2001; Shepard et al. 2014), the abundance of complex woody debris, the remote locations of many streams, and the spatial scale of the project, make this option infeasible. Soda Butte Creek has numerous debris jams, and many brook trout evade capture in this complex habitat. Complex woody debris is among the factors that favor brook trout when in sympatry with cutthroat trout (Shepard et al. 1999).

Genetic status of the Soda Butte Creek Yellowstone cutthroat trout population is a secondary driver of this proposed project. Introgression is the movement of a gene of one species into the gene pool of another. Genetic testing of fish from Soda Butte Creek has shown introgression from <1% to >1%, with rainbow trout and westslope cutthroat trout alleles being present (Leary 2005; Leary 2014). Populations with >1% but <10% introgression are conservation populations and have relatively high conservation value (May 2000). The most recent genetic analysis indicates that Soda Butte Creek contains a hybrid swarm among Yellowstone cutthroat trout (99.5%), rainbow trout (0.1%), and westslope cutthroat trout (0.4%). This full fish removal would provide an opportunity to restore upper Soda Butte Creek to a nonhybridized Yellowstone cutthroat trout fishery, which has the highest conservation value. This project would secure 38 miles of habitat for native Yellowstone cutthroat trout lacking brook trout or hybrids.

1.3 *Relevant Plans*

Each agency has at least one plan addressing Yellowstone cutthroat trout conservation (Table 2). These documents describe management and conservation goals for Yellowstone cutthroat trout, listed or sensitive wildlife species, or criteria for maintaining the natural or aesthetic values of the surrounding landscape. This project is consistent with conservation planning, priorities, and implementation throughout the Yellowstone cutthroat trout's native range.

Table 2. Planning and strategy documents with relevance to the Soda Butte Creek.

Agency	*Citation*	*Website*
Montana Cutthroat Trout Steering Committee (MCTSC)	Memorandum of Understanding and Conservation Agreement for Westslope Trout and Yellowstone Cutthroat Trout in Montana (2007)	http://fwp.mt.gov/fishAndWildlife/management/yellowstoneCT/
FWP	Yellowstone Cutthroat Trout Conservation Strategy for Montana (2013)	http://fwp.mt.gov/fishAndWildlife/management/yellowstoneCT/
FWP	Statewide Fisheries Management Plan (2014)	http://fwp.mt.gov/fishAndWildlife/management/fisheries/statewidePlan/
NPS	Native fish Conservation Plan Environmental Assessment (2011)	http://parkplanning.nps.gov/document.cfm?parkID=111&projectID=30504&documentID=37967
WGFD	A Plan for the Conservation and Management of Yellowstone Cutthroat Trout in Wyoming (2014)	Website pending
Multiple	(May 2000) Memorandum of Agreement for Conservation and Management of Yellowstone Cutthroat Trout among MT, ID, WY, NV, U.S. Forest Service YNP, Grand Teton National Park. (2000)	http://www.fws.gov/mountain-prairie/species/fish/yct/archive/Microsoft%20Word%20-%20YCT-MOU.pdf

1.4 *Overlapping Jurisdictions & Authority*

This project overlaps several jurisdictional boundaries (Table 3; Figure 2). These include the states of Montana and Wyoming, the CGNF and SNF, and YNP. Nearly half of the watershed is in YNP, with almost 90% of the YNP portion being in Wyoming. Montana accounts for 32% of the watershed. The entire portion of the watershed that is in the SNF is part of the North Absaroka Wilderness. Private land accounts for 3% of the watershed area.

Table 3. Percentages and acres of the upper Soda Butte Creek watershed under the existing stewardship categories.

Stewardship	*Acres*	*Percent of Watershed*	*Percent in Montana*	*Percent in Wyoming*	*Acres in Montana*	*Acres in Wyoming*
Private Lands	1,040	3	8		1,040	
YNP	18,092	48	5	43	1,843	16,249
CGNF	9,130	24	76		9,130	
SNF/North Absaroka Wilderness	9,303	18		24		9,303
Total	**37,565**	**100**	**25**	**68**	**12,013**	**25,552**

With implementation of the proposed alternative, 38 miles of stream habitat would be available for nonhybridized Yellowstone cutthroat trout (Table 4). In Wyoming, 22 miles of stream are slated for treatment, and 10 of these miles are in the North Absaroka Wilderness. Montana has 16 miles of stream proposed for treatment. Despite the fewer number of stream miles, Montana is the project lead because the brook trout originated in Montana, and Soda Butte Creek is most accessible from Montana. The number of stream miles in YNP, the CGNF, and the SNF are roughly equal, with 10 to 13 miles of stream. Only 4 miles of stream flow through private lands.

Table 4. Number and percent of stream miles to be treated in the Soda Butte Creek watershed under existing stewardship categories.

Stewardship	*Miles Treated*	*Percent of Watershed*	*Percent in Montana*	*Percent in Wyoming*	*Miles in Montana*	*Miles in Wyoming*
Private Lands	4	11	11		4	
YNP	13	35	4	31	1	12
CGNF	10	27	27		10	
SNF/North Absaroka Wilderness	10	27		27		10
Total	38	100	42	58	16	22

Because the project crosses so many jurisdictional boundaries, authority to conduct this project comes from several sources. In Montana, authority comes from the following requirements under the Montana Code Annotated (MCA § 87-1-702; § 87-1-201[9][a]), which authorize FWP to:

- Perform such acts as may be necessary to the establishment and conduct of fish restoration and management projects;
- Manage wildlife, fish, game and nongame animals in a manner that prevents the need for listing under § 87-5-107 or under the federal Endangered Species Act (ESA), 16 U.S.C. 1531, *et seq*.;
- Manage listed species, sensitive species, or a species that is a potential candidate for listing under the ESA in a manner that assists in the maintenance or recovery of those species.

In Wyoming, the Wyoming Game and Fish Commission provides for the direction and supervision of the Wyoming Game and Fish Department and through the department provides an adequate and flexible system of control, propagation, management and protection, and regulation of all wildlife in Wyoming (W.S. 23-1-301-303, W.S. 23-1-401).

State agencies use piscicide to remove nonnative fish populations and many treatments occur on National Forest System lands in Region 2. The USFS Rocky Mountain Region has an MOU with state agencies that identifies responsibilities for various management actions. A central theme of these MOUs, the Fish and Wildlife Coordination Act (Public Law 85-624), and the Sikes Act

(Public Law 93-452) is one of coordination among states and the Forest Service. In the spirit of these agreements and laws, the determination of a need to treat and the application of pesticides consistent with label requirements are considered state actions but are coordinated under the cooperation of the local FS unit and in some cases the region.

Forest Service policy (FSM 2320) states that chemical treatment may be necessary to prepare waters for the reestablishment of indigenous fish species, consistent with approved wilderness management plans, to conserve or recover federally listed threatened or endangered species, or to correct undesirable conditions resulting from human activity. Proposals for chemical treatments are considered and may be authorized by the federal administering agency through application of the MRDG as outlined in Section E., General Policy (Association of Wildlife and Fish Agencies 2006). Any use of chemical treatments in wilderness requires prior approval by the federal administering agency.

The U.S. Forest Service authorizes the use of piscicide in designated wilderness using the analysis presented in an EA. The Forest Service draft decision is subject to the objection process pursuant to 36 CFR 218, subparts A and B. Objections will only be accepted from those who have previously submitted specific written comments regarding the proposed project during scoping or other designated opportunity for public comment in accordance with § 218.5(a). Issues raised in objections must be based on previously submitted timely, specific written comments regarding the proposed project unless based on new information arising after the designated comment opportunities.

Sensitive fish and wildlife species on National Forest System Lands are managed under the authority of the National Forest Management Act (NFMA), and are administratively designated by the Regional Forester (FSM 2670.5; USFS 2004). The project area is included in Forest Service regions 1 and 2 on the Custer Gallatin and Shoshone National forests, respectively. FSM 2670.22 requires the maintenance of viable populations of native and desired nonnative species and to avoid actions that may cause a species to become threatened or endangered. The NFMA directs the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." [16 U.S.C. 1604(g)(3)(B)]. Providing ecological conditions to support diversity of native plant and animal species in the project area satisfies the statutory requirements. The Forest Service's focus for meeting the requirements of NFMA and its implementing regulations is on assessing habitat to provide for a diversity of species.

FSM 2672.42 directs the Forest Service to conduct a biological evaluation (BE) to analyze impacts on sensitive species. If any unmitigated, significant effects are identified in the BE, the deciding officer must make a decision to allow or disallow the impact. If the significant effects would result in a trend toward federal listing, the deciding officer cannot allow the project to proceed. The Forest Service's decision authority with respect to this project is limited to the use

of pesticide in wilderness. The analysis for sensitive aquatic species in this document is intended to inform the FS Region 2 decision whether to allow pesticide use in the North Absaroka wilderness and meets the requirements for a BE as outlined in FSM 2672.42. A separate stand-alone BE for effects to sensitive terrestrial wildlife species was also prepared for this project. See Table 5 below for a list of sensitive species.

The Yellowstone cutthroat trout is the only sensitive fish species occurring in the analysis area. Forest Service regions 1 (CGNF) and 2 (SNF) list the northern leopard frog (*Rana pipiens*) and the western toad (*Anaxyrus boreas*) as sensitive species. Neither of these two sensitive amphibian species were detected during a 1999 herpetofauna survey of the Gallatin National Forest survey conducted by Atkinson and Peterson (2000). Moreover, Werner et al. 2004 shows that the occupied range of the northern leopard frog is outside of the project area. In addition to these two amphibian species, the Columbia spotted frog (*Rana luteiventris*), which has been documented in the project area, is a FS Region 2 listed sensitive species. This report constitutes the BE for Yellowstone cutthroat trout, northern leopard frog, western toad, and Columbia spotted frog.

Under Section 7 of the ESA, each federal agency must ensure that any action authorized, funded or carried out is not likely to jeopardize the continued existence of any threatened or endangered species or critical habitat. A biological assessment (BA) was completed for the project and sent to the USFWS for informal consultation and concurrence (Appendices: NEPA Compliance Documents). Potentially affected threatened and endangered species and habitats include grizzly bear, Canada lynx, Canada lynx critical habitat, and gray wolf. The final Forest Service decision for piscicide use in the North Absaroka Wilderness would not be signed until concurrence is received.

1.5 *Estimated Commencement Date:*

Pending weather and stream flow, bioassays to determine the minimum effective concentration needed would occur before treatment during summer low flows. Full piscicide treatment would likely occur the in mid to late August 2015, weather permitting. Additional treatments in subsequent years would occur if a total fish kill is not achieved.

1.6 *Consultation*

Preparation of this EA included consultation with several entities. On April 20, 2015, FWP sent a letter to the Crow Tribe, alerting them to this project, and soliciting comment on the potential for the project to harm cultural resources or resources with religious value.

FWP contacted Bryce Maxell a zoologist with the Montana Natural Heritage Program for information on the potential of the project to have a negative effect on amphibians.

FWP contacted Larry Lahren, an archeologist, to ascertain which tribe occupied the project area before European settlement.

2 Alternatives

2.1 *Alternatives Considered*

2.1.1 Alternative A: Proposed Action

The proposed action calls for using the piscicide CFT Legumine, a commonly used formulation of rotenone, for chemical removal of all fish in the Soda Butte Creek watershed from its headwaters downstream to Ice Box Canyon. Treated waters would include the main stem of Soda Butte Creek, its tributary streams, associated wetlands, (Figure 6), and several unnamed tributaries).

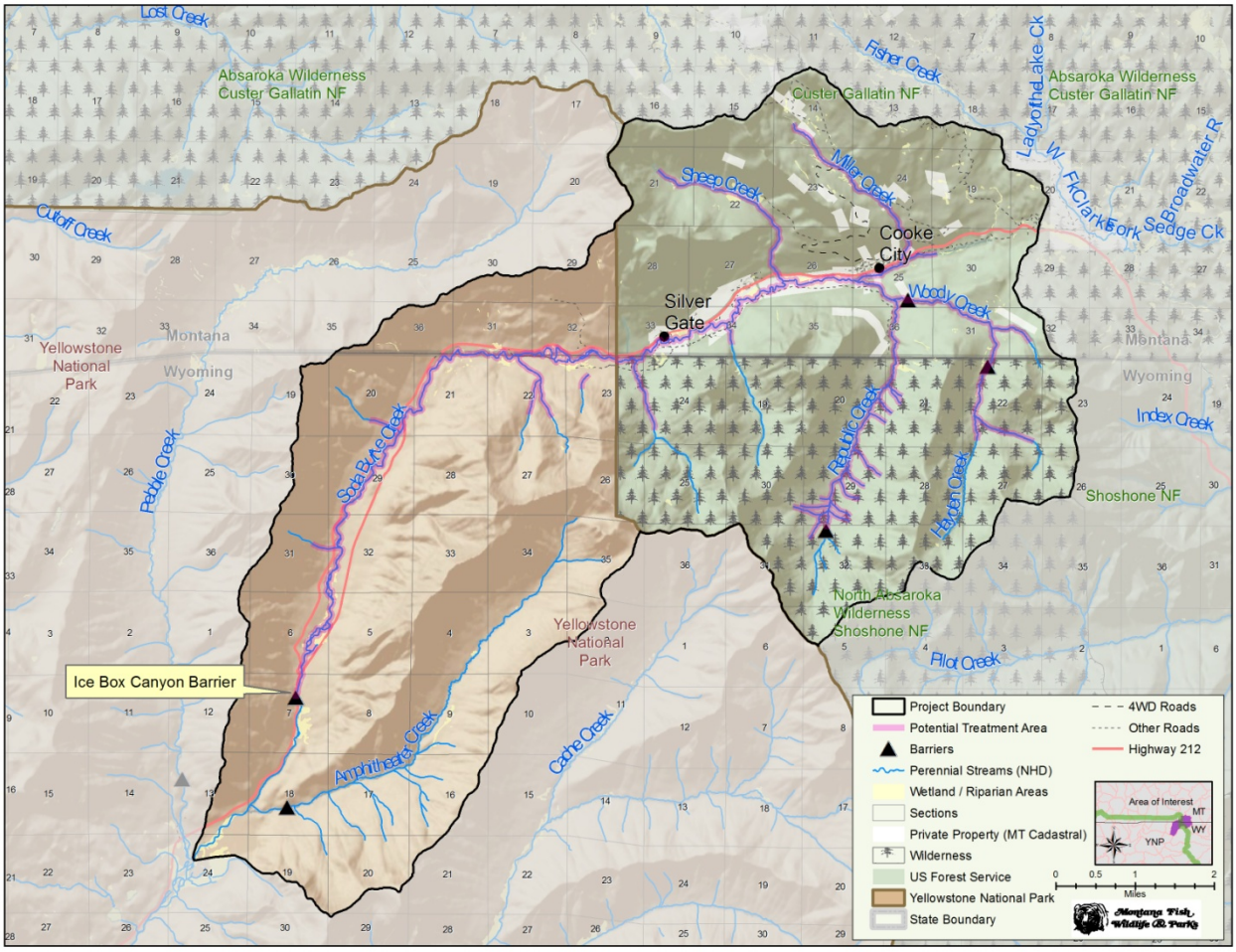

Figure 6. Proposed treatment area in the Soda Butte Creek watershed.

The primary means of delivering the CFT Legumine solution to streams would be the use of drip stations in accordance with all established label guidelines. Drip stations are 5-gallon containers filled with a solution of water and CFT Legumine (Figure 7). A bioassay would allow calculation of the lowest effective dose of rotenone for the project waters. The concentration of CFT Legumine in drip stations would likely be in the range of 0.5 to 10 ppm. Once diluted in the stream, the concentration of rotenone would be 25 to 50 ppb, which is roughly equal to ¼ to ½ - grains of table salt per liter. The drip station releases a thin stream of the diluted CFT Legumine, and runs at least 4 hours. Fieldworkers with backpack sprayers would apply the same concentration of CFT Legumine to off-channel waters, such as wetlands and isolated pools.

Figure 7. Drip station

Powdered rotenone mixed with sand and gelatin would be used in several situations. The rotenone-sand matrix would be placed at the mouths of small tributaries or seeps, to prevent fish from finding refugia from lethal concentrations of rotenone.

A detoxification station releasing potassium permanganate ($KMnO_4$) would be established at the barrier in Ice Box Canyon, and a backup station would be established at ½ hour of the streams'

travel time from the first station. The backup station would be operated only if the primary station fails to oxidize the rotenone.

Fieldworkers would access designated points on stream by hiking. Horses may be used to transport gear into more remote sites. Helicopter support would transport personnel and gear into the Sheep Creek drainage. The use of helicopter would occur over 2 days or less.

Following successful removal of all fish, nonhybridized Yellowstone cutthroat trout would be restocked in the Soda Butte Creek watershed. The stocked fish would come from the best available source of Yellowstone cutthroat trout. Ideally, these would be fish from within the Lamar River watershed, as this project is part of YNP's native fish management plan for the Lamar River (Koel et al. 2011), and the fish would be genetically adapted to the area. The specific source of fish is yet to be determined.

Benthic macroinvertebrate monitoring would follow FWP's piscicide policy (FWP 2012). As no sensitive species have been captured in Soda Butte Creek, and the objective is to evaluate recovery of benthic macroinvertebrate populations, Soda Butte Creek falls into category 1 protocol for sampling. Sampling would occur about 1 month before piscicide treatment. The sampling approach would use a travelling kick net at 3 sites within the treatment area, and sampling at 1 control site outside of the treatment area. Calculated metrics would include taxa richness, % EPT (mayflies, stone flies, and caddis flies), and catch per unit effort. Invertebrates would be identified to the lowest practical taxonomic level.

As a considerable portion of the treated waters flow through designated wilderness, additional sampling would occur to evaluate if the project would have any effect on wilderness values. Macroinvertebrates would be collected in streams flowing through the North Absaroka Wilderness, using the same FWP protocols for category 1 streams (FWP 2012).

Monitoring, using electrofishing, snorkeling, or both, would allow determination of the effectiveness of the chemical removal effort. Often, especially in high gradient streams with simple habitat, a single treatment is sufficient. In streams with complex habitat, including beaver dams and adjacent wetlands, total elimination requires more than 1 treatment. Project collaborators would evaluate the success of chemical removal soon after the treatment. If fish remain, a second or third treatment in subsequent years would be necessary. In some cases, retreatment of a portion of the project area would meet the project objective. Monitoring would also allow measurement of the recovery of the Yellowstone cutthroat trout population, with monitoring efforts following the area fisheries biologist's monitoring schedule.

The average cost per year for the preferred alternative is estimated to be slightly higher than the average yearly cost of previous mechanical removal efforts. However, the preferred alternative has a foreseeable conclusion, whereas mechanical removal effort in Soda Butte is assumed

perpetual, thus so are its associated costs. Furthermore, anything less than complete eradication of brook trout would allow their invasion into the Lamar River drainage, and the effect of this invasion on the Lamar River watershed would incur direct and indirect costs that are impossible to estimate.

2.1.2 Alternative B: No Action

The no action alternative means agencies would not conduct any fish removal in Soda Butte Creek.

2.2 *Alternatives Considered but Dismissed from Consideration*

2.2.1 Alternative C: Mechanical Suppression

Under this alternative, project partners would periodically conduct removal efforts to suppress brook trout in Soda Butte Creek and its several tributaries. All brook trout captured during electrofishing would be removed and Yellowstone cutthroat trout would be returned to the stream. The intensity of mechanical removal that occurred from 2004 through 2013 is infeasible to continue in perpetuity. Therefore, the frequency of removal efforts would decrease and would be contingent on the managing area biologists' workloads.

Although this alternative has been dismissed from consideration, it was the preferred alternative for decades. Therefore, justifying its abandonment requires in-depth explanation. Accordingly, mechanical suppression is among the alternatives evaluated in Chapter 3.

2.2.2 Spot Treating with Rotenone

This alternative calls for spot treating with rotenone. Spot treating kills fish within waters receiving a toxic dose of rotenone. Brook trout are widely dispersed within the project area. Brook trout escaping exposure to rotenone would continue to reproduce and invade streams within Soda Butte Creek and the larger Lamar River watershed. Moreover, spot treatment would leave untreated water that would harbor brook trout. Spot treatment would not eliminate or reduce hybridization in the Soda Butte Creek watershed.

2.2.3 Angling

Angling is an inefficient means to eradicate fish from streams. Unlike piscicide, anglers cannot target young-of-the-year fish. Furthermore, many of the tributaries are steep, small streams and are often covered with deadfall timber. Few anglers would desire to fish these waters, given the difficulty in accessing them, and the relatively low abundances and small size of the fish. Any reductions in fish numbers from angling would free resources for the next generation of brook trout.

3 Affected Environment and Predicted Environmental Consequences

3.1 *Land Use*

3.1.1 Alternative A: Proposed Action – Land Uses

The proposed action is most likely to have influence on hunting and angling. Land uses such as timber harvest, agriculture or mining would remain unaffected. Although unlikely, the proposed action could extend into hunting season, and fieldworkers could displace wildlife and be a nuisance to hunters. Nonetheless, fish removal efforts upstream of the barrier would be limited to the stream corridor, leaving the majority of the landscape unaffected. Moreover, agencies regularly conduct fieldwork into hunting season, so this project would not present a new disturbance for hunters. Overall, this work would result in short-term and minor effects on hunting.

Treatment with rotenone would drastically reduce or eliminate fishing opportunities in treated reaches until project completion. The result would be temporary, as Soda Butte Creek would be restocked with nonhybridized Yellowstone cutthroat trout. Nonetheless, the poor quality of fishing could be a nuisance or source of contention from local or visiting anglers. Agency response would be to include informational meetings and posting of signs along the stream alerting anglers to the temporary elimination of fish. Public outreach conducted in Cooke City, Montana, has found substantial support from local landowners. This EA's public comment period would expand the outreach to anglers, conservationists, and anyone else with interest in Soda Butte Creek. The return of nonhybridized Yellowstone cutthroat trout to Soda Butte Creek would compensate for the loss of the existing fishery. In removal projects, cutthroat trout populations replace the removed nonnative species (Shepard 2010). Therefore, no changes in abundance or biomass of fish would occur,

3.1.2 Alternative: No Action

Land uses would be unaffected by the no action alternative.

3.1.3 Alternative C: Mechanical Suppression

Mechanical suppression requires more crews and bulky equipment. The duration for each year's effort would be about the same length as piscicide treatment, although mechanical removal efforts would occur over a greater number of years. In past years, removal efforts occurred during hunting season, and no disturbance or conflicts with hunters was observed. Fieldworkers would temporarily displace game from the stream corridor; however, this would be short-term and minor. Moreover, hunters would have the rest of the landscape outside of YNP in which to hunt.

3.1.4 Cumulative Effects of Alternatives on Land Use

Implementing the project as described would have minor and short-term effects on land uses in the Soda Butte Creek watershed: however, no cumulative effects on existing land uses would be expected. The temporary elimination of fish would result in a lack of fish in Soda Butte Creek until project completion, which is when the fish removal is successful. Signs posted along Soda Butte Creek would educate anglers about the project, so they do not fish fishless waters. Anglers would still have access to high quality fishing opportunities in YNP. As mechanical removal is more labor intensive and requires more fieldworkers, it would present more of a disturbance for hunters and wildlife than chemical removal, although this disturbance would still be short-term and minor. The no-action alternative would not affect land use.

3.2 *Soils*

3.2.1 Alternative A: Proposed Action

Soils would be unaffected by the proposed action.

3.2.2 Alternative B: No Action

The no-action alternative would not affect soils.

3.2.3 Alternative C: Mechanical Suppression

The mechanical suppression option would not affect soils.

3.2.4 Cumulative Effects on Soils

None of the alternatives would have a cumulative effect on soils.

3.3 *Vegetation*

3.3.1 Alternative A: Proposed Action—Vegetation

The proposed action would entail fieldworkers and horses. Fieldworkers would trample vegetation; however, this disturbance would be short-term, minor, and limited to the riparian corridor or near trails. Horses and fieldworkers have the potential to spread noxious weeds from feed and clothing. Requiring certified weed-free hay and mandatory removal of weeds from clothing, footwear, and equipment would greatly reduce the potential for the spread of noxious weeds.

3.3.2 Alternative B: No Action

The no-action alternative would not affect vegetation.

3.3.3 Alternative C: Mechanical Suppression

Mechanical suppression would result in fieldworkers trampling vegetation. In addition, electrofishing along Soda Butte Creek would require use of one or more boat-mounted

generators and an electrofisher. Occasionally, the boats are dragged across vegetation, which would result in short-term compression.

3.3.4 Cumulative Effects of Alternatives on Vegetation

For the chemical removal or mechanical suppression alternative, the presence of fieldworkers and horses would have a short-term and minor effect on vegetation. Trampling streamside vegetation would be the primary disturbance, although the presence of humans could introduce noxious weeds into the project area. The effects on vegetation can be minimized by scheduling the project towards the end of August, when most plants would be past their vulnerable, reproductive stages. Vehicles would receive an undercarriage wash, fieldworkers would wear weed-free clothing, and horses would have weed free hay to reduce the potential for spread of noxious weeds. Because of the increase in duration and number of people, mechanical suppression would have more effects on vegetation than would piscicide treatment. Nonetheless, this would be short-term and minor. The no-action alternative would not affect vegetation. No cumulative effects on vegetation are expected with the implementation of any of the alternatives.

3.4 *Wildlife and Fish*

3.4.1 Alternative A: Proposed Action

Changes in the Diversity and Abundance of Game Animals and Birds

Given its proximity to YNP and wildness of the surrounding area, the project area supports an abundance of game species, including moose (*Alces alces*), elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), and black bear (*Ursus americanus*). In addition, dusky grouse (*Dendragapus obscures*) and ruffed grouse (*Bonasa umbellus*) are also likely abundant.

The proposed action would have short-term and minor effects on game species. The presence of fieldworkers would disturb game species for 1 to 2 days in a given area. Most of the young of these species would be relatively mature, and capable of withstanding this short-term disturbance.

Potential Effects on Species of Special Concern and Sensitive, Threatened or Endangered Species

The Montana Natural Heritage Program (MNHP) maintains a database and field guide on species distribution, status, ecology, life history strategies of animals, and sightings throughout the state. This database provided the technical basis for determining potential effects on species of special concern. The database includes a comprehensive list of citations to support information presented in the field guide and this document. A query of animals occurring within the Soda Butte Creek area indicate the presence of a diversity of big game species, birds, small mammals, reptiles, and amphibians typical of this type of environment.

Given the proximity to YNP and the wildness of surrounding country, the project area is within the range of numerous species of special concern and species designated as sensitive by the U.S. Forest Service (Table 5). The ranges delineated are broad and may not reflect the suitability of habitat for a given species occurring within the project area. This evaluation focuses on species likely to live and breed in a high elevation, forested, montane environment during the treatment period in August, and includes observations of presence of species, evidence of breeding, or other indicators of a species' presence.

For most species, the disturbance would be short-term and minor, with temporary disturbance from fieldworkers hiking along a stream and attending drip stations. The duration of the disturbance would likely be 1 to 2 days per treated reach. Note that a later August treatment date is past the breeding season of most species.

Table 5: Species of special concern, sensitive, and threatened species with ranges overlapping the project area (See the biological evaluation in Appendices: NEPA Compliance Documents for complete list of sensitive and listed species in the CGNF and SNF).

Class	***Common Name***	***Scientific Name***	***FWP Status***	***U.S. Forest Service Status***
Amphibia	Western toad	*Anaxyrus boreas*	S2	Sensitive
	Northern leopard frog	*Rana pipiens*		Sensitive
	Columbia spotted frog	*Rana luteiventris*		Sensitive
Fish	Yellowstone cutthroat trout	*Oncorhynchus clarkii bouvieri*	S2	Sensitive
Aves	Harlequin duck	*Histrionicus histrionicus*	S2B	Sensitive
	Northern goshawk	*Accipiter gentilis*	S3	
	Golden eagle	*Aquila chrysaetos*	S3	
	Brown creeper	*Certhia americana*	S3	
	Clark's nutcracker	*Nucifraga columbiana*	S3	
	Black rosy finch			
Mammalia	Fringed myotis	*Myotis thysandodes*	S3	
	Hoary bat	*Lasiurus cinereus*	S3	
	Spotted bat	*Euderma maculatum*	S3	Sensitive
	Townsend's big-eared bat	*Corynorhinus townsendii*	S3	Sensitive
	Grizzly bear	*Ursus arctos*	S2S3	Threatened
	Wolverine	*Gulo gulo*	S3	Sensitive
	Gray wolf	*Canis lupis*		Listed in Wyoming
	Lynx	*Lynx canadensis*	S3	Threatened
	Bison	*Bison bison*	S2	
	Dwarf shrew	*Sorex nanus*	S2S3	
	Merriam's shrew	*Sorex merriami*	S3	

Definitions of Status Codes and Descriptors
S2 = At risk because of very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
S3=Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.
S2B = an at risk breeding population, with an S2 ranking
S2S3 = Indicates that populations in different geographic portions of the species' range in Montana have a different conservation status *(e.g., S1 west of the Continental Divide and S4 east of the Continental Divide).*
Sensitive = Listed as a sensitive species USFS regions 1 and 2.
Threatened = Listed as threatened under the U.S. Endangered Species Act

The species of special concern, sensitive, and threatened species with the most potential to experience short-term disturbance in the area are: Columbia spotted frogs, western toads, Yellowstone cutthroat trout, harlequin ducks, lynx, and grizzly bears. The MNHP lists no observations of western toads in the Soda Butte Creek drainage; neither have crews removing brook trout encountered western toads. Nonetheless, the MNHP's database lists 1 observation at

a similar elevation in an adjacent drainage. Due diligence requires addressing this species, given the proximity of an observation to the Soda Butte Creek watershed. There have been no recorded observations of northern leopard frogs within the project area, which is outside their range (Werner et al. 2004). Effects of piscicide treatment on amphibians are described in detail in sub-chapter 3.4.4., Cumulative Effects on Wildlife and Fish.

Yellowstone cutthroat trout would benefit substantially from this project. The proposed action would restore nonhybridized Yellowstone cutthroat trout to 38 stream miles. This accomplishment is consistent with conservation planning objectives established by all agency partners and meets their obligation to implement projects as agreed to under the MOU (MCSTC 2007).

The MNHP database lists one sighting of a harlequin duck in the watershed, which is designated as an indirect indicator of breeding. Harlequin ducks have the unique life-history strategy of overwintering along coastal, rocky shores of the Pacific Ocean, then flying hundreds of miles inland to breed in high gradient, mountain streams. Males arrive first in early spring, and depart in June following breeding. Females arrive later and remain until late July to early September. The MNHP lists a single observation of a harlequin duck on Soda Butte Creek near Silver Gate, Montana. The date of the sighting is September 3, 2004. A single sighting along a heavily fished stream suggests that harlequin ducks are rare in Soda Butte Creek. Moreover, the treatment would occur during their outmigration period, so that these birds, including the fledgling ducklings, would be mobile.

Grizzly bears are common in the project area, and the project would increase the potential for conflicts with humans by providing dead fish within Soda Butte Creek and its tributaries. Furthermore, fieldworkers would be venturing into grizzly bear habitat, which could result in potentially dangerous encounters with grizzly bears. To prevent bear-human conflicts, all attractants (including food, garbage, and chemicals associated with fish removal) would be stored in compliance with the relevant Food Storage Order for the Custer-Gallatin or Shoshone National Forest. In addition, fish killed through chemical treatment would be collected within 24 hours, and disposed of in accordance with applicable Food Storage Order requirements. This applies to all portions on National Forest lands of Soda Butte Creek and the lower ¼-mile of all its tributaries that would be treated.

To mitigate for risks of conflicts between bears and humans, all fieldworkers would make noise and camp in hard-sided campers. All participants in project activities would be trained in bear safety practices and the proper use of bear pepper spray, and would carry bear pepper spray at all times while working outside of vehicles or developed areas. Signs would educate the public on the project, and warn recreationist about the potential for increased bear activity along the stream. To minimize disturbance to grizzly bears, helicopter use for transporting personnel and equipment into the Sheep Creek drainage would be limited to 2 days annually between July 1-

August 22nd. Daily helicopter flight paths would follow the shortest practical and safe route between landing zones. Finally, any incident involving a grizzly bear or black bear would be reported to the Forest Service representative within 24 hours. Project activities may be immediately temporarily suspended or modified if such an action is necessary in order to prevent bear-human conflicts. With adherence to these design criteria and mitigations, the effect determination for grizzly bear in the attached BA is "*may effect - not likely to adversely affect.*"

The gray wolf is protected under the endangered species list in Wyoming, but has no special status in Montana. The biological assessment for terrestrial wildlife species (Pils 2015; Appendices: NEPA Compliance Documents) concluded that the proposed action is "*Not likely to jeopardize the continued existence of the grey wolf*." There would be no changes to prey base or open road density. The project would have no effects on den or rendezvous sites.

The project area is within the range of the Canada lynx. The biological assessment for terrestrial wildlife species (Pihls 2015; Appendices: NEPA Compliance Documents) found the project would have "no effect" on Canada lynx. The determination is based on the following rationale: 1) the project complies with the Northern Rockies Lynx Management Direction; 2) snowshoe hare habitat would not be reduced; 3) trail use, camping, and dispersed off-road activities would be consistent with existing travel management direction; and 4) activities would occur during spring, summer, and fall.

Effects on Fish

The proposed actions would temporarily eliminate all fish in treated reaches of Soda Butte Creek and its tributaries. Species affected would include brook trout and hybridized Yellowstone cutthroat trout. Restocking Soda Butte Creek with locally acquired, nonhybridized Yellowstone cutthroat trout would restore these waters to their historic condition, which is among the objectives of the MOU (MCTSC 2007) and other conservation planning documents (Table 2). Moreover, the return of nonhybridized Yellowstone cutthroat trout restores biological integrity given the intrinsic value of native species.

Potassium permanganate exposure in the detoxification zone also has potential to affect fish. According to the material safety data sheet for Potassium permanganate , the 96-hour lethal concentration for 50% of test fish is 1.8 mg/L, which is nearly twice the treatment concentration. Furthermore, Potassium permanganate has a low estimated lifetime in the environment, as it oxidizes to potassium and insoluble manganese dioxide. Therefore, the effect of release of Potassium permanganate to detoxify rotenone would result in minor and short-term effects on water quality.

The effects on the range-wide distribution of brook trout and rainbow trout would be minor. These species have broad distribution in Montana and Wyoming. This project would have a minimal effect on their distribution, as most streams supporting rainbow trout and brook trout

would continue to support them. Moreover, Soda Butte Creek does not currently support a rainbow trout population, but the existing Yellowstone cutthroat trout have genes from rainbow trout and westslope cutthroat trout owing to historic stocking or past invasion. Opportunities to protect or restore Yellowstone cutthroat trout are relatively limited, and require areas protected by a natural or constructed barrier. Furthermore, a sufficient amount of connected habitat must be available in order to have a population size that would be resilient to inbreeding and catastrophic events. The proposed alternative provides an opportunity to establish a nonhybridized population of Yellowstone cutthroat trout in a large, secure drainage adjacent to and within YNP. These opportunities are relatively rare, and rainbow and brook trout would continue to be widespread and abundant in other waters in Montana and Wyoming.

The effects on Yellowstone cutthroat trout would be immensely beneficial. As discussed in 1.2 Objective of Proposed Action, Yellowstone cutthroat trout have experienced substantial declines in abundance and distribution. The preferred alternative would restore 38 miles of stream habitat to its historic condition of supporting a native and nonhybridized Yellowstone cutthroat trout population. Moreover, it would eliminate a source of brook trout and nonnative genes that could expand into the greater Lamar River watershed.

Diversity or Abundance of Nongame Species

This piscicide portion would have potential to result in changes in diversity and abundance of a variety of nongame wildlife species. Again, the MNHP database provided the descriptions of distribution and life history strategies. This section examines the risks to wildlife associated with direct exposure to rotenone, a diminished prey base relating to reduced biomass of fish or aquatic invertebrates, or exposure to rotenone through ingestion of dead animals or treated water. For mobile species, the presence of humans, horses, and a helicopter would result in temporary displacement, which would be short-term and minor.

Rotenone is highly toxic to fish, and treatment would eliminate all fish within the treatment area. A near fishless condition would remain in the project area until full removal of the existing fish. This area would then be restocked with nonhybridized Yellowstone cutthroat trout. Recovery of the Yellowstone cutthroat trout population would be evaluated in the following years with electrofishing surveys or snorkeling according to the area biologist's monitoring schedule. By removing a competing nonnative species and restoring a genetically pure Yellowstone cutthroat population, the proposed action would result in a "*Beneficial Impact*" to Yellowstone cutthroat trout in the upper Soda Butte Creek drainage (Pihls 2015; Appendices: NEPA Compliance Documents).

Brook trout may be functionally different predators, which may result in changes in species composition of the aquatic invertebrate community (Benjamin et al. 2011; Lepori et al. 2012). This difference may also change trophic or food web level functioning. Nonetheless, overall density and production of invertebrates has not been detectable in macroinvertebrate

communities facing brook trout versus cutthroat trout predation (Lepori 2012). Restoring the native fish species is consistent with improved biological integrity, as the native fish would exert the same community level pressure on invertebrates with which they evolved.

Gilled aquatic invertebrates are nontarget organisms with considerable potential to experience negative effects from piscicide treatment. In streams, benthic populations of true flies, stone flies, mayflies, and caddis flies would be the primary affected taxa. Owing to a number of factors, these effects would be short-term and temporary.

Although differences in formulation, concentration, and duration of rotenone treatment complicate making robust predictions on the effects of rotenone on macroinvertebrates, the scientific literature allows for some generalizations. Investigations into the effects of rotenone on benthic organisms indicate that rotenone results in temporary reduction of stream-dwelling invertebrates. In one case, no significant reduction in aquatic invertebrates occurred despite concentrations of rotenone being twice as high as the proposed concentration (Houf and Campbell 1977). In other cases, invertebrates recovered quickly after treatment. For example, after piscicide treatment of a California stream, macroinvertebrates experienced an “explosive resurgence” in numbers, with black fly larvae recovering first, followed by mayflies and caddis flies within 6 weeks after treatment (Cook and Moore 1969). Stoneflies returned to pretreatment abundances by the following spring. Another mitigative factor is that invertebrates that were most sensitive to rotenone also tended to have the highest rate of recolonization due to short life cycles (Engstrom-Heg et al. 1978). Although gill-respiring invertebrates are a sensitive group, many are far less sensitive to rotenone than fish (Schnick 1974; Chandler and Marking 1982; Finlayson et al. 2010). Due to their short life cycles (Anderson and Wallace 1984), good dispersal ability (Pennack 1989), and generally high reproductive potential (Anderson and Wallace 1984), aquatic invertebrates are capable of rapid recovery from disturbance (Boulton et al. 1992; Matthaei et al. 1996).

Larval drift and reproduction by aerial adults are the primary mechanisms of recovery, and several miles of stream upstream of the treatment area would provide a source of invertebrates drifting into reclaimed waters. Likewise, aerial adults from downstream would lay eggs and repopulate invertebrate communities. Proximity to adjacent sub-watershed populations would further expedite this recovery. Moreover, macroinvertebrates would be in a diverse array of life history stages with varying susceptibility to rotenone, and adults would be able to reproduce soon after treatment. Observations on Lower Deer Creek documented a substantial hatch of caddis flies and midges the day following treatment of an area (C.L. Endicott, FWP, personal communication).

The well-established ability of macroinvertebrates to recover after disturbance, combined with the lower susceptibility of many taxa to rotenone, would contribute to rapid recovery of invertebrate populations. Disturbance is a common occurrence in streams and includes floods,

wildfire, and human-caused alterations such as incompatible livestock grazing practices (Mihuc and Minshall 1995; Wohl and Carline 1996; Minshall 2003). These disturbances have greater potential to have long-term effects on stream-dwelling assemblages than piscicide treatments, given longer-term changes in geomorphology, impairment of riparian health and function, and reduced water quality. Rotenone treatment mimics a pulse disturbance, which is common in streams, and aquatic macroinvertebrates have evolved in this disturbance regime.

The MNHP's list of species of special concern does not report any rare or unique invertebrates within the general area of the Soda Butte Creek project, nor has monitoring in neighboring streams found any species of special concern. Numerous instances of pre-project sampling in fish-bearing or fishless waters have never detected invertebrate species of special concern (D. Gustafson, Montana State University retired, personal communication). Non–fish-bearing reaches within the watershed would not be treated, so invertebrates that have not coevolved with fish would not be affected.

Implementation of a monitoring plan will allow evaluation of the short- and long-term effects of piscicide treatment on invertebrates. Sampling would follow FWP protocols (FWP 2012) for category 1 streams, which are those with no records of sensitive species. A sampling event would occur 1 month before treatment, followed by another sampling event in the following year. Sampling would occur at 3 sites within the project area, and 1 control site upstream of treated waters. Macroinvertebrate samples would also be collected on each stream flowing through designated wilderness, using the same schedule.

Additional data are available to aid in evaluating the response of macroinvertebrate communities to piscicide treatment in Soda Butte Creek. The Montana Department of Environmental Quality (DEQ), the CGNF, and YNP have been monitoring macroinvertebrates in Soda Butte Creek for years. These data provide source of information on the temporal and longitudinal health and composition of benthic communities, and variability across sampling events.

Amphibians have the potential to be exposed to rotenone during treatment. Species that may be in the treatment area during fish removal are the Columbia spotted frog (*Rana luteiventris*) and the western toad. Of these, the Columbia spotted frog has the greatest probability for exposure to rotenone, given their preference for streamside or in-stream habitat. Outside of the breeding season, western toads are less dependent on surface water.

Rotenone is lethal to tadpoles of Columbia spotted frogs and western toads (Grisak 2007; Billman 2010). Treating waters later in the summer would avoid sensitive gilled stages. CFT Legumine is nonlethal to metamorphs, juveniles, and adults (Billman 2010).

Effects on adult frogs would be insignificant, given their low vulnerability to rotenone, their mobility, and project timing. Adult Columbia spotted frogs do not suffer an acute response to trout-killing concentrations of rotenone formulations (Grisak et al. 2007; Billman et al. 2012).

Adult western toads would likely be less sensitive than frogs, given their impermeable skin (Maxell and Hokit 1999). Moreover, adult toads and frogs have the ability to leave the aquatic environment, which substantially reduces the potential for exposure (Maxell and Hokit 1999). The combination of low vulnerability of these species to rotenone, and their mobility, means the effects on adult amphibians would be short term and minor.

In the long term, Columbia spotted frogs may actually benefit from the return of native Yellowstone cutthroat trout to Soda Butte Creek and its tributaries. This species coevolved with Yellowstone cutthroat trout. Moreover, fish introductions are among the threats to Columbia spotted frogs (Maxell 2009). In general, returning native species to an ecosystem is beneficial to the biological integrity of that ecosystem, as it restores communities that have coevolved and are compatible.

Another consideration in predicting the effect of rotenone treatment on toads and frogs is the reproductive capacity of these species. Like invertebrates, Columbia spotted frogs show a prodigious ability to recolonize after piscicide treatment. Columbia spotted frogs rebounded the following spring after application of CFT Legumine in a lake that was treated at the piscicide concentration proposed for this project (Billman et al. 2012). As expected, gill-respiring tadpoles suffered total mortality in the 24 hours following exposure. In contrast, non–gill-breathing metamorphs, juveniles, and adults did not show any apparent response. Monitoring the following year showed that tadpoles repopulated all treated waters and their numbers were similar to, or higher than, pretreatment levels. These tadpoles were the progeny of adult frogs that had overwintered in the area.

Because the known distribution of northern leopard frogs does not extend into the project area, the proposed action would have “no impact” on this species. Because rotenone is lethal to Columbia spotted frog and western toad tadpoles, which may be present during project treatment, but not lethal to adult amphibians, this project “*May impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species*”

Terrestrial and common gartersnakes (*Thamnophis elegans* and *T. sirtalis*) may occur in the project area. A reduction in aquatic based food may affect these snakes, although these species are generalists and would still have forage from terrestrial sources. Nonetheless, the rapid recolonization of invertebrates, a glut of dead fish to consume, and their generalist feeding habits suggest that this project would have no or positive effects on snakes.

A temporary reduction in prey of aquatic origin has the potential to influence mammals, amphibians, reptiles, birds, and bats. The American mink is the mammalian predator of fish that is most likely to occur in the project area. Mink are opportunistic predators and scavengers, with fish and invertebrates comprising a portion of their diet. Therefore, the reduction in density of

fish following treatment may displace mink to adjacent, untreated reaches until fish populations recover. Nonetheless, as opportunists, American mink have flexibility to switch to other prey species and have the ability to disperse.

Other mammalian predators may experience short-term and minor consequences. Opportunistic black bears (*Ursus americanus*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*), coyotes (*Canis latrans*), otters (*Lontra canadensis*), and striped skunks (*Mephitis mephitis*) would likely consume dead fish immediately after piscicide treatment. The temporary reductions of aquatic prey, and the brief availability of dead fish, constitute short-term and minor effects on mammalian predators and scavengers. Removal of dead fish would further minimize the potential effects on mammalian predators, although the EPA (2007) has concluded that there is a low and acceptable risk to birds and mammals from eating dead fish that are exposed to rotenone.

Several bird species with the potential to occur within the project area consume fish or invertebrates with an aquatic life-history stage. The American dipper (*Cinclus mexicanus*) forages for aquatic invertebrates in mountain streams year round. Numerous species of songbird eat winged adults of invertebrates originating from streams but would still have access to invertebrates of terrestrial origin. The effect of a reduction of forage base on birds would be minor and short-term. As rotenone does not affect all aquatic invertebrates, some invertebrate prey would remain to support American dippers, although some level of displacement is possible. Note that follow-up monitoring in Lower Deer Creek, Montana, 1 year after treatment found American dippers at similar numbers as before treatment, presence of numerous juvenile birds, and location of a new dipper nest within the project area (C.L. Endicott, FWP, personal communication).

Bats also consume winged insects. Rotenone projects therefore have potential to have a negative effect on bats. Diet preferences and seasonal habitat use for bats in the project area indicate that effects on bats would be negligible. Bat species that may occur in the project area consume mostly invertebrates of terrestrial origin. Because of the rapid recovery of aquatic invertebrates, and a lack of reliance on invertebrates of aquatic origin, bats would experience no adverse effects from piscicide treatment in Soda Butte Creek.

Ingestion of rotenone, either from drinking rotenone-treated water or from consuming dead fish or invertebrates from rotenone-treated streams, is a potential route for rotenone exposure for wildlife. A substantial body of research has investigated the effects of ingested rotenone in terms of acute and chronic toxicity and other potential health effects. An important consideration in reviewing these studies is that most of the laboratory studies used exceptionally high concentrations of rotenone that would be unattainable under proposed field application. The low level of effects at these superelevated concentrations indicates that risks to wildlife from

exposure to proposed levels would be minor and short-lived, if wildlife experience any effects from ingesting treated water or dead fish and invertebrates.

In general, ingested rotenone does not affect mammals because of digestive action in their stomach and intestines (AFS 2002). Investigations examining the potential for acute toxicity from ingesting rotenone find that mammals would need to consume impossibly high amounts of rotenone-treated water or rotenone-killed animals to obtain a lethal dose. For example, a 22-pound dog would have to drink nearly 8,000 gallons of treated water within 24 hours or eat 660,000 pound of rotenone-killed fish within a day to receive a lethal dose (CDFG 1994). A half-pound mammal would need to consume 12.5 mg of pure rotenone or drink 66 gallons of treated water for a lethal dose (Bradbury 1986). In comparison, the effective concentration of rotenone to kill fish is 25 to 50 ppb, which is several orders of magnitude lower than concentrations resulting in acute toxicity to mammals.

Evaluations of mammals' potential exposure to rotenone from scavenging indicate that acute toxicity from ingesting rotenone-killed fish is highly unlikely (EPA 2007). Estimation of the daily consumption of dead fish by an “intermediate-sized mammal” of 350 mg, which is about half the size of a male American mink, estimated a daily dose of 20.3 ppb of rotenone. This is well below the median lethal dose of 13,800 ppb of rotenone for a mammal of that size. A “large mammal” is one with 1,000 g body weight, which is within the weight range for female American mink. If a mammal of that size fed exclusively on fish killed by rotenone, it would receive an equivalent daily dose of 37 ppb of rotenone. In comparison, the estimated median lethal concentration of rotenone for a 1,000 g mammal was 30,400 ppb, which is over 800 times the daily dose. The EPA (2007) concluded that piscivorous mammals were highly unlikely to consume enough fish to result in acute toxicity.

Chronic toxicity associated with availability of dead fish over time would not pose a threat to mammals, nor would other health effects be likely. Rats and dogs fed high levels of rotenone for 6 months to 2 years experienced only diarrhea, decreased appetite, and weight loss (Marking 1988). The unusually high treatment concentrations did not cause tumors or reproductive problems. Toxicology studies investigating potential secondary effects of rotenone exposure have found no evidence that it results in birth defects (HRI 1982), gene mutations (BRL 1982; Van Geothem et al. 1981), or cancer (Marking 1988). Rats fed diets laced with 10 to 1000 ppm of rotenone over a 10-day period did not experience any reproductive dysfunction (Spencer and Sing 1982). Furthermore, fish decay rapidly after piscicide treatment, and the rotenone also breaks down rapidly, so chronic exposure would not occur.

Birds may also scavenge dead fish and invertebrates or ingest treated water; however, research on toxicity of rotenone to birds indicates that acute toxicity was not possible from field application of rotenone to achieve a fish kill. In general, birds require concentrations of rotenone at least 1,000 to 10,000 times greater than is required for lethality in fish (Skaar 2001). Chickens,

pheasants, and related gallinaceous birds are resistant to rotenone, and 4-day-old chicks are more resistant than adults (Cutkomp 1943). Rotenone is nontoxic to waterfowl at concentrations used in stream reclamation projects, as acute toxicity occurs at levels 2,000 times higher than the proposed treatment concentration (Ware 2002).

Evaluation of the risks to scavenging birds were based on estimated daily dose and body size and indicated no risk of acute toxicity from eating rotenone-killed fish (EPA 2007). The daily dose of rotenone from consumption of scavenged fish ranged from 15 µg to 95 µg. At this level of contamination, a raven-sized bird would need to consume from 43,000 to 274,000 dead fish in 1 day to obtain a lethal dose.

Observations of terrestrial gartersnakes (*Thamnophis elegans*) consuming piscicide killed fish on Lower Deer Creek, near Big Timber, Montana indicates reptiles have potential to be exposed to rotenone by scavenging or drinking water. Although no studies on the effect of consumption of rotenone-killed fish on reptiles are available, snakes are likely invulnerable to a toxic effect. A snake's digestive system breaks down bone, fur, scales, and exoskeletons, and can likely handle the highly reactive and fragile rotenone molecule. Furthermore, the exposure concentrations are so low as to not affect other scavengers, suggesting that snakes would have similar tolerance.

Comparisons of concentrations of potassium permanganate in piscicide applications to exposures documented in the MSDSs and scientific literature indicate that potassium permanganate would not pose risks to animals or humans exposed to the treatment range of 0.5 to 1 ppm. For example, a rat-sized mammal would need to drink 275 to 572 mg liters of water in a day for a lethal dose. A 70 kg (154 pound) human would need to consume 77 g (2.5 ounces) for a lethal dose. A safe chronic dose of a potassium permanganate for humans is 4.9 mg/L or ppm at a rate of 2 liters per day (EPA 1995 in Durkin 2008). This concentration is typically greater than the concentration of potassium permanganate used to detoxify rotenone.

In summary, effects on nontarget species of wildlife would range from nonexistent to short-term and minor. Fish would suffer total mortality; however, restocking would result in these effects being temporary. Restoration of a population of nonhybridized Yellowstone cutthroat trout would have substantial conservation value. Piscicide would kill some aquatic invertebrates; however, some species or life history stages can withstand proposed concentrations of rotenone. Moreover, biomass of invertebrates recovery rapidly, and community composition recovers within a year. Some fish or invertebrate predators may experience temporary reductions in prey base, which may displace these animals until fish and macroinvertebrate populations rebound. Concentrations of rotenone in water and dead fish would be thousands of times less than levels causing acute and chronic toxicity to animals ingesting treated water or dead fish. Moreover, as rotenone degrades rapidly, the duration of potential exposure would be short, measurable in days, and would not pose long-term threats to wildlife.

Creation of a Barrier to the Movement or Migration of Animals

In Ice Box Canyon, the NPS has blasted a barrier that prevents upstream movement of fish. The purpose was to prevent invasion of rainbow trout and hybrids from downstream. The barrier was created in anticipation of the implementation of the preferred alternative, and these actions are complementary.

Increase in Conditions That Would Stress Wildlife

The presence of fieldworkers walking in and along streams and attending drip stations would be the only stressor on wildlife. This stressor would last for 1 to 2 days per stream and would probably occur 1 day a year until a full fish kill has been achieved. Helicopters would make 2 to 3 flights over 1 to 2 days to transport fieldworkers and gear into Sheep Creek. These stressors are short-term and minor.

3.4.2 Alternative B: No Action

This alternative has several possible repercussions for fish; however, other species would not be affected. Cessation of the brook trout removal efforts would allow this species to increase in abundance and distribution, which puts the entire Yellowstone cutthroat trout population in Soda Butte Creek at risk. Furthermore, hybridized fish would remain a source of nonnative genes in Soda Butte Creek and the Lamar River watershed. Finally, brook trout would continue to invade streams in YNP, which puts the entire Lamar River watershed at risk of losing its Yellowstone cutthroat trout. The no-action alternative would have no cumulative effects on mammals, invertebrates, birds, reptiles, amphibians, or any other taxa.

3.4.3 Alternative C: Mechanical Suppression

The periodic removal of brook trout would result in temporary reductions in brook trout distribution and abundance. Many fish would evade capture and would continue to reproduce in Soda Butte Creek. To prevent the ultimate extirpation of Yellowstone cutthroat trout in the Soda Butte Creek, mechanical removal would need to continue in perpetuity. However, the level of effort that occurred from 2004 through 2014 would not be feasible, as it is a major expense, and those funds could be used on projects with a definite end. Therefore, brook trout would likely increase in abundance between sampling events, which would have a negative effect on Yellowstone cutthroat trout. Presence of fieldworkers and electrofishing gear would result in the periodic disturbance of wildlife, which would be short-term and minor for each suppression effort. Mechanical suppression would have no cumulative effects on mammals, invertebrates, birds, reptiles, amphibians, or any other taxa.

3.4.4 Cumulative Effects on Wildlife and Fish

Alternative A would bring substantial, desirable changes to the fish populations within the Soda Butte Creek watershed, and contribute to the cumulative effort of the agencies' conservation programs for the species. Additionally, alternative A would reestablish a nonhybridized population in 38 miles of interconnected habitat in the upper Soda Butte Creek watershed and

protect fish in the Lamar River watershed. Other wildlife would experience minor or short term, effects from the piscicide treatment but no cumulative effects are expected on those species.

The no-action alternative would result in no disturbance to any species examined, except for fish. The no-action alternative would have profound implications for native fish conservation. Not implementing the project would allow brook trout to increase in numbers and distribution, which often results in the extirpation of cutthroat trout. In addition, hybrids would continue to distribute nonnative genes into the larger Lamar River watershed. Brook trout would continue to invade waters in YNP, putting the existing Yellowstone cutthroat trout in jeopardy, and eliminating the possibility of achieving a native fishery in the Lamar River watershed.

The mechanical suppression option would not eliminate brook trout and hybrids in Soda Butte Creek, but would temporarily reduce their abundance. Nonetheless, the remaining fish would continue to breed and thrive in this watershed between removal events and would continue to invade waters in the Soda Butte Creek watershed and YNP.

The direct, indirect, and cumulative effects of the proposed action would not result in a trend toward federal listing or loss of population viability for any potentially affected species within the analysis area. For a summary of effect determinations for terrestrial wildlife species see the biological assessment (Pihls 2015) and biological evaluation (Sestrich 2015) in Appendices: NEPA Compliance Documents). The effect determinations for sensitive aquatic species are summarized below (Table 6).

Table 6. Summary of effect determinations for sensitive aquatic species.

Species	***Status***	***BE Determination***
Yellowstone cutthroat trout	CGNF, SNF	Beneficial impact
Columbia spotted frog	SNF	May affect individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species
Northern leopard frog	CGNF, SNF	No impact
Western toad	CGNF, SNF	May affect individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of viability to the population or species

3.5 *Water Resources*

3.5.1 Alternative A: Proposed Action

Changes in Water Quality from Use of Piscicide

This project would involve application of rotenone into Soda Butte Creek and some tributaries and release of potassium permanganate at the downstream end of the treatment. Rotenone was

formerly registered as an insecticide for use in organic agriculture and home gardening but is currently registered only as a piscicide. Rotenone comes from the roots and stems from various tropical and subtropical plants in the pea family (Fabaceae). The molecular constituents of rotenone are carbon, hydrogen, and oxygen, and detoxification entails breaking rotenone into these nontoxic components. Rotenone is relatively inexpensive and accessible and is a routine method to remove unwanted fish from lakes and streams. Rotenone acts by blocking the ability of tissues to use oxygen, which causes fish to asphyxiate quickly.

The plant-derived rotenone is a highly reactive molecule, a factor favoring its quick decomposition in the environment. This degradability is in marked contrast to some synthetic pesticides. Organochlorines are pesticides comprised of chlorinated hydrocarbons, and include chemicals such as DDT, heptachlor, and chlordane. These compounds persist in the environment long after their release, making the behavior and fate of organochlorine pesticides substantially different from rotenone, which breaks down within days, or less, in a stream or soil environment.

Organophosphates are another class of pesticide that differs markedly from rotenone in terms of threats to human health and the environment. Commonly used organophosphate pesticides include malathion, parathion, and diazinon. Although these chemicals are considerably less persistent than the organochlorines, they are more acutely toxic and act as potent neurotoxins. Organophosphate poisonings are one of the most common causes of poisoning worldwide. In contrast, rotenone does not share this acute toxicity to humans with the organophosphate pesticides.

CFT Legumine is the rotenone formulation proposed for this project. The EPA has registered this formula (Reg. No. 75338-2), and approved its use as a piscicide. Information on its chemical composition, persistence in the environment, and ecological risks come from a number of sources, including material data safety sheets (MSDSs) and manufacturer's instructions. (A MSDS is a form detailing chemical and physical properties of a compound, along with information on safety, exposure limits, protective gear required for safe handling, and procedures to handle spills safely.) In addition, Fisher (2007) analyzed the concentrations of major and trace constituents in CFT Legumine, evaluated the toxicity of each, and examined persistence in the environment.

The MSDS for CFT Legumine lists three categories of ingredients for this formula (Table 7). Rotenone comprises 5% of CFT Legumine by weight. Associated resins account for 5%, and the remaining 90% are inert ingredients, of which the solvent n-methylpyrrolidone is a component. Additional information in the MSDS confirms rotenone's extreme toxicity to fish.

Table 7: Composition of CFT Legumine from material safety data sheets (MSDS)

Chemical Ingredients	*Percentage by Weight*	*CAS. No.*[1]	*TLV*[2] *(units)*
Rotenone	5.00	83-79-4	5 mg/m^3
Other associated resins	5.00		
Inert ingredients including n-methylpyrrolidone	90	872-50-4	Not listed

[1]Chemical abstracts number
[2]A TLV reflects the level of exposure that the typical worker can experience without an unreasonable risk of disease or injury

Analysis of the chemical composition of CFT Legumine found that, on average, rotenone comprised 5% of the formula (Table 8; Fisher 2007), consistent with MSDS reporting. Other constituents were solvents or emulsifiers added to assist in the dispersion of the relatively insoluble rotenone. DEGEE, or diethyl glycol monoethyl ether, a water-soluble solvent, was the largest fraction of the CFT Legumine analyzed. Likewise, n-methylpyrrolidone comprised about 10% of the CFT Legumine™. The emulsifier Fennedefo 99™ is an inert additive consisting of fatty acids and resin acids (by-products of wood pulp and common constituents of soap formulations), and polyethylene glycols (PEGs), which are common additives in consumer products such as soft drinks, toothpaste, eye drops, and suntan lotions. Trace constituents included exceptionally low concentrations of several forms of benzene, xylene, and naphthalene. These organic compounds were at considerably lower concentrations than measured in Prenfish, another commercially available formulation of rotenone, which uses hydrocarbons to disperse the piscicide. Their presence in trace amounts in CFT Legumine relates to their use as solvents in extracting rotenone from the original plant material.

Table 8. Average percent concentrations and ranges of major constituents in CFT Legumine (Fisher 2007).

Major CFT LegumineFormula Constituent	*Rotenone*	*Rotenolone*	*n-methylpyrrolidone*	*DEGEE*[1]	*Fennedefo 99*
Average %	5.12	0.718	9.8	61.1	17.1
Range	4.64-5.89	0.43-0.98	8.14-10.8	58.2-63.8	15.8-18.1

[1]diethyl glycol monoethyl ether

Persistence in the environment and toxicity to nontarget organisms are major considerations in determining the potential risks to human health and the environment, and several factors influence rotenone's persistence and toxicity. Rotenone has a half-life of 14 hours at 24 °C, and 84 hours at 0 °C (Gilderhus et al. 1986, 1988), meaning that half of the rotenone is degraded and is no longer toxic in that time. As temperature and sunlight increase, so does degradation of rotenone. Higher alkalinity (>170 mg/L) and pH (>9.0) also increase the rate of degradation. Rotenone tends to bind to, and react with, organic molecules. Because this binding inactivates

the rotenone, higher rotenone concentrations are required in streams with increased amounts of organic matter. Nonetheless, detoxification at the downstream end of the project area would rapidly degrade rotenone into potassium and the insoluble manganese dioxide.

Proposed mitigative activities would further reduce the spatial and temporal extent of rotenone toxicity. A detoxification station established immediately below the barrier at Ice Box Canyon would release potassium permanganate to the effective concentration of 2 to 5 ppm. This strong oxidizer rapidly breaks down rotenone into its nontoxic constituents of carbon dioxide and water, with total breakdown occurring within 15 to 30 minutes of exposure. Total breakdown typically occurs within ¼- to ½-miles of stream travel-time. Potassium permanganate, in turn, breaks down into potassium and the solid manganese disulfide, which are common constituents in surface waters and have no deleterious effects at the concentrations used (Finlayson et al. 2000). In addition, potassium permanganate is a commonly used oxidizer in wastewater treatment plants, so its release into streams and rivers is a regular and widespread phenomenon. The result of release of potassium permanganate on water quality would be elimination of toxic concentrations of rotenone. An additional backup detoxification station would be on-site and would be deployed if necessary.

The concentration of rotenone in treated waters is another factor relating to potential effects from incidental ingestion by other organisms, including humans, which can serve as a proxy for the potential effects on large mammals. (See 5.5 Risk or Health Hazards for a full analysis of the effects on humans.) The effective concentration of rotenone is 25 to 50 ppb, which is roughly equivalent to ¼ to ½ of a grain of table salt per liter. In contrast, concentrations of 14,000 ppb (1,400 grains of salt per liter) pose no adverse effects to human health from chronic ingestion of water (National Academy of Sciences 1983). Moreover, concentrations associated with acute toxicity to humans are 300-500 mg per kilogram of body weight (Gleason et al. 1969), which means a 160-pound person would have to drink over 23,000 gallons in one sitting to receive a lethal dose (Finlayson et al. 2000). Similarly, risks to wildlife from ingesting treated water are exceptionally low. For example, ¼-pound bird would have to consume 100 quarts of treated water, or more than 40 pounds of fish and invertebrates, within 24 hours, for a lethal dose (Finlayson et al. 2000). The EPA, in their recent reregistration evaluation of rotenone (EPA 2007), concluded that exposure to rotenone, when applied according to label instructions, presented no unacceptable risks to humans and wildlife. In summary, this project would have no adverse effect wildlife that ingest water, dead fish, or dead invertebrates.

Bioaccumulation of rotenone would not result in threats to human health and the environment under the preferred alternative. Rotenone can bioaccumulate in the fat tissues of fish that are exposed to nontoxic levels (Gingerich and Rach 1985). As a complete fish-kill is the goal, and application would occur over a short time period, bioaccumulation would not be a problem.

Moreover, breakdown of rotenone in killed fish and invertebrates would also be rapid, so scavengers such as skunks, mink, or birds would not experience chronic exposure.

Potential toxicity and persistence of the other constituents of the CFT Legumine formulation are additional considerations. Proposed concentrations of n-methylpyrrolidone (about 2 ppm) would have no adverse effects to humans ingesting treated waters. According to the MSDS, ingestion of 1000 ppm per day for 3 months does not result in deleterious effects to humans. In addition, n-methylpyrrolidone would not persist in surface waters, given its high biodegradability. This rapid degradation, combined with its low toxicity, makes n-methylpyrrolidone a commonly used solvent in wastewater treatment plants.

Fisher (2007) examined the toxicity and potential persistence of other major constituents in CFT Legumine, including DEGEE, fatty acids, PEGs, and trace organic compounds (benzene, xylene, naphthalene). With proposed application of CFT Legumine, none of these compounds would violate water quality standards, nor would they reach concentrations shown to be harmful to wildlife or humans. Furthermore, persistence of these chemicals was not a concern. The trace organics would degrade rapidly through photolytic (sunlight) and biological mechanisms. Likewise, the PEGs would biodegrade in a number of days. The fatty acids would also biodegrade, although they would persist longer than the PEGs or benzenes. However, these are not toxic compounds, so the relatively longer persistence would not adversely affect water quality. The trace organics would be at exceptionally low concentrations, given dilution of the formulation added to the drip station, followed by dilution in the stream. These organic compounds would be well below levels that are harmful. Moreover, these are moderately to highly volatile chemicals that would break down through the same mechanisms as rotenone, namely oxidation, dilution, and treatment with potassium permanganate. Overall, the low toxicity, low persistence, and lack of bioaccumulation indicate the inert constituents in CFT Legumine would have a minor and temporary effect on water quality.

Despite the low potential risk associated with the use of CFT Legumine, out of an abundance of caution, the following management practices, mitigation measures, and monitoring efforts would be employed:

1. A pretreatment bioassay would be conducted to determine the lowest effective concentration and travel time of the chemical in the stream.
2. Signs would be posted at trailheads and along the stream to warn people not to drink the water, consume dead fish, or have recreational contact with the water.
3. Piscicide would be diluted in water and dripped into the stream at a constant rate by using a device that maintains a constant head pressure.
4. A detoxification station would be set up downstream of the target reach. Potassium permanganate would be used to neutralize the piscicide at that point.

5. An additional detoxification would be established downstream from the initial detoxification station as a safeguard.
6. Project personnel would be trained in the use of these chemicals including the actions necessary to deal with spills as prescribed in the MSDS for CFT Legumine.
7. Persons handling the piscicide would wear protective gear as prescribed in the CFT Legumine label.
8. Only the amount of piscicide and potassium permanganate that is needed for immediate use would be held near the stream.
9. Sentinel or caged fish would be located below the detoxification station and within the target reach to determine and monitor the effectiveness of both the rotenone and potassium permanganate .

The presence and fate of dead fish would be another potential alteration of water quality associated with piscicide treatment. Typically, dead fish are left within the stream, so that their decomposition contributes nutrients to promote recolonization of macroinvertebrates; however, leaving dead fish in the stream in grizzly bear habitat could result in conflicts with humans. Black bears are also common, and avoiding conflicts with this species is desirable. To minimize adverse bear/human interactions in areas where conflicts are likely, dead fish would be retrieved and disposed of in a secure location. The exception would be on isolated tributaries, such as those within wilderness areas that are located away from trails.

Potential Effects on Groundwater Quality

Investigations on the fate and transport of rotenone in soil and groundwater indicate that this project would not alter groundwater quality. Rotenone binds readily to soils and is broken down by soil and in water (Engstrom-Heg 1971; Dawson et al. 1991; 1976; Skaar 2001; Ware 2002). Because of its strong tendency to bind with soils, rotenone's mobility in most soil types is only 1 inch; however, rotenone can travel up to 3 inches in sandy soils (Hisata 2002). The combination of low mobility and rapid breakdown prevents rotenone from contaminating groundwater.

Groundwater investigations associated with several piscicide projects also indicate application of rotenone, and the inert ingredients, would not threaten groundwater quality. California investigators monitored groundwater in wells adjacent to and downstream of rotenone projects and did not detect rotenone, rotenolone, or any of the other organic compounds in the formulated products (CDFG 1994). Likewise, case studies in Montana have concluded that rotenone movement through groundwater does not occur. FWP monitored groundwater associated with several rotenone projects, with wells ranging from 65 to 200 feet from the treated waters. Repeated sampling occurred within periods of up to 21 days, with no detectable concentrations of rotenone or the inert ingredients found.

Effects on Other Water Users

According to the manufacture's label, signs must be posted warning humans not to enter the water during the time the signs are posted. For treatments applying less than 90 ppb rotenone (as proposed here), the signs can be removed immediately after the treatment is complete. Therefore, humans would have no exposure to rotenone treated water.

Discharge Affecting Water Quality Regulations

This project would involve application of CFT Legumine, an EPA registered piscicide, to Soda Butte Creek and select tributaries. Montana law (MCA § 75-5-308) allows application of registered pesticides to control nuisance aquatic organisms or to eliminate undesirable and nonnative aquatic species. FWP would apply rotenone under DEQ's General Permit for Pesticide Application (#MTG87000). DEQ accepted a notice of intent in a letter dated August 13, 2012, that allows FWP to operate under the General Permit for Pesticide Application. These requirements call for minimizing the concentration and duration of chemical to the extent practicable. FWP would accomplish this by performing a bioassay to determine the lowest effective concentration of rotenone. By following the manufacturer's label, and conditions of the general permit for pesticide application, the alterations in water quality would be within acceptable levels under the Clean Water Act and Montana's narrative and numeric water quality standards.

Wyoming issues general permits authorizing discharge of pesticides through its Wyoming Pollutant Discharge Elimination System. Effluent limitations include using the lowest effective amount of pesticide per application, and optimum frequency of pesticide being applied. Similar to Montana's discharge permit, Wyoming's permit requires that discharge would follow the manufacturer's label instructions and associated cleaning and maintenance.

3.5.2 Alternative B: No Action

Under the no-action alternative, neither CFT Legumine of potassium permanganate would be released into streams in the project area. Therefore, no-action would not affect water resources.

3.5.3 Alternative C: Mechanical Suppression

Mechanical suppression would have low probability of affecting water quality. The boat-mounted generators use gasoline; however, they would be filled away from the stream. In addition, fieldworkers would ensure that all caps are securely tightened. Gasoline-powered electrofishers are a commonly used type of gear in regular fisheries monitoring efforts, and fieldworkers are proficient in the environmental and safety concerns associated with gasoline-powered devices.

3.5.4 Cumulative Effects on Water Resources

Implementing alternative A would result in release of a piscicide into Soda Butte Creek and some tributaries. As rotenone is a highly reactive molecule, it would break down quickly through

natural processes, augmented by release of potassium permanganate downstream of the barrier in Ice Box Canyon. The inert ingredients have low toxicity and short period of persistence.

The no-action alternative would not affect water resources.

Mechanical suppression presents a small risk of a gasoline spill. By filling the tank away from the stream and screwing caps on tight, contamination of water would be unlikely.

No cumulative effects to existing water uses would be expected by any of the alternatives.

4 Wilderness

4.1 *Wilderness Values*

The proposed action would result in activity in the North Absaroka Wilderness. The North Absaroka Wilderness is managed to maintain "wilderness character," including opportunities for solitude or a primitive and unconfined type of recreation, making "the imprint of man's work less noticeable," protecting indigenous species, and allowing natural processes to regulate ecosystems. Modern civilization and human control that affect ecological systems and processes can compromise wilderness character.

The Minimum Requirements Decision Guide (Appendices: NEPA Compliance Documents) informs the following analysis, and summarizes the effects of each alternative on the five qualities of wilderness character. These include "untrammeled", "undeveloped", "natural", and "solitude or primitive and unconfined recreation."

4.1.1 Alternative A: Proposed Action – Wilderness

Spatial Extent of Human-Associated Disturbance and Piscicide Use in Designated Wilderness

Disturbance associated with the proposed action would include short-term presence of humans, horses, camping, and the removal of the existing fishery using CFT Legumine. Following U.S. Forest Service camping specifications and food storage order restrictions would mitigate for the effects of camping and presence of horses.

Meeting the project objective of removing nonnative brook trout and hybrids would require complete removal of all fish within the project area, including fish-bearing waters in designated wilderness. Approximately 17 miles of stream flow through the North Absaroka Wilderness, and an estimated 10 miles would be treated with CFT Legumine (Table 9). Streams flowing through designated wilderness include Hayden Creek, Republic Creek, and Soda Butte Creek.

Table 9. Summary of perennial stream miles and miles of proposed stream channel for rotenone treatment in the North Absaroka Wilderness. Stream miles are approximations based on GIS data and would be refined via field reconnaissance.

Stream	*Estimated Perrenial Stream Miles*	*Estimated Treatment Miles*
Hayden Creek	3.88	1.99
Republic Creek	8.31	6.80
Soda Butte Creek	0.38	0.38
Woody Creek	0.13	0.00
Unnamed tributary 1	1.50	0.00
Unnamed tributary 2	2.79	0.98
Total	16.98	10.15

Potential Effects on Wilderness Character

Piscicide application has the potential for minor, short-term effects on wilderness character. A brief increase in human activity, temporary reductions in stream-dwelling aquatic invertebrates, and total removal of fish would occur. An implementation plan incorporates design criteria to minimize effects on wilderness character.

Camping, the use of livestock, and fish removal activities all present potential effects on the North Absaroka Wilderness Area and wilderness values. The camping and livestock effects would be mitigated by following FS camping specifications and food storage order restrictions. Analysis of alternatives has shown that the proposed action would accomplish project objectives with the least intrusion on wilderness values.

Applicators would hike to treatment locations. Horses and fieldworkers would transport gear. If overnight camping is deemed necessary to support project activities, crews would camp at pre-approved agency locations and would practice minimum-impact camping techniques, and would comply with all food storage orders to reduce wilderness impacts. Crews camping overnight are would likely not exceed six individuals per sub-watershed, or 6 nights per year. Fish in wilderness waters are expected to occur at low densities. Therefore, dead fish would be allowed to sink to the bottom of treated waters and decompose, which would maintain nutrients in the aquatic ecosystem. Signs would be posted at the trailheads to inform wilderness users of the objectives of the project, its importance, and techniques used to accomplish the objectives. Information officers representing their respective agencies would be stationed at trailheads and other key areas to inform the public. Treatment in wilderness would **not** include the use of any motorized equipment. High gradient reaches not suitable for fish would remain untreated. These areas would serve as refugia for macroinvertebrates, which would facilitate recolonization of the macroinvertebrate community.

Untrammeled

The proposed treatment would affect the untrammeled nature of the project area in the short-term by introducing human manipulation within the wilderness ecosystem. This short-term trammeling would be beneficial in the long-term by removing nonnative and hybridized fish, and replacing them with native, nonhybridized Yellowstone cutthroat trout. This action would correct previous trammeling that occurred with stocking or invasion of nonnative fish. Moreover, chemical removal is less time intensive, and does not require clearing of vegetation and woody debris. In comparison, mechanical suppression would require considerable removal of vegetation and debris, which would extend the duration and severity of trammeling.

Undeveloped

Under the proposed action, the undeveloped quality of the wilderness character in the North Absaroka Wilderness would remain unchanged.

Natural

In the long term, this alternative would improve the naturalness of the treatment area by restoring native Yellowstone cutthroat trout, which was the natural state of these waters. The positive effects would extend far beyond the North Absaroka Wilderness boundary, because the potential for brook trout to invade the greater Lamar River drainage in Yellowstone National Park would be eliminated.

In the short-term, the natural conditions of the wilderness would be temporarily impaired by introduction of the chemical piscicide rotenone. Toxic concentrations of rotenone would last from several hours to a few days. Rotenone is specific to gilled aquatic organisms and has no known adverse effects to flora or other fauna. Other than fish, aquatic macroinvertebrates would be most vulnerable; however, numerous studies as well as local monitoring have demonstrated that rotenone effects on stream-dwelling macroinvertebrate communities are short. Recolonization of aquatic macroinvertebrates occurs rapidly, especially when untreated refugia are maintained.

Amphibians have a gilled stage during which they experience a toxic effect. Nonetheless, aquatic habitats in the wilderness project area consist primarily of moderate to high-gradient streams and are not suitable breeding habitat for the vulnerable gilled stage of Columbia spotted frog or western toad. These species would be unlikely to be affected in designated wilderness. An in-depth analysis of the effects of rotenone on aquatic and terrestrial species is in subchapter 3.4 Wildlife and Fish.

Solitude or Primitive and Unconfined Recreation

Disturbance to recreationalists seeking solitude and a wild state would be short-term and minor. No more than 30 people would be working in the wilderness at any given time with approximately 10 individuals per sub-watershed. During rotenone treatment, visitors would have the potential to encounter fieldworkers, horses, and piscicide treatment for less than 2 weeks per year, over a

probable 2-year treatment schedule. Treatments in following years are unlikely, but may be required to meet the project objective, resulting in short-term disturbance to these recreational values.

The proposed action would have minimal, if any effect on angling. Where present, fish in wilderness treatment reaches occur at low densities, and there is little angling pressure. Fish bearing stream reaches would be restocked soon after treatment, but fish would not begin to reach catchable size until the following summer. Restoring genetically pure Yellowstone cutthroat trout to the project area streams would have long-term positive effects on outdoor recreation by providing individuals with an opportunity to catch native Yellowstone cutthroat trout. Currently angling is not a common type of recreation along the streams in wilderness. Their high gradient, small size, and abundance of debris makes angling difficult, and would not provide a high-quality sport fishery for Yellowstone cutthroat trout.

Other Features of Value

There would be no affects on unique components that reflect the character of the North Absaroka Wilderness.

Summary of the Effects of the Proposed Action on Wilderness

Fish removal using the piscicide is the only effective, practical alternative for meeting the project objective of complete removal of brook trout and hybrids, with the least potential alterations of wilderness values. Completing this project for the conservation of Yellowstone cutthroat trout improves the natural quality of wilderness character in the long term, and would return these streams to their historic state. Piscicide treatment also meets the objectives for fish and wildlife management in FSM 2323.3 by helping to conserve a native species that has a potential for future listing under ESA. The short-term alterations of the untrammeled and natural qualities of wilderness character relating to chemical piscicide are balanced by the improved long-term natural conditions of wilderness character through restoration of a native species

4.1.2 Alternative B: No Action

Potential Effects on Wilderness Character

Under the no-action alternative, the presence of hybrids and nonnative brook trout presents a negative effect on wilderness character, as this assemblage does not reflect the historic fishery that evolved in this setting, and diminishes the biological integrity of the watershed. Failure to eradicate or suppress hybrids and brook trout would allow this negative influence to persist.

Untrammeled

Inaction would have no effect on the untrammeled quality of wilderness character.

Undeveloped

Inaction would have no effect on the undeveloped quality of wilderness character.

Natural

Through inaction, indigenous species, patterns, and processes would not be protected and natural conditions would not be preserved. Nonnative brook trout abundance would increase in stream reaches within wilderness. Yellowstone cutthroat trout would decline commensurate with increases in brook trout distribution and abundance. Remaining Yellowstone cutthroat trout would continue to have low levels of hybridization with nonnative rainbow and westslope cutthroat trout. This altered fish assemblage would result in degradation to the natural quality of wilderness character.

Solitude or Primitive and Unconfined Recreation

Inaction would have no effect on the solitude and unconfined recreation quality of wilderness character.

Other Features of Value

Inaction would have no effect on the other features of value quality of wilderness character.

5 Effects on the Human Environment

5.1 *Aesthetics and Recreational Opportunities*

5.1.1 Alternative A: Proposed Action

Fishing would be the primary recreational opportunity affected by this alternative. The proposed action would preclude angling until nonhybridized Yellowstone cutthroat trout are restocked in the project area. The existing hybridized Yellowstone cutthroat trout are popular with tourists and the local community. Soda Butte Creek provides an opportunity to fish for slightly hybridized Yellowstone cutthroat trout in a spectacular setting. A substantial public outreach and education effort would mitigate for the temporary loss of fishing, and would promote awareness of native species conservation. In addition, Soda Butte Creek is close to high-quality angling opportunities in YNP, so anglers would have nearby access to fishing for native Yellowstone cutthroat trout.

This alternative would be limited to the project area. Brook trout and rainbow trout would remain widespread and abundant in Montana and Wyoming. Opportunities to fish for and harvest these species would not be appreciably reduced.

This project would temporarily affect aesthetics due to the dead fish present in Soda Butte Creek and its tributaries. Removal of dead fish would make this a minor and short-term negative effect on aesthetic. Moreover, scavengers would quickly consume fish that fieldworkers missed.

The proposed action would not affect other aesthetic or recreational activities, such as hunting, hiking, traveling by horseback, or backpacking.

5.1.2 Alternative B: No Action

Given the invasive and competitive nature of brook trout, this alternative could result in reductions in and potentially the extirpation of Yellowstone cutthroat trout in Soda Butte Creek and its tributaries. Moreover, the spread of brook trout into YNP would put the entire Lamar River watershed at risk, as they would increase in abundance and invade other streams in the Lamar River watershed. Hybrids would remain as a source of nonnative genes. Many anglers travel to YNP to fish for native cutthroat trout, and the no-action alternative would reduce the quality of fishing for those Yellowstone cutthroat trout.

The no-action would not affect other aesthetic or recreational activities, such as hunting, hiking, traveling by horseback, or backpacking.

5.1.3 Alternative C: Mechanical Suppression

Relying on mechanical removal to limit brook trout populations brings considerable risks. The removal effort that occurred from 2004 through 2013 would not be financially feasible to continue in perpetuity. Therefore, mechanical suppression would decrease in frequency. As the intensive removal efforts from 2004 through 2013 were unsuccessful in appreciably decreasing brook trout abundance and did not prevent invasion of new waters, decreased effort would likely result in greater numbers of brook trout and their expansion in the Soda Butte Creek watershed and YNP. Moreover, the existing Yellowstone cutthroat trout fishery would remain a hybrid swarm and a source of nonnative genes to the larger watershed.

Mechanical suppression would not affect other aesthetic or recreational activities, such as hunting, hiking, traveling by horseback, or backpacking.

5.1.4 Cumulative Effects on Aesthetics and Recreational Opportunities

Implementing the proposed alternative would result in 38 miles of secure, connected habitat for Yellowstone cutthroat trout. Native trout draw anglers from around the world, and locally, to catch this beautiful fish. The proposed alternative would temporarily eliminate fishing in the project area.

The no-action alternative would result in increases in abundance of brook trout in the Soda Butte Creek watershed, and ultimately the entire Lamar River watershed. Brook trout displace Yellowstone cutthroat trout, often within a few years. Rainbow trout genes would also continue to spread in the watershed. Elimination or substantial reductions of Yellowstone cutthroat trout would negatively affect anglers targeting the native Yellowstone cutthroat trout. Moreover, as brook trout would remain abundant and widely distributed throughout the western U.S., displacement of Yellowstone cutthroat trout by brook trout would contribute to a homogenization of fish populations in the West, with nonnative trout being the most common species.

Mechanical suppression would have a negative effect on the hybridized Yellowstone cutthroat trout in the Soda Butte Creek watershed, and the larger Lamar River watershed. With a reduction in the removal effort, brook trout would likely substantially increase in numbers, and continue to invade new waters. The result could be reduced quality of fishing for hybridized Yellowstone cutthroat trout, as brook trout outcompete Yellowstone cutthroat trout and can extirpate them within decades. The mechanical suppression option would not allow meeting the conservation goal of restoring a nonhybridized Yellowstone cutthroat trout fishery, and the nonnative genes would continue to spread throughout the watershed.

Implementation of any of the alternatives would not result in cumulative effects on any of the existing aesthetic values or recreational opportunities.

5.2 *Community*

5.2.1 Alternative A: Proposed Action

The proposed action would have an initial, short-term negative effect on the local community because of the temporary elimination of the fishery and fishing. Restoring a nonhybridized population of Yellowstone cutthroat trout, after successful removal of the existing fishery, would reestablish the native species in the project area. The towns of Cooke City and Silver Gate actively promote native Yellowstone cutthroat trout with sales of t-shirts, fishing gear, and other souvenirs. A nonhybridized population would provide greater conservation value that the community could use in promotion of the biological integrity and angling opportunity of nonhybridized Yellowstone cutthroat trout.

5.2.2 Alternative B: No Action

The no-action alternative has the potential to have a negative effect on the local communities. Expansion of the distribution and abundance of brook trout would threaten the health and abundance of the Yellowstone cutthroat trout population in Soda Butte Creek and its larger watershed, which could have a negative influence on tourism. Anglers targeting native Yellowstone cutthroat trout would likely not visit Silver Gate and Cooke City but would spend their money in Gardiner or Livingston, where Yellowstone cutthroat trout would be more accessible.

Local support for Yellowstone cutthroat trout conservation has been considerable. The Beartooth Alliance and local landowners have been active in promoting conservation of Yellowstone cutthroat trout, and agencies have an obligation to follow their lead and complement their advocacy.

In addition, the cumulative effects of failing to follow through on native fish restoration projects increases the likelihood of including Yellowstone cutthroat trout for protection under the Endangered Species Act. Listing could have a far-reaching affect in communities throughout the

Yellowstone cutthroat trout's native range, as it would reduce flexibility in the land and water management activities of landowners, agencies, agriculture, and extractive industries.

5.2.3 Alternative C: Mechanical Suppression

Unlike piscicide application, mechanical suppression would not result in the temporary elimination of the fishery, and opportunities to fish, in Soda Butte Creek. Nonetheless, brook trout would remain as a threat to the highly valued Yellowstone cutthroat trout in Soda Butte Creek and the Lamar River watershed. If brook trout exceed Yellowstone cutthroat trout in numbers, anglers targeting the native Yellowstone cutthroat trout may choose to stay in Gardiner or Livingston, where Yellowstone cutthroat trout are more accessible. If the level of suppression is insufficient to curb the growth of brook trout populations, Soda Butte Creek would contribute to justification of listing Yellowstone cutthroat trout for protection under the Endangered Species Act. As with the no-action alternative, listing could have far-reaching implications for communities throughout the Yellowstone cutthroat trout's native range.

5.2.4 Cumulative Effects on Community and Taxes

The proposed alternative would have an initial negative effect on the local communities, although high-quality fishing opportunities would be available in YNP. Restoring the nonhybridized Yellowstone cutthroat trout would increase the biological integrity and provide an opportunity to educate the public about native fish. Local merchants would still be able to sell souvenirs, fishing gear, and souvenirs celebrating native Yellowstone cutthroat trout. The no-action alternative would not result in a short-term loss of the fishery; however, the biological integrity could degrade because of the increase in brook trout and spread of nonnative genes. With the exception of temporary loss of the fishery, mechanical suppression would bring similar benefits and risks as the no-action alternative. Brook trout have potential to invade new waters, and nonnative genes would remain in the Lamar River watershed. The potential to decrease the biological integrity of the prized Yellowstone cutthroat trout population could have negative effects on the communities' abilities to promote and benefit financially from Yellowstone cutthroat trout.

No cumulative impacts to Cooke City or Silver Gate are expected by the implementation of any one of the alternatives since only the diversity of species within the fishery is being affected and there would be no change to the angling opportunity within the watershed.

5.3 *Air Quality*

5.3.1 Alternative A: Proposed Action

A portable generator would be used at the detoxification station to power the auger used to deliver potassium permanganate . This would result in a short-term and minor release of exhaust into the air. Backpack sprayers used in wetlands and backwaters would release a mist of CFT

Legumine, but rotenone is not volatile, and would quickly fall out of suspension. Applicators would wear respirators to prevent inhalation of the dilute CFT Legumine solution mist.

5.3.2 Alternative B: No Action

This alternative would not affect air quality.

5.3.3 Alternative C: Mechanical Suppression

The mechanical alternative would entail use of gasoline-powered generators. The exhaust would cause a short-term, minor, and localized decrease in air quality.

5.3.4 Cumulative Effects on Air Quality

The no-action alternative would not affect air quality. Piscicide application and mechanical suppression would result in release of exhaust from gas-powered generators. The effects of both would be short-term and minor within a given event; however, the mechanical suppression alternative would result in release of exhaust as long as mechanical suppression continues.

5.4 *Noise and Electrical Effects*

5.4.1 Alternative A: Proposed Action

This alternative would likely use a helicopter to transport gear and fieldworkers to remote parts of the project area over the course of 1 to 2 days, with 2 to 3 flights occurring per day. This disturbance would be short-term and minor and would not occur within the North Absaroka Wilderness area. A portable generator would also be used at the detoxification station to power the auger used to deliver potassium permanganate.

5.4.2 Alternative B: No Action

This alternative would not affect noise or electrical services.

5.4.3 Alternative C: Mechanical Suppression

Mechanical suppression along Soda Butte Creek would require use of gasoline-powered generators. The generators would create noise during the periodic, 4-day suppression effort. The noise would be short-term, minor, and localized, but would continue into the foreseeable future, as suppression efforts must be continued to keep brook trout in check.

5.4.4 Cumulative Effects on Noise and Electrical Effects

The proposed action would create noise with the use of a helicopter to transport fieldworkers and gear to areas located outside of designated wilderness to the upper portions of Sheep Creek, Montana. Helicopters would be needed for 1 to 2 days, with 2 to 3 flights per day. The noise would be short-term and minor. The no-action alternative would not create noise or affect any electrical systems. Gas-powered generators used to electrofish Soda Butte Creek in suppression efforts, or deliver Potassium permanganate to detoxify rotenone, would create noise, which

would be short-term and minor. Noise associated with suppression efforts would occur over many more years than piscicide treatment.

5.5 *Risk or Health Hazards*

5.5.1 Alternative A: Proposed Action

Risks to human health relate to exposure to rotenone, to the inert ingredients in the CFT Legumine formulation, or to the potassium permanganate used in detoxifying rotenone. Information examined here includes an analysis of human health risks relating to rotenone exposure (Table 10; EPA 2007), MSDS sheets for chemicals used, and an evaluation of the chemical constitution of the CFT Legumine formula (Fisher 2007).

Acute toxicity refers to the adverse effects of a substance from either a single exposure or multiple exposures in a short space of time. Rotenone ranks as having high acute toxicity through oral and inhalation routes of exposure, and low acute toxicity through exposure to skin (EPA 2007). Acute toxicity would be applicable to undiluted CFT Legumine, with median lethal doses for rats ranging from 39.5 mg/kg for female rats, and 102 mg/kg for male rats.

Chronic exposure is repeated oral, dermal, or inhalation of the target chemical (EPA 2007). In humans, chronic exposure is the length of time equivalent to approximately 10% of the life span. In piscicide treatments in streams, exposure to rotenone lasts at most 4 days. Therefore, the only people likely to experience chronic exposure are the applicators who dispense diluted CFT Legumine over multiple projects. The use of protective eyewear, gloves and dust/mist respirators (in the case of hand held devices that dispense rotenone) is sufficient to protect worker health.

The analysis of dietary risks considered threats to the subgroup “females 13-49 years old” and examined exposure associated with consuming exposed fish and drinking treated surface water (EPA 2007). In determining potential exposure from consuming fish, the EPA used maximum residues in fish tissue. The concentrations of residue considered were conservative, meaning that they may have been an overestimate of the rotenone concentrations in muscle tissue, as they included unpalatable tissues, where concentrations may be higher. The EPA concluded that acute dietary exposure estimates resulted in a dietary risk below the EPA’s level of concern; therefore, consumption of fish killed by rotenone does not present an acute risk to the sensitive subgroup.

Table 10: Toxicological endpoints for rotenone (EPA 2007)

Exposure Scenario	Dose Used in Risk Assessment, Uncertainty Factor (UF)	Level of Concern for Risk Assessment	Study and Toxicological Effects
Acute Dietary (females 13-49)	NOAEL = 15 mg/kg/day UF = 1000 aRfD = 15 mg/kg/day / 1000 = 0.015 mg/kg/day	Acute PAD = 0.015 mg/kg/day	Developmental toxicity study in mouse (MRID 00141707, 00145049) LOAEL = 24 mg/kg/day based on increased resorptions
Acute Dietary (all populations)	An appropriate endpoint attributable to a single dose was not identified in the available studies, including the developmental toxicity studies.		
Chronic Dietary (all populations)	NOAEL = 0.375 mg/kg/day UF = 1000 cRfD = 0.375 mg/kg/day / 1000 = 0.0004 mg/kg/day	Chronic PAD = 0.0004 mg/kg/day	Chronic/oncogenicity study in rat (MRID 00156739, 41657101) LOAEL = 1.9 mg/kg/day based on decreased body weight and food consumption in both males and females
Incidental Oral Short-term (1-30 days) Intermediate-term (1-6 months)	NOAEL = 0.5 mg/kg/day	Residential MOE = 1000	Reproductive toxicity study in rat (MRID 00141408) LOAEL = 2.4/3.0 mg/kg/day [M/F] based on decreased parental (male and female) body weight and body weight gain
Dermal Short-, Intermediate-, and Long-Term	NOAEL = 0.5 mg/kg/day 10% dermal absorption factor	Residential MOE = 1000 Worker MOE = 1000	Reproductive toxicity study in rat (MRID 00141408) LOAEL = 2.4/3.0 mg/kg/day
Inhalation Short-term (1-30 days) Intermediate-term (1-6 months)	NOAEL = 0.5 mg/kg/day 100% inhalation absorption factor	Residential MOE = 1000 Worker MOE = 1000	[M/F] based on decreased parental (male and female) body weight and body weight gain
Cancer (oral, dermal, inhalation)	Classification; No evidence of carcinogenicity		

UF = uncertainty factor, NOAEL = no observed adverse effect level, LOAEL = lowest observed adverse effect level, aPAD = acute population adjusted dose, cPAD = chronic population adjusted does, RfD = reference dose, MOE = margin of exposure, NA = Not Applicable

The EPA considered chronic dietary risks relating to exposure through drinking water. Chronic exposure from consuming exposed fish was not evaluated, given rotenone's rapid degradation and low propensity to bioaccumulate in fish. Based on the chronic toxicity endpoint, the drinking water level of concern was 40 ppb, which addressed effects on infants and children, the most sensitive population subgroup. The effective concentration for fish eradication is 25 ppb to 50 ppb but would be of short duration, which would not allow chronic ingestion of treated water. The probability of infants and children drinking rotenone-treated water from Soda Butte Creek is extremely remote. Signs alerting the public to the presence of rotenone-treated water would further reduce the probability of ingestion by humans.

In evaluating the potential for chronic exposure to rotenone, the EPA acknowledged the rapid degradation of rotenone in the environment and that expediting deactivation with oxidizing agents, such as potassium permanganate was a standard procedure in many projects. The EPA concluded that no chronic exposures to rotenone would occur where water is treated with potassium permanganate or subjected to an oxidative water treatment regime.

The EPA estimated recreational risks associated with swimming, which would entail skin contact and incidental ingestion. The effective concentration of rotenone within Soda Butte Creek would be considerably lower than thresholds for dermal contact or incidental ingestion. Nonetheless, signs at access points would alert recreationist to the presence of rotenone for the 4 days of treatment and restrictions on public access to the stream would provide an additional safety measure.

An aggregate risk is the combined risk from dietary exposure and nonoccupational sources, such as residential and recreational exposure. In its evaluation of the aggregate risk, the EPA combined the risk of eating treated fish and drinking treated water and concluded that the risk did not exceed their level of concern. The EPA did not aggregate recreational risk with the dietary risk, as the dietary assessment is conservative and recreational exposure would be intermittent and would not occur for the general population. Moreover, stream closings, detoxification, and project timing would minimize or eliminate the potential for recreational exposure.

Occupational risks relate to fieldworkers mixing and applying rotenone. The EPA (2007) calculated margins of exposure for handlers mixing and applying rotenone through various methods, and with varying levels of protective gear, from none to use of gloves, respirators, and protective clothing. The proposed approaches for this project call for use of a liquid formula applied with drip stations or backpack sprayer of seeps, springs, and backwaters (should they occur). Powder rotenone, combined with sand and gel, may be used in some places. The margins of exposures for these applications are below the level of concern with the use of gloves. Requiring protective eyewear, protective clothing, and respirators for applicators mixing rotenone would be highly protective of the health of applicators in the field.

The proposed formula for this project is CFT Legumine, which contains 5% rotenone and 95% inert ingredients. Fisher (2007) evaluated the chemical composition of the inert fraction, the persistence of these constituents, and the potential to have an effect on human health and the environment subchapter 3.5Water Resources details these findings). In general, the inert ingredients do not pose a threat to human health given their low toxicity and short period of persistence in the environment.

Concerns over putative links to Parkinson's disease have been raised after a study in which rats injected with rotenone for up to 2 weeks showed lesions characteristic of Parkinson's disease (Betarbet et al. 2000). Review of the methodology employed in this study finds no similarities to fisheries-related piscicide projects in terms of dose, duration of exposure, or mode of delivery. The rats received constant injection of rotenone and dimethyl sulfoxide directly into their bloodstream, resulting in continuously high concentrations of rotenone. The purpose of the dimethyl sulfoxide was to enhance tissue penetration of the rotenone, as normal routes of exposure actually slow introduction of chemicals into the bloodstream. In contrast, field exposure would involve far lower concentrations of rotenone, without the synergistic effects of dimethyl sulfoxide to promote uptake into tissues. Moreover, the rapid breakdown of rotenone in the environment would not support more than a few days of potential exposure from ingesting water or dead animals. Finally, continuous intravenous injection in no way resembles any potential mode of field exposure to rotenone, which would be ingestion of dilute rotenone in water, or consumption of fish or invertebrates killed by rotenone. As the injection study does not provide a model for potential effects of field application of rotenone, and other researchers have not found Parkinson's-like effects in exposed animals (Marking 1988), we conclude that rotenone application would not result in neurological risks to field exposed humans or animals.

A recent study linked the use of rotenone and paraquat with the development of Parkinson's disease in humans later in life (Tanner et al. 2011). The retrospective study included mostly farmers from 2 states within the United States who presumably used rotenone for terrestrial application to crops and/or livestock. Rotenone is no longer approved for agricultural uses and is only approved for aquatic application as a piscicide.

The results of epidemiological studies of pesticide exposure are highly variable (Guenther et al. 2011). A series of studies have found no correlations between pesticide exposure and Parkinson's disease (Jiménez-Jiménez et al. 1992; Hertzman 1994; Engel et al. 2001; Firestone et al. 2010). In contrast, some have found correlations between pesticide exposure and Parkinson's disease (Hubble et al. 1993; Lai et al. 2002; Tanner et al. 2011) and some have found it difficult determine which pesticide or pesticide class is implicated if associations with Parkinson's disease occur (Engel et al. 2001; Tanner et al. 2009). Criticisms of epidemiological studies linking pesticide exposure to Parkinson's disease relate to the high variation among study results, generic categorization of pesticide exposure scenarios, questionnaire subjectivity, and the

difficulty in evaluating the causal factors in the complex disease of Parkinson's disease, which may have multiple causal factors, such age, genetics, or environment (Raffaele et al. 2011).

A specific concern is the inability to assess the degree of exposure to certain chemicals, including rotenone, particularly the concentration of the chemical, frequency of use, application, specific use, and exposure routes (Raffaele et al. 2011). Tanner et al. (2011) provided no information on formulation of rotenone used (powder or liquid) or the farmers' exposure (dose and frequency) during their careers. This study also lacked data on the personal protective equipment used or any information about other pesticides to which the farmers were exposed during the period of the study. Without such data on the dose and duration of rotenone exposure, it is difficult to evaluate whether aquatic applications of rotenone pose a potential risk for the development of Parkinson's disease in exposed humans.

An exhaustive review of the risks to human health of rotenone use as a piscicide concluded the following: "To date, there are no published studies that conclusively link exposure to rotenone and the development of clinically diagnosed Parkinson's disease. Some correlation studies have found a higher incidence of Parkinson's disease with exposure to pesticides among other factors, and some have not. It is very important to note that in case-control correlation studies do not establish causality and that some associations identified in odds-ratio analyses may be chance associations or due to confounding variables. Only one study (Tanner et al. 2011) found an association between rotenone and paraquat use and Parkinson's disease in agricultural workers, primarily farmers. However, there were substantial differences among the methods of application, formulation, and doses of rotenone in residential settings compared with aquatic use as a piscicide, and the agricultural workers interviewed were also exposed to many other pesticides during their careers. Through the EPA re-registration process of rotenone, occupational exposure risk is minimized by new requirements that state handlers may only apply rotenone at less than the maximum treatment concentrations (50 ppb), the development of engineering controls to some of the rotenone dispensing equipment, and requiring handlers to wear specific PPE (Guenther et al. 2011).

To reduce or eliminate risks to human health, including any potential risk of Parkinson's disease, public exposure to rotenone-treated water must be eliminated to the extent possible. Areas treated with rotenone would be closed to public access during the treatment. Signs would be placed at access points informing the public of the closure and the presence of rotenone treated waters. Personnel would be onsite to inform the public and escort them from the treatment area should they enter. Rotenone treated waters would be contained to the proposed treatment areas by adding potassium permanganate to the stream at the downstream end of the treatment reach at the Ice Box Canyon barrier.

Establishment of a detoxification station, as well as a backup station would limit the spatial extent of rotenone toxicity. Potassium permanganate would neutralize any remaining rotenone

before it leaves the project area. The efficacy of the neutralization would be monitored by using fish held in cages at predetermined locations and a handheld chlorine meter. Therefore, the potential for public exposure to rotenone-treated waters is minimal. The potential for exposure would be greatest for field workers applying the chemical. To reduce their exposure, personal protection equipment use would follow the manufacturer's label.

Finally, a description of the traditional uses of rotenone by native people is informative in evaluating its potential for creating hazards to human health. Native Brazilians have considerable exposure to rotenone through their use of this piscicide as a means to obtain fish for consumption (Teixera et al. 1984). They extract rotenone from the roots of the *Timbo* plant and distribute the pulp by swimming into fish-bearing waters. Despite this high level of dermal and dietary exposure to rotenone, no harmful effects were apparent from this centuries-old practice. Moreover, in contrast to the use of rotenone in fisheries management programs, the traditional method of applying rotenone from root does not involve use of protective gear or manipulation of the dose applied.

5.5.2 Alternative B: No Action

This alternative would have no effect on human health or related hazards.

5.5.3 Alternative C: Mechanical Suppression

Risks to human health with mechanical suppression relate to the potential for injury among fieldworkers. Fieldworkers receive training in electrofishing techniques and safety.

5.5.4 Cumulative Effects on Human Health

Alternative A would pose minimal risk to human health if applicators use prescribed protective gear while applying CFT Legumine. The no-action alternative would have no effects on human health. Electrofishing is a regular part of fisheries management, and fieldworkers would be trained in electrofishing techniques and safety.

No cumulative impacts to existing risks or health hazards are expected within the project area because the implementation methods for Alternatives A and C would only be completed by trained staff and the no action alternative does not change existing conditions.

5.6 *Cultural Resources*

5.6.1 Alternative A: Proposed Action

This alternative would not affect cultural resources because no ground ground-disturbing activities are part of the proposed action.

5.6.2 Alternative B: No Action

This alternative would not affect cultural resources.

5.6.3 Alternative C: Mechanical Suppression

This alternative would not affect cultural resources.

5.6.4 Cumulative Effects on Cultural Resources

None of the alternative would affect cultural resources.

6 Need for an Environmental Impact Statement

Evaluation of the environmental, social, cultural, and economic effects of the proposed alternative found any effects to be short-term and minor. Moreover, the proposed action would be beneficial in protecting and securing a stronghold for Yellowstone cutthroat trout. The community would benefit from protecting and improving the status of this species of special concern and important sport fish. These actions complement the stewardship and commitment to Yellowstone cutthroat trout within the watershed and are consistent with conservation planning for Yellowstone cutthroat trout.

Evaluation of the no-action alternative found this alternative would have substantial negative effects on the environment and would be detrimental to the people living in the historic range of the Yellowstone cutthroat trout, as the continued spread of brook trout would increase justification for listing the Yellowstone cutthroat trout under the Endangered Species Act. By not implementing any conservation actions to stem the numbers and distribution of brook trout, agencies would be allowing brook trout to continue to increase in numbers, and ultimately to invade the entire Lamar River watershed, which could result in the extirpation of Yellowstone cutthroat trout. Similarly, hybridized Yellowstone cutthroat trout would continue to spread nonnative genes in the Lamar River watershed. These results are contrary to the goals and objectives of the MOU (MCTSC 2007), and would have a devastating effect on Yellowstone cutthroat trout.

Mechanical suppression would likewise have substantial negative effects on the ecological and human environment. Essentially, this approach would delay the consequences of the no-action alternative and would put the entire Lamar River watershed at risk for the extirpation of Yellowstone cutthroat trout. The consequences would be long-term and significant.

NEPA evaluations by federal agencies determine whether an action would have a significant effect on any of the categories evaluated. The NPS evaluated the use of piscicide in restoration and conservation of native fish species and issued a finding of no significant impact (FONSI), meaning an environmental impact statement is not required. Likewise, the U.S. Forest Service reviewed the direct, indirect, and cumulative effects of the proposed activities and alternatives for the Soda Butte Creek Yellowstone cutthroat trout Conservation Project, and determined that

these actions would not have a significant impact on the quality of the human environment. Thus, an environmental impact statement will not be prepared.

Finally, FWP reviewed the alternatives and found the proposed alternative would have no, or only short-term and minor effects on all of the categories evaluated. Therefore, there is no need for the preparation of an environmental impact statement.

7 Public Participation

7.1 *Public Involvement*

Public notification of the EA release and opportunities will be through the following media:

- Legal notices posted in the *Livingston Enterprise, The Cody Enterprise,* The *Bozeman Daily Chronicle, and The Billings Gazette:*
- Direct mailing to adjacent landowners and interested parties;
- Public notices on the FWP webpage (*http://fwp.mt.gov*) and its Facebook page (https://www.facebook.com/#!/MontanaFWP).
- A public meeting will be held on May 18, 2015 in Livingston at the Yellowstone Pioneer Lodge, beginning at 7:00 pm.
- A second public meeting will be held at the Cooke City Chamber of Commerce conference room on May 27, 2015 beginning at 7:00 pm.

Copies of this EA will be available for public review at FWP Region 5 Headquarters at 2300 Elmo Drive, Billings, Montana and on the FWP website (*http://fwp.mt.gov*).

7.2 *Public Comment Period*

The public comment period will extend for 30 days following announcement in *The Cody Enterprise*, and will begin May 14, 2015 and end June 19, 2015. Written comments will be accepted until 5:00 pm on June 19, 2015.

Send comments to:

Jason Rhoten
Montana Fish, Wildlife & Parks
2300 Elmo Lake Drive
Billings, MT 59105
(406) 698-1905
jrhoten@mt.gov

If you choose to submit comments to the U.S. Forest Service, please note the following:

Written comments shall include your name, address, and (if possible) telephone number; title of the document on which you are commenting; and specific facts or comments along with supporting reasons that you believe the Responsible Official should consider in reaching a decision.

Individuals and entities (non-governmental organizations, businesses, partnerships, state and local governments, Alaska Native Corporations, and Indian Tribes) who have submitted timely, specific written comments regarding a proposed project or activity during any designated opportunity for public comment may file an objection. Opportunity for public comment on an Environmental Assessment includes: during scoping, the 30 day public review period or any other instance where the responsible official seeks written comments.

Written comments are those submitted to the responsible official or designee during a designated opportunity for public participation provided for a proposed project. In order to have standing to file an Objection, specific written comments should be within the scope of the proposed action, have a direct relationship to the proposed action, and must include supporting reasons for the responsible official to consider.

Comments received through the U.S. Postal Service must be postmarked no later than the end of the 30-day comment period. All other comments, including e-mail, fax, and personal delivery must be received by COB (4:30 p.m.) at the Wapiti Ranger District office, 1403 203a, Yellowstone Ave., Cody, Wyoming 82414, by June 19, 2015. It is the responsibility of all individuals and organizations to ensure their comments are received in a timely manner. For electronically mailed comments, the sender should normally receive an automated electronic acknowledgement from the agency as confirmation of receipt. If the sender does not receive an automated acknowledgement of the receipt of the comment, it is the sender's responsibility to ensure timely receipt by other means. Written comments should be sent to Susan Stresser, District Ranger, Wapiti Ranger District, 203A Yellowstone Ave, Cody, WY 82414, or by fax at 307-527-7158, or by e-mail at comments-rocky-mountain-shoshone@fs.fed.us.

Additionally, pursuant to 7 CFR 1.27(d), any person may request the agency to withhold a submission from the public record by showing how the Freedom of Information Act (FOIA) permits such confidentiality. Persons requesting such confidentiality should be aware that, under the FOIA, confidentiality may be granted in only very limited circumstances, such as to protect trade secrets. The Forest Service will inform the requester of the agency's decision regarding the request for confidentiality and, where the request is denied, the agency will return the submission and notify the requester that the comments may be resubmitted with or without names and addresses."

7.2.1 Parties Responsible for Preparation of the EA

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Appendices: NEPA Compliance Documents

Effects Analysis and Biological Evaluation

Minimum Requirements Decision Guide Workbook

Biological Assessment for Terrestrial Wildlife Species for the Soda Butte Creek Yellowstone Cutthroat Trout Restoration Project

White Paper: Removal of Fish Using Chemical and Mechanical Means

.

RESOURCE: Wildlife (terrestrial)

EFFECTS ANALYSIS WORKSHEET AND BIOLOGICAL EVALUATION

Soda Butte Creek Yellowstone Cutthroat Trout Restoration

CUSTER GALLATIN and SHOSHONE NATIONAL FORESTs
GARDINER and CLARKS FORK RANGER DISTRICTs

❑ Description of Additional Analysis, Information, Documentation, or Consultation Needs.

Forest Service decision authority with respect to this project is specifically limited to the authorization of piscicide application within the wilderness.

1. Regional Forester designated Sensitive Terrestrial Wildlife - potential effects of project activities on sensitive species. As part of the National Environmental Policy Act process, the Forest Service must review programs and activities through a Biological Evaluation to determine their potential effect on sensitive species (FSM 2670.32). All Forest Service planned, funded, executed or permitted programs and activities are to be reviewed for possible effects on sensitive species (FSM 2672.4). There are currently 10 terrestrial species identified as "sensitive" that are known or suspected to occur on the Gallatin National Forest, and 31 terrestrial sensitive wildlife species for the Shoshone National Forest. These species are listed in the table below with corresponding narratives of basic biology and effects following.

2. Forest Plan designated Management Indicator Species (MIS) – MIS species from the Gallatin Forest Plan include elk (hunted species), marten (old growth, moist spruce sites) and goshawk (old growth, dry Douglas fir) and are also included in the table below. Grizzly bear and bald eagle are analyzed as threatened and sensitive species). There are 16 MIS species for the Shoshone National Forest, many of which are the same as for the Gallatin.

3. T&E – potential effects on threatened and endangered species and designated critical habitat. The Endangered Species Act of 1973, as amended, requires all Federal agencies to review any project authorized, funded or carried out to determine the action is not likely to jeopardize the continued existence of any proposed, threatened or endangered species and designated critical habitat. Forest Service policy requires that all Forest Service programs and activities need to be reviewed for possible effects on proposed, threatened or endangered species (FSM 2672.4). Effects on grizzly bear, lynx and lynx critical habitat were addressed in a Biological Assessment. A determination regarding the likely effects of this action on the status of species is provided below.

4. Migratory Birds - Migratory bird species are protected from harm under the Migratory Bird Treaty Act (16 USC 703-711) which requires federal agencies to ensure that environmental analyses of federal actions evaluate the effects of actions and agency plans on migratory birds. On January 10, 2001, President Clinton signed an Executive Order titled “Responsibilities of Federal Agencies to Protect Migratory Birds”. On January 17, 2001, the USDA Forest Service and the USDI Fish and Wildlife Service signed a Memorandum of Understanding to complement the Executive Order. There are currently no Forest Plan standards specific to migratory birds.

❑ Description of the Spatial and Temporal Bounds used for Effects Analyses:

Following is a description of the temporal bounds and spatial bounds (e.g., *the area considered in the analysis for the issue*) used for the effects analysis.

The time frame (temporal bounds) for project implementation and effects would begin during the 2015 summer application of the piscicide and continue through 2016, and possible 2017, when indirect effects would continue.

The spatial bounds include the streams and associated water bodies where the piscicide would be directly applied.

There would no cumulative effects from this project so no cumulative effect analysis area was defined.

❑ Issues Affecting this Resource Related to the Proposal:

Include a description of the potential issues related to this resource associated with implementation of the proposal (i.e. sharply define what could be affected and by which components of the proposal). If no issues, state the reasons for that conclusion and consider yourself done.

Potential risk to wildlife associated with direct exposure to rotenone, a diminished prey base relating to reduced biomass of fish or aquatic invertebrates, or exposure to rotenone through ingestion of dead animals or treated water.

❑ Mitigation Required to Address Issues and Protect This Resource:

List mitigation required to implement this proposal in order to protect this resource (please bullet the mitigation). A description can also be included if necessary to further describe the mitigation. State what the mitigation is designed to do and indicate how you know it will be effective.

1. To prevent bear-human conflicts, all attractants (including food, garbage, and chemicals associated with fish removal) will be stored in compliance with the relevant Food Storage Order for the Custer-Gallatin or Shoshone National Forest.

2. Any incident involving a grizzly bear or black bear will be reported to the Forest Service representative within 24 hours. Project activities may be immediately temporarily suspended or modified if such an action is necessary in order to prevent bear-human conflicts.

3. Helicopter use for transporting personnel and equipment into the Sheep Creek drainage will be limited to 2 days annually between July 1-August 15. Daily helicopter flight paths will follow the shortest practical and safe route between landing zones.

4. Fish killed through chemical treatment will be collected within 24 hours and disposed of in accordance with applicable food storage order requirements. This applies to all portions on National Forest Lands of Soda Butte Creek and the lower ¼ mile of all its tributaries that would be treated.

5. All participants in project activities would be trained in bear safety practices and the proper use of bear pepper spray, and will carry bear pepper spray at all times while working outside of vehicles or developed areas.

❑ Direct/Indirect Effects:

Describe any direct/indirect effects to this resource associated with implementation of the proposal.

Effects on nontarget species of wildlife would range from nonexistent to short-term and minor. Some species may experience temporary reductions in prey base, which may displace these animals until fish and macroinvertebrate populations rebound. Concentrations of rotenone in water and dead fish would not pose long-term threats to wildlife.

A temporary reduction in prey of aquatic origin has potential to influence mammals, amphibians, reptiles, birds, and bats. Mammalian predators that are likely to exploit prey of aquatic origin in the treatment area as a regular source of their diet include the river otter. Additionally, availability of dead fish from piscicide treatment would attract scavenging animals to the stream corridor to consume dead fish immediately over the short-term. In the streams, large concentrations of dead fish would be avoided to prevent disturbance of scavenging animals and ensure human and animal safety.
The temporary reductions of aquatic prey, and the brief availability of dead fish, constitute short-term and minor effects on mammalian predators including river otters.

In addition, piscivorous mammals were highly unlikely to consume enough fish to result in observable acute toxicity and thus would not result in neurological risks to field exposed animals. There are no anticipated negative impacts to terrestrial wildlife that may consume treated water or fish killed by rotenone.

A number of bird species with potential to occur within the project area consume fish or invertebrates with an aquatic life history stage. Numerous species of songbird eat winged adults of invertebrates originating from streams; most songbirds that consume winged invertebrates would not be present during the fall treatment period. The effect of a reduction of forage base on these organisms would be minor and short-term. Bats also consume winged insects, and therefore, rotenone projects have potential to have a negative effect on bats. Diet preferences and seasonal habitat use for bats in the project area indicate effects on bats would be negligible.

SUMMARY OF EFFECTS

THREATENED AND ENDANGERED SPECIES BIOLOGICAL ASSESSMENT

Species	Proposed Action
Grizzly Bear	NLAA
Canada Lynx	NE
Canada Lynx Critical Habitat	NE
Gray Wolf (Shoshone NF only)	NJ

NE = No Effect
NLAA = May effect, not likely to adversely affect
LAA = May effect, likely to adversely affect
BE = Beneficial Effect
NJ= Not likely to jeopardize the continued existence of the species

SENSITIVE SPECIES BIOLOGICAL EVALUATION

Species	Sensitive Status	BE Determination, Proposed Action
Bald Eagle	CGNF, SNF	NI
Peregrine Falcon	CGNF, SNF	NI
Black-backed Woodpecker	CGNF, SNF	NI
Flammulated Owl	CGNF, SNF	NI
Harlequin Duck	CGNF, SNF	NI
Trumpeter Swan	CGNF, SNF	NI
Bighorn Sheep	CGNF, SNF	NI
Wolverine	CGNF, SNF	NI
Townsend's big-eared bat	CGNF, SNF	NI
Gray Wolf	CGNF	NI
Fringed Myotis	SNF	NI
Spotted Bat	SNF	NI
Townsend's Big-eared Bat	SNF	NI
Hoary Bat	SNF	NI
White-tailed prairie dog	SNF	NI
Water vole	SNF	NI
River otter	SNF	MIIH
American marten	SNF	NI
Northern goshawk	SNF	NI
Ferruginous hawk	SNF	NI
Northern harrier	SNF	NI
Mountain Plover	SNF	NI
Long-billed curlew	SNF	NI
Black tern	SNF	NI
Burrowing owl	SNF	NI
Boreal owl	SNF	NI
Short-eared owl	SNF	NI
Lewis' woodpecker	SNF	NI
Olive-sided flycatcher	SNF	NI
Loggerhead shrike	SNF	NI
Brewer's sparrow	SNF	NI
Greater sage grouse	SNF	NI
Grasshopper sparrow	SNF	NI

NI = No Impact

MIIH = May Impact Individuals or Habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species

WIFV= Will Impact individuals or habitat with a consequence that the action may contribute to a trend toward Federal listing or cause a loss of Viability to the population or species

BI = Beneficial Impact

❑ Cumulative Effects

There would be very minor, if any, cumulative effects from this project so no cumulative effect analysis area was completed.

❑ FINDING OF NO SIGNIFICANT IMPACT

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

The proposed action will not result in significant effects to any threatened or endangered species. A Wildlife Biologist reviewed the project and analyzed the potential impacts of the proposed activity on various species and their habitats in the BE/BA (Project File).

10. Whether the action threatens a violation of Federal. State, or Local law or requirements imposed for the protection of the environment.

The action will not violate Federal, State, and local laws or requirements and is consistent with all applicable management direction. This action and its associated analysis are in compliance with all applicable laws, regulations, policy, and Forest Plan direction, as follows.

<u>Endangered Species Act</u>
Under Section 7 of the Endangered Species Act, each Federal agency must ensure that any action authorized, funded or carried out is not likely to jeopardize the continued existence of any threatened or endangered species. Effects on grizzly bear, lynx and lynx critical habitat, and gray wolves (in Wyoming only) were addressed in a Biological Assessment that has been submitted to the U.S. Fish & Wildlife Service for their review.

<u>National Forest Management Act</u>
The National Forest Management Act (NFMA) requires that Forest plans "preserve and enhance the diversity of plant and animal communities...so that it is at least as great as that which can be expected in the natural forest" (36 CFR 219.27). There are currently 10 terrestrial species identified by the Regional Forester as "Sensitive" that are known or suspected to occur on the Gallatin National Forest, and an additional 23 sensitive species for the Shoshone National Forest. The determination of proposed trout restoration would have ‘no impact’ on all of the designated sensitive terrestrial wildlife species except the river. The project ‘may Impact Individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species’.

<u>Forest Plan Direction</u>
These actions are consistent with management direction in the Land and Resource Management Plan for the Gallatin National Forest approved in 1987 (including page III-6, III-24) as well as the Shoshone National Forest Forest Plan. Standards for the wildlife resource would be met. There would be no effects to management indicator species.

<u>Migratory Bird Treaty Act</u>
On January 10, 2001, President Clinton signed an Executive Order outlining responsibilities of federal agencies to protect migratory birds. On January 17, 2001, the USDA Forest Service and the USDI Fish and Wildlife Service signed a Memorandum of Understanding to complement the Executive Order. Executive Order 13186 requires agencies to ensure that environmental analyses evaluate the effects of federal actions and agency plans on migratory birds, with emphasis on species of concern. The trout restoration could impact individual birds or family groups, but under prescribed application measures, would not have adverse effects on any species of migratory bird at the population level, and would not result in a loss of migratory bird habitat or be an extirpation threat to any migratory birds.

/s/ *Andrew Pils* April 20, 2015

Wildlife Biologist *Date*

ARTHUR CARHART NATIONAL WILDERNESS TRAINING CENTER

MINIMUM REQUIREMENTS DECISION GUIDE WORKBOOK

"…except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act…"

-- The Wilderness Act of 1964

Project Title: **Soda Butte Creek Yellowstone Cutthroat Trout Restoration**

MRDG Step 1: Determination

Determine if Administrative Action is Necessary

Description of the Situation

What is the situation that may prompt administrative action?

Yellowstone cutthroat trout (YCT) historically occupied 17,721 miles of habitat in the western U.S. Today YCT currently occupy just 7,528 miles (44%) of their historic stream habitats. Only 3,000 miles (17%) of these historic streams contain genetically unaltered YCT. Introduction of non-native fish species, irrigation, agricultural, timber, and mining practices, and over-harvesting have been causes of YCT declines. YCT have been petitioned for listing under the Endangered Species Act though the USFWS determined that listing was not warranted at the time. YCT are a Species of Special Concern in Montana and are a U.S. Forest Service Sensitive Species in Regions 1, 2, and 4. This species' conservation needs include maintaining genetic integrity, habitat free of non-native competing species, and habitat and population expansion and protection.

The Lamar River Basin is one of the most important watersheds for YCT conservation because of the large amount of interconnected high elevation, high quality habitat, at the core of the species range. Nonnative brook trout in Soda Butte Creek, a primary tributary to the Lamar River, threaten the long-term persistence of YCT in the Lamar River Basin. If not eradicated, brook trout could spread downstream throughout the Lamar River Basin in Yellowstone National Park. Brook trout in the Lamar River Basin would have a high probability of causing substantial population declines and possible extinctions of YCT

populations in tributary streams. For this reason, removal of brook trout in Soda Butte Creek is among the top two priorities of the Upper Yellowstone Geographic Management Unit of the YCT Interstate Working Group.

The existing YCT population in Soda Butte has a low level of introgression with westslope cutthroat trout and rainbow trout and the population is no longer representative of fish endemic to the upper Lamar River drainage. This is likely a result of a legacy of past stocking efforts and potentially due to upstream invasion of rainbow trout from the Lamar River. In 2014, a bedrock chute in Ice Box Canyon on Soda Butte Creek was modified into a fish barrier to prevent future rainbow trout invasion into the upper Soda Butte Creek watershed. Rainbow trout pose a significant hybridization risk to YCT in the Lamar River and this barrier provides an opportunity to preserve the genetic legacy of YCT endemic Lamar basin in a location secure from rainbow trout introgression.

Over ten years of intensive mechanical removal efforts using backpack and mobile electrofishing equipment by Montana, Department of Fish Wildlife and Parks, Wyoming Game and Fish, U.S.D.A Forest Service, and National Parks Service personnel in Soda Butte Creek and tributary streams has decreased the abundance of brook trout, but has failed to eradicate the species. Variables such as fish size, habitat complexity, stream size, water velocity, pool depth, turbidity, and conductivity affect the capture efficiency of electrofishing equipment. In Soda Butte Creek, frequent log jams, turbidity, deep pools, and relatively large stream size limit the effectiveness of electrofishing equipment and the ability to mechanically remove all brook trout.

Options Outside of Wilderness

Can action be taken outside of wilderness that adequately addresses the situation?

☐ YES	**STOP – DO NOT TAKE ACTION IN WILDERNESS**
☒ NO	**EXPLAIN AND COMPLETE STEP 1 OF THE MRDG**

Explain:

Complete removal of undesirable fish species is predicated on removing **all** fish from **all** connected waters so that there are no refugia. To meet the project objective of removing all brook trout upstream from the Ice Box Canyon fish barrier, connected waters in the North Absaroka Wilderness in Woody Creek, Republic Creek, Unnamed tributary (referred to as Guitar Creek), and Soda Butte Creek would need to be treated. If left untreated, surviving brook trout in wilderness stream reaches would repopulate the project area and the project objective would not be met.

Criteria for Determining Necessity
Is action necessary to meet any of the criteria below?

A. Valid Existing Rights or Special Provisions of Wilderness Legislation

Is action necessary to satisfy valid existing rights or a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws) that ***requires*** *action? Cite law and section.*

☒ YES ☐ NO

Explain:

No Section 4(c) prohibited uses are being requested. Section 4d(8) of the Wilderness Act recognizes the role of state fish and wildlife agencies in management of populations in wilderness. What is being requested is to manage the fishery by removing non-native trout species. Management actions within wilderness may be conducted to re-establish or perpetuate an indigenous species adversely affected by human influence or perpetuate or recover a threatened or endangered species. The presence of previously stocked brook trout in Soda Butte Creek poses an extinction risk not only to YCT in Soda Butte Creek and its tributaries but to downstream YCT populations in the greater Lamar River Basin. This project would involve removing the existing non-native brook trout in Soda Butte Creek and its tributaries.

B. Requirements of Other Legislation

Is action necessary to meet the requirements of other federal laws? Cite law and section.

☒ YES ☐ NO

Explain:

Although the USFWS has determined that ESA listing is not warranted, YCT are a Forest Service Sensitive Species in Regions 1, 2, and 4. Sensitive species are managed under the authority of the National Forest Management Act (NFMA) and are administratively designated by the Regional Forester (FSM 2670.5; USFS 2004). FSM 2670.22 requires the maintenance of viable populations of native and desired non-native species and to avoid actions that may cause a species to become listed as threatened or endangered under ESA. The NFMA directs the Forest Service to “provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives.” [16 U.S.C. 1604(g)(3)(B)]. Providing ecological conditions to support diversity of native plant and animal species in the project area satisfies the statutory requirements. The Forest Service’s focus for meeting the requirements of NFMA and its implementing regulations is on assessing habitat to provide for a diversity of species and their conservation needs so that listing is prevented under the

Endangered Species Act. The conservation needs of YCT include maintaining habitat free from competing and hybridizing species and population expansion and protection. This project is compliant with the NFMA because it would help further these conservation needs.

FSM 2602-2 states that the U.S. Forest Service will maintain a partnership with State fish and wildlife agencies in habitat management efforts. It recognizes the State wildlife and fish agencies as responsible for the management of animals and the Forest Service as responsible for the management of habitat. It recognizes involvement of other Federal agencies, concerned conservation groups, and individuals in activities affecting wildlife and fish as appropriate.

C. Wilderness Character

Is action necessary to preserve one or more of the qualities of wilderness character, including: Untrammeled, Undeveloped, Natural, Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation, or Other Features of Value?

UNTRAMMELED

☐ YES ☒ NO

Explain:

UNDEVELOPED

☐ YES ☒ NO

Explain:

NATURAL

☒ YES ☐ NO

Explain:

Replacing nonnative brook trout and hybridized YCT with genetically pure YCT endemic to the upper Lamar River Basin is necessary to improve and restore the **natural quality** of wilderness character of this area and restore the species native to the drainage. This project contributes to the conservation of a native species, which is

ecologically adapted to the area.

SOLITUDE OR PRIMITIVE & UNCONFINED RECREATION

☐ YES ☒ NO

Explain:

OTHER FEATURES OF VALUE

☐ YES ☒ NO

Explain:

Step 1 Decision
Is administrative action necessary in wilderness?

Decision Criteria

A.	Existing Rights or Special Provisions	☒ YES	☐ NO
B.	Requirements of Other Legislation	☒ YES	☐ NO
C.	Wilderness Character		
	Untrammeled	☐ YES	☒ NO
	Undeveloped	☐ YES	☒ NO
	Natural	☒ YES	☐ NO
	Outstanding Opportunities	☐ YES	☒ NO
	Other Features of Value	☐ YES	☒ NO

Is administrative action necessary in wilderness?

☒ YES **EXPLAIN AND PROCEED TO STEP 2 OF THE MRDG**

☐ NO **STOP – DO NOT TAKE ACTION IN WILDERNESS**

Explain:

The distribution and abundance of YCT has been greatly reduced since European settlement.

Nonnative brook trout threaten the long-term persistence of YCT in the Lamar River drainage. Until sources of brook trout invasion are addressed in Soda Butte Creek and its connected tributaries in wilderness, YCT populations in Soda Butte Creek and the greater Lamar River Basin will be at an ever increasing extinction risk. This is because fish in high gradient streams tend to disburse in a downstream direction either voluntarily or unintentionally during flood events. Electrofishing removal efforts in Soda Butte Creek and tributaries over the last two years have documented an alarming downstream expansion of brook trout into Yellowstone Park. Removing nonnative brook trout and hybridized YCT in Soda Butte Creek and its tributaries upstream from the Ice Box Canyon fish barrier and replacing them with pure YCT endemic to the Lamar Basin would a) eliminate the threat of brook trout invasion and establishment in the greater Lamar River Basin and b) would establish a genetically pure conservation population of this imperiled species secure from downstream hybridization risk. This effort would constitute a significant contribution to conservation of a species to help avoid future listing under the ESA as required under the NFMA. This action would result in approximately 12 stream miles of secure YCT habitat on Soda Butte Creek and additional stream miles on its connected tributary streams. Moreover, this project would help restore and preserve the **natural quality** of wilderness character.

MRDG Step 2

Determine the Minimum Activity

Other Direction

*Is there "special provisions" language in legislation (or other Congressional direction) that explicitly **allows** consideration of a use otherwise prohibited by Section 4(c)?*

AND/OR

Has the issue been addressed in agency policy, management plans, species recovery plans, or agreements with other agencies or partners?

☒ YES **DESCRIBE OTHER DIRECTION BELOW**

☐ NO **SKIP AHEAD TO TIME CONSTRAINTS BELOW**

Describe Other Direction:

This proposed project conforms to direction in the Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness (FSM 2323.32 #5). These guidelines for fish and wildlife management in U.S. Forest Service administered wilderness areas indicate that: Chemical treatment may be necessary to prepare waters for the reestablishment of indigenous fish species**,** consistent with approved wilderness management plans**,** to conserve or recover federally listed threatened or endangered species, or to correct undesirable conditions resulting from human activity. Proposals for chemical treatments will be considered and may be authorized by the Federal administering agency through application of the MRDG as outlined in Section E., General Policy. Any use of chemical treatments in wilderness requires prior approval by the Federal administering agency.

Guidelines for Chemical Treatment

a) Use only registered pesticides according to label directions.
b) In selecting pesticides, give preference to those that will have the least impact on non-target species and on the wilderness environment.
c) Schedule chemical treatments during periods of low human use, insofar as possible.

Immediately dispose of fish removed in a manner agreed to by the Federal administering agency and the State agency.

In addition, in a Memorandum of agreement for conservation and management of Yellowstone cutthroat trout *(Oncorhynchus clarki bouvieri)* among Montana, Idaho, Wyoming, Nevada, Utah, U.S Forest Service, Yellowstone National Park, and Grand Teton National Park (2000) the Forest Service agreed to the following goals and objectives:

- Goal: Ensure the persistence of the Yellowstone cutthroat trout subspecies within its historic range. Manage YCT to preserve genetic integrity and provide adequate numbers and populations to provide for protection and maintenance of intrinsic and recreational values associated with this fish.

- Objective 2. Secure and enhance conservation populations
    - Identify genetic purity of existing populations. Prioritize populations based on

genetic purity, population size, unique characteristics, and management goals. Secure and if necessary enhance all known and suspected genetically pure YCT populations, and high priority introgressed populations. These efforts might include, but are not limited to:

- Expansion of current populations within the context of their streams and watersheds.

- Objective 3. Restore populations. Increase the number of stream populations by restoring YCT within their native range. Local restoration goals and approaches will be developed to meet this objective.

Time Constraints

What, if any, are the time constraints that may affect the action?

Interagency fish population data collected concurrently with brook trout removal efforts has shown a rapid downstream expansion of brook trout into Yellowstone Park. Most recent data indicate that brook trout are less than 0.6 mile upstream from the Ice Box Canyon fish barrier in Soda Butte Creek and 8.7 miles from the Lamar River. The window for removing brook trout before they invade the Lamar River is quickly closing and it is imperative that all brook trout are removed from Soda Butte Creek and its tributaries in August 2015 and 2016.

Components of the Action

What are the discrete components or phases of the action?

Component X:	*Example: Transportation of personnel to the project site*
Component 1:	**Identify treatment area**: For each tributary stream, identify all suitable aquatic habitat connected to fish-bearing stream reaches below migration barriers. Ground truth treatment area as well as refugia upstream from treated reaches.
Component 2:	**Macroinvertebrate monitoring**: Collect macroinvertebrate samples to ensure that there are no unique species within the project area that would be threatened by piscicide treatment. If unique macroinvertebrates are present, minimization measures would be employed to protect them. Macroinvertebrate monitoring would be repeated at year one and year two post-project to document recovery.
Component 3:	**Project implementation planning**: Conduct dye tests, discharge measurements, and bioassays to determine rotenone travel time and drip station spacing. Data would be used to prepare maps of drip station locations with GPS coordinates.

Component 4:	**Rotenone treatment**: Personnel would hike on foot to pre-determined GPS coordinates on treatment reaches and deploy rotenone drip stations to chemically treat flowing waters. Non-flowing waters would be treated with non-motorized backpack sprayers. Sentinel fish would be deployed in net bags upstream of each drip station to evaluate treatment effectiveness. Sentinel fish and equipment may be delivered to backcountry locations using pack stock. Treatment of wilderness waters in a given year would likely occur over a time period not to exceed two weeks. Treatment of non-wilderness waters would partially overlap with treatment of wilderness waters and would also be completed within a two week time frame. A second year of treatment would occur to increase probability of successful brook trout removal. Follow-up treatments would be predicated on the results of effectiveness monitoring (see below).
Component 5:	**Rotenone detoxification**: Detoxification station below Ice-Box Canyon (outside of Wilderness) would begin operating continuously and monitored for effectiveness until all rotenone has left the system.
Component 6:	**Effectiveness monitoring**: After the second year of treatment, a combination of backpack electrofishing and environmental DNA testing (requiring only water samples) would be used to determine whether all brook trout have been successfully removed.
Component 7:	**YCT Restocking:** Restocking in Wilderness with genetically pure YCT would occur: a) only after effectiveness monitoring indicates that brook trout have been successfully removed and b) only in stream reaches where fish were present prior to the removal effort. Those waters that were fishless prior to the removal would **not** be stocked. Fish would be transported to restocking locations in Wilderness via pack stock and on foot/backpack. Non Wilderness waters would be restocked primarily via hatchery truck from the open road system. No stocking would occur directly into the Wilderness reach of Soda Butte Creek. Instead, fish in this reach would redistribute from adjacent stocked reaches.
Component 8:	
Component 9:	

Proceed to the alternatives.

Refer to the **MRDG Instructions** regarding alternatives and the effects to each of the comparison criteria.

MRDG Step 2: Alternatives

Alternative 1: No Action

Description of the Alternative
What are the details of this alternative? When, where, and how will the action occur? What mitigation measures will be taken?

Brook trout and hybridized YCT would not be removed from Soda Butte Creek.

Component Activities
How will each of the components of the action be performed under this alternative?

Component of the Action		Activity for this Alternative
X	*Example: Transportation of personnel to the project site*	*Example: Personnel will travel by horseback*
1	None associated with No Action	None associated with No Action
2		
3		
4		
5		
6		
7		
8		
9		

Wilderness Character
What is the effect of each component activity on the qualities of wilderness character? What mitigation measures will be taken?

UNTRAMMELED

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒

1	No Action	☐	☐	☒
2		☐	☐	☐
3		☐	☐	☐
4		☐	☐	☐
5		☐	☐	☐
6		☐	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects				NE
Untrammeled Total Rating		**0**		

Explain:

Inaction would have no effect on the untrammeled quality of wilderness character.

UNDEVELOPED

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	No Action	☐	☐	☒
2		☐	☐	☐
3		☐	☐	☐
4		☐	☐	☐
5		☐	☐	☐
6		☐	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects				NE
Undeveloped Total Rating		**0**		

0

Explain:

Inaction would have no effect on the undeveloped quality of wilderness character.

NATURAL

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	No Action	☐	☒	☐
2		☐	☐	☐
3		☐	☐	☐
4		☐	☐	☐
5		☐	☐	☐
6		☐	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects			3	NE
Natural Total Rating		**-3**		

Explain:

Through inaction, indigenous species, patterns, and processes would not be protected and natural conditions will not be preserved. Nonnative brook trout abundance would increase in stream reaches within Wilderness. YCT would decline commensurate with increases in brook trout distribution and abundance. Remaining YCT would continue to have low levels of hybridization with nonindigenous rainbow and westslope cutthroat trout. This would result in degradation to the natural quality of wilderness character.

SOLITUDE OR PRIMITIVE & UNCONFINED RECREATION

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	No Action	☐	☐	☒
2		☐	☐	☐
3		☐	☐	☐
4		☐	☐	☐
5		☐	☐	☐

6		☐	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects				NE
Solitude or Primitive & Unconfined Rec. Total Rating		**0**		

Explain:

Inaction would have no effect on the solitude and unconfined recreation quality of wilderness character.

OTHER FEATURES OF VALUE

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	No Action	☐	☐	☒
2		☐	☐	☐
3		☐	☐	☐
4		☐	☐	☐
5		☐	☐	☐
6		☐	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects				NE
Other Features of Value Total Rating		**0**		

Explain:

Inaction would have no effect on the other features of value quality of wilderness character.

Traditional Skills

What is the effect of each component activity on traditional skills?

TRADITIONAL SKILLS

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	No Action	☐	☐	☒
2		☐	☐	☐
3		☐	☐	☐
4		☐	☐	☐
5		☐	☐	☐
6		☐	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects				NE
Traditional Skills Total Rating		**0**		

Explain:

Inaction would have no effect on the traditional skills quality of wilderness character.

Economics

What is the estimated cost of each component activity?

COST

Component Activity for this Alternative		Estimated Cost
X	*Example: Personnel will travel by horseback*	*$1,900*
1	No direct cost of No Action Alternative	$0.00
2		
3		
4		
5		
6		
7		

8		
9		
Total Estimated Cost		**$0.00**

Explain:

There are no financial obligations related to the no action alternative.

Safety of Visitors & Workers

What is the risk of this alternative to the safety of visitors and workers? What mitigation measures will be taken?

RISK ASSESSMENT	Probability of Accident				
Severity of Accident	Frequent	Likely	Common	Unlikely	Rare
Catastrophic: Death or permanent disability	1 ☐	1 ☐	2 ☐	2 ☐	3 ☐
Critical: Permanent partial disability or temporary total disability	1 ☐	2 ☐	2 ☐	3 ☐	4 ☒
Marginal: Compensable injury or illness, treatment, lost work	2 ☐	3 ☐	3 ☐	4 ☐	4 ☒
Negligible: Superficial injury or illness, first aid only, no lost work	3 ☐	4 ☐	4 ☐	4 ☐	4 ☒
Risk Assessment	**Low Risk**				

Risk Assessment Code

1 = Extremely High Risk	**2 = High Risk**	**3 = Moderate Risk**	**4 = Low Risk**

Explain:

There is no safety risk related to the No Action alternative. Overall risk is low.

Summary Ratings for Alternative 1

Wilderness Character	
Untrammeled	0
Undeveloped	0
Natural	-3
Solitude or Primitive & Unconfined Recreation	0

Other Features of Value	0
Wilderness Character Summary Rating	**-3**

Traditional Skills	
Traditional Skills	0

Economics	
Cost	0

Safety	
Risk Assessment	Low Risk

MRDG Step 2: Alternatives

Alternative 2: Fish Removal Using the Fish Toxicant Rotenone

Description of the Alternative
What are the details of this alternative? When, where, and how will the action occur? What mitigation measures will be taken?

Because brook trout eradication using intensive electrofishing effort has not been attainable in Soda Butte Creek or its tributaries, chemical removal using the piscicide rotenone remains the only feasible alternative for maintaining or restoring the YCT population in Soda Butte Creek. Complete removal of undesirable fish species using piscicide is predicated on chemically treating all connected waters that may support fish so that there are no untreated refugia in suitable fish habitat. To meet the project objective of removing all brook trout and hybridized YCT upstream from the Ice Box Canyon fish barrier, connected waters in the North Absaroka Wilderness in Woody Creek, Republic Creek, Guitar Creek, and Soda Butte Creek would need to be chemically treated over a minimum two-year period starting in 2015. Additional treatments are entirely dependent on the success of the previous treatments. There is a very low but real possibility additional treatments would be necessary. Based on GIS analysis, there are a total of 16.98 perennial stream miles in the North Absaroka Wilderness within the project area (Table 1; Figure 1). Of these, 10.1 stream miles are estimated to be treated. However this value is an approximation and may vary based on field reconnaissance as described below. Rotenone treatment would begin at the upper end of suitable fish habitat and proceed in a downstream direction. Potassium permanganate (to detoxify the rotenone and eliminate impacts to downstream biota) would be applied in a manner consistent with the product label per Federal law (Attachment A). Proper permits for chemical treatment would be obtained and applied in order to meet the direction and intent of the Federal Water Pollution Control Act (Clean Water Act). The State of Montana would provide certified applicators and would strictly adhere to application directions and guidance.

Table 1. Summary of perennial stream miles and miles of proposed stream channel for rotenone treatment in the North Absaroka Wilderness. Stream miles are approximations based on GIS data and will be refined via field reconnaissance.

Stream Name	Perennial Stream Miles	Approximated Treatment Miles
Hayden Creek	3.88	1.99
Republic Creek	8.31	6.80
Soda Butte Creek	0.38	0.38
Woody Creek	0.13	0.00
Unnamed Trib 1	1.50	0.00
Unnamed Trib 2 (Guitar Creek)	2.79	0.98
Grand Total	**16.98**	**10.15**

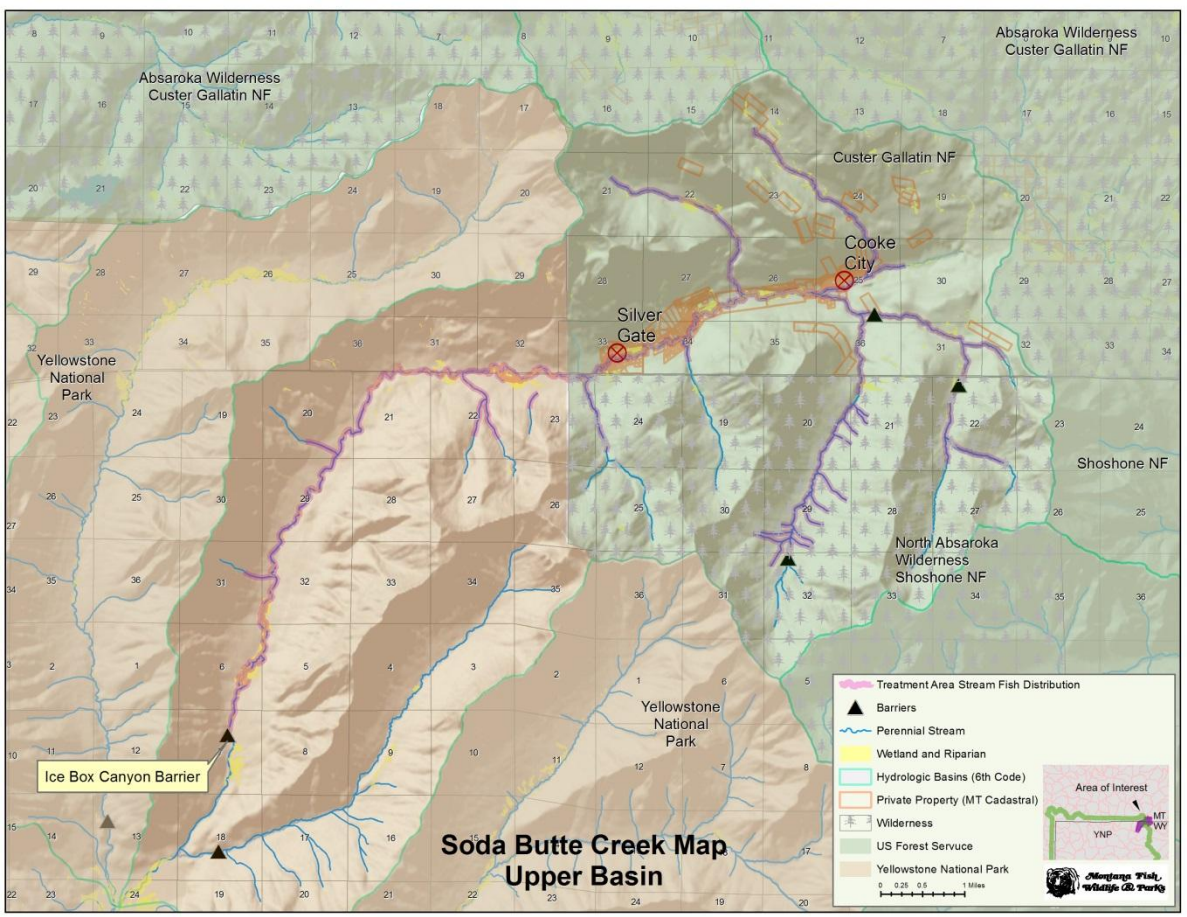

Figure 1. Soda Butte YCT Restoration Project area map.

Prior to rotenone treatment, flow measurments, dye tests (using non-toxic Rhodamine WT or Fluorescein) to determine chemical travel time, and bioassays would be conducted for the purpose of determining placement of application sites and quantity of rotenone. Additional reconnaissance would occur to refine treatment reaches based on fish habitat suitability (presence of flowing water or isolated pools in reaches with suitable gradient).

For flowing waters, rotenone would be applied primarily via five gallon drip cans placed at predetermined intervals and locations based on chemical travel time. Any non-flowing waters would be treated with a non-motorized backpack weed sprayer. Live YCT sentinel fish would be placed in net bags immediately above each drip station for evaluation of treatment effectiveness. Each drip can would be manned continuously by at least one person.

Applicators would hike to treatment locations. Pack stock or agency employees would assist in packing gear. If overnight camping is deemed necessary to support project activities, crews would camp at pre-approved agency locations and would practice minimum-impact camping techniques and would comply with all food storage orders to reduce wilderness impacts. Crews camping overnight are not expected to exceed six individuals per subwatershed and no more than six nights per year are anticipated. Dead fish carcasses

would be disposed of by allowing them to sink to the bottom of treated waters and decompose, thus returning nutrients to the aquatic ecosystem. Signs would be posted at the trailheads to inform wilderness users of the objectives of the project, its importance, and techniques used to accomplish the objectives. Information officers representing their respective agencies will be stationed at trailheads and other key areas to inform the public.

Treatment in wilderness would **not** include the use of any motorized equipment.

High gradient reaches not suitable for fish would remain untreated. These areas would serve as refugia for macroinvertebrates thereby facilitating rapid recolonization of the macroinvertebrate community.

Restocking in Wilderness with genetically pure YCT would occur: a) only after effectiveness monitoring indicates that brook trout have been successfully removed and b) only in stream reaches where fish were present prior to the removal effort. Those waters that were fishless prior to the removal would **not** be stocked. Fish would be transported to restocking locations in Wilderness via pack stock and on foot/backpack. Non Wilderness waters would be restocked primarily via hatchery truck from the open road system. No stocking would occur directly into the Wilderness reach of Soda Butte Creek. Instead, fish in this reach would redistribute from adjacent stocked reaches.

Component Activities

How will each of the components of the action be performed under this alternative?

Component of the Action		Activity for this Alternative
X	*Example: Transportation of personnel to the project site*	*Example: Personnel will travel by horseback*
1	Pre-application data collection/ reconnaissance.	Personnel would travel on foot.
2	Transportation of personnel to the project site.	Personnel will travel on foot
3	Transportation of equipment to the project site.	Equipment will be carried by personnel or on pack stock.
4	Overnight occupancy	Personnel will camp at pre-designated sites using minimum impact camping techniques and comply with food storage order.
5	Rotenone application	Personnel will apply rotenone via accepted non-motorized methods per label requirements.

6	Project monitoring (fish populations and aquatic macroinvertebrates)	Personnel will use accepted fish population and macroinvertebrate sampling methods under the AFWA agreement to monitor project effectiveness and recovery.
7	YCT restocking	YCT would be restocked in Wilderness via pack stock and foot travel only to those waters having fish prior to rotenone treatment.
8		
9		

Wilderness Character

What is the effect of each component activity on the qualities of wilderness character? What mitigation measures will be taken?

UNTRAMMELED

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	Personnel will travel on foot	☐	☐	☒
2	Equipment will be carried by personnel or on pack stock.	☐	☐	☒
3	Personnel will camp at pre-designated sites using minimum impact camping techniques and comply with food storage order.	☐	☐	☒
4	Personnel will apply rotenone via accepted non-motorized methods per label requirements.	☐	☒	☐
5	Personnel will use accepted fish population and macroinvertebrate sampling methods under the AFWA agreement to monitor project effectiveness and recovery.	☐	☐	☒
6	YCT would be restocked in Wilderness via pack stock and foot travel only to those waters having fish prior to rotenone treatment.	☒	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐

Total Number of Effects	1	1	NE
Untrammeled Total Rating		**0**	

Explain:

The proposed treatment would by definition affect the untrammeled nature of the project area in the short term by introducing human manipulation within the wilderness ecosystem. This short term trammeling would be beneficial in the long term by removing non-native and hybridized fish and replacing them with a native species. It would also correct previous trammeling that occurred when non-native rainbow trout were introduced and stocked and would negate any future trammeling related to mechanically removing exotic fish.

UNDEVELOPED

	Component Activity for this Alternative	Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	Personnel will travel on foot.	☐	☐	☒
2	Equipment will be carried by personnel or on pack stock.	☐	☐	☒
3	Personnel will camp at pre-designated sites using minimum impact camping techniques and comply with food storage order.	☐	☐	☒
4	Personnel will apply rotenone via accepted non-motorized methods per label requirements.	☐	☐	☒
5	Personnel will use accepted fish population and macroinvertebrate sampling methods under the AFWA agreement to monitor project effectiveness and recovery.	☐	☐	☒
6	YCT would be restocked in Wilderness via pack stock and foot travel only to those waters having fish prior to rotenone treatment.	☐	☐	☒
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects		0	0	NE
Undeveloped Total Rating			**0**	

Explain:

Under this Alternative there would be no effect on the undeveloped quality of wilderness character in the North Absaroka Wilderness.

NATURAL

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	Personnel will travel on foot.	☐	☐	☒
2	Equipment will be carried by personnel or on pack stock.	☐	☐	☒
3	Personnel will camp at pre-designated sites using minimum impact camping techniques and comply with food storage order.	☐	☐	☒
4	Personnel will apply rotenone via accepted non-motorized methods per label requirements.	☒	☒	☐
5	Personnel will use accepted fish population and macroinvertebrate sampling methods under the AFWA agreement to monitor project effectiveness and recovery.	☐	☐	☒
6	YCT would be restocked in Wilderness via pack stock and foot travel only to those waters having fish prior to rotenone treatment.	☒	☐	☐
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects		2	1	NE
Natural Total Rating		**1**		

Explain:

In the long term, this alternative would improve the naturalness of the treatment area by restoring fish native to the drainage and removing non-native species previously introduced and stocked. The positive effects of this project extend far beyond the North Absaroka Wilderness boundary because the potential for brook trout to invade the greater Lamar River Drainage in Yellowstone National Park would be eliminated. In the short term, the natural conditions of the wilderness would be temporarily impaired by introduction of the chemical pisscicide rotenone. Rotenone is specific to gilled aquatic organisms and has no known adverse effects to flora or other fauna. Other than fish, aquatic macroinvetebrates would be most affected by rotenone treatment. However, numerous studies as well as local monitoring have demonstrated that rotenone effects on stream dwelling macroinvertebrate communities

are short in duration and recolonization of aquatic macroinvertebrates occurs rapidly, especially when untreated refugia are maintained (see Attachment B). Aquatic habitats in the wilderness project area consist primarily of moderate to high gradient streams and are not suitable breeding habitat for gill breathing Colomuba spotted frog or western toad larvae. Therefore these species are unlikely to be affected in Wilderness.

SOLITUDE OR PRIMITIVE & UNCONFINED RECREATION

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	Personnel will travel on foot.	☐	☐	☒
2	Equipment will be carried by personnel or on pack stock.	☐	☐	☒
3	Personnel will camp at pre-designated sites using minimum impact camping techniques and comply with food storage order.	☐	☐	☒
4	Personnel will apply rotenone via accepted non-motorized methods per label requirements.	☒	☒	☐
5	Personnel will use accepted fish population and macroinvertebrate sampling methods under the AFWA agreement to monitor project effectiveness and recovery.	☐	☐	☒
6	YCT would be restocked in Wilderness via pack stock and foot travel only to those waters having fish prior to rotenone treatment.	☐	☐	☒
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects		1	1	NE
Solitude or Primitive & Unconfined Rec. Total Rating		**0**		

Explain:

Impacts to recreation related to this Alternative would be minimal and of short duration. No more than 30 people would be working in the wilderness at any given time with approximately 10 individuals per subwatershed. During the Rotenone treatment there would be a period of less than two weeks in year one and two weeks in year two which removal efforts may directly impact visitors. Treatments in following years are unlikely, but may be required to meet the project objective. Impacts to visitors would be identical for out-year treatments. Where present, fish in wilderness treatment reaches occur at low densities, and there is little angling

pressure. Fish bearing stream reaches would be restocked soon after treatment, but fish would not begin to reach catchable size until the following summer. Restoring genetically pure YCT to the project area streams would have long term positive impacts on opportunities for outdoor recreation by providing individuals with an opportunity to catch trout native to the drainage. Currently, there is very little angling use in the wilderness area. Increased use is unlikely to occur, as these areas will not be promoted as a YCT sport fishery.

OTHER FEATURES OF VALUE

Component Activity for this Alternative		Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	Personnel will travel on foot.	☐	☐	☒
2	Equipment will be carried by personnel or on pack stock.	☐	☐	☒
3	Personnel will camp at pre-designated sites using minimum impact camping techniques and comply with food storage order.	☐	☐	☒
4	Personnel will apply rotenone via accepted non-motorized methods per label requirements.	☐	☐	☒
5	Personnel will use accepted fish population and macroinvertebrate sampling methods under the AFWA agreement to monitor project effectiveness and recovery.	☐	☐	☒
6	YCT would be restocked in Wilderness via pack stock and foot travel only to those waters having fish prior to rotenone treatment.	☐	☐	☒
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects		0	0	NE
Other Features of Value Total Rating		**0**		

Explain:

There would be no effect on any other unique components that reflect the character of the North Absaroka Wilderness.

Traditional Skills
What is the effect of each component activity on traditional skills?

TRADITIONAL SKILLS

	Component Activity for this Alternative	Positive	Negative	No Effect
X	*Example: Personnel will travel by horseback*	☐	☐	☒
1	Personnel will travel on foot.	☐	☐	☒
2	Equipment will be carried by personnel or on pack stock.	☒	☐	☐
3	Personnel will camp at pre-designated sites using minimum impact camping techniques and comply with food storage order.	☐	☐	☒
4	Personnel will apply rotenone via accepted non-motorized methods per label requirements.	☐	☐	☒
5	Personnel will use accepted fish population and macroinvertebrate sampling methods under the AFWA agreement to monitor project effectiveness and recovery.	☐	☐	☒
6	Pack stock and foot travel would be used to deliver YCT to Wilderness restocking locations.	☐	☐	☒
7		☐	☐	☐
8		☐	☐	☐
9		☐	☐	☐
Total Number of Effects		1	0	NE
Traditional Skills Total Rating		**1**		

Explain:

Stock transport skills may be used to move materials in and out of the wilderness.

Economics
What is the estimated cost of each component activity?

COST

Component Activity for this Alternative	Estimated Cost

X	*Example: Personnel will travel by horseback*	*$1,900*
1	Field Reconnaissance/Treatment Implementation Planning (Personnel costs for dye tests, flow measurments, perrenial flow surveys)	$7,300
2	Pack Stock Rental	$5,000
3	Implementation (Personnel Costs)	$18,600
4	Food	$8,400
5	Materials and Supplies (Rotenone, Permangenate, Sentinal Fish, misc)	$1,695
6	Broodstock Development / Restocking (only waters with fish present prior to treatment)	$10,000
7	Monitoring (Fish Population and Macroinvertebrate)	$4,000
8		
9		
Total Estimated Cost		**$54,995**

Explain:

Costs reflect **two years** of rotenone treatment as well as restocking and monitoring and are specific to the portion of the project located within wilderness.

Safety of Visitors & Workers

What is the risk of this alternative to the safety of visitors and workers? What mitigation measures will be taken?

RISK ASSESSMENT	Probability of Accident				
Severity of Accident	Frequent	Likely	Common	Unlikely	Rare
Catastrophic: Death or permanent disability	1 ☐	1 ☐	2 ☐	2 ☐	3 ☒
Critical: Permanent partial disability or temporary total disability	1 ☐	2 ☐	2 ☐	3 ☐	4 ☒
Marginal: Compensable injury or illness, treatment, lost work	2 ☐	3 ☐	3 ☐	4 ☒	4 ☐
Negligible: Superficial injury or illness, first aid only, no lost work	3 ☐	4 ☐	4 ☒	4 ☐	4 ☐
Risk Assessment	**Overall Probability = Unlikely**				

Risk Assessment Code

1 = Extremely High Risk	2 = High Risk	3 = Moderate Risk	4 = Low Risk

Explain:

Overall risk of accident or injury is low and is primarily associated with individuals hiking in Wilderness/bear country and working with or around pack stock. Exposure to employees from undiluted rotenone is mitigated via PPE per label/MSDS requirements. Dead fish are unlikely to be a significant attractant to bears in the area because fish densities are low and fish sink to the bottom of pools where they rapidly decompose.

Summary Ratings for Alternative 2

Wilderness Character	
Untrammeled	0
Undeveloped	0
Natural	1
Solitude or Primitive & Unconfined Recreation	0
Other Features of Value	0
Wilderness Character Summary Rating	**1**

Traditional Skills	
Traditional Skills	1

Economics	
Cost	$54,995

Safety	
Risk Assessment	Low

MRDG Step 2: Alternatives Not Analyzed

Alternatives Not Analyzed
What alternatives were considered but not analyzed? Why were they not analyzed?

Mechanical removal using other methods such as electrofishing was considered but not analyzed for the following reasons:

1. It is unlikely complete brook trout removal (the primary project objective) could be achieved in project area streams given that the ongoing (over ten years) mechanical removal effort outside of Wilderness on Soda Butte Creek and tributaries has been unsuccessful.
2. The time frame for successful mechanical removal (four or more years) would not meet the project objective of completely removing brook trout by fall 2016. Adhering to this time frame is essential for preventing brook trout from invading and becoming established in the Lamar River and its other tributaries. As discussed in item #1 above, attaining complete removal carries with it a high level of uncertainty.
3. Construction of barriers and habitat simplification are required to attain conditions where complete brook trout removal is possible. However, these actions would have lasting negative effects on the Untrammeled, Undeveloped, Natural, and Unconfined Recreation qualities of Wilderness Character.
4. The complexity and extend of habitat in Soda Butte Creek and associated tributaries does not lend itself to successful mechanical removal of brook trout

A detailed mechanical removal discussion as it relates to Soda Butte Creek and tributaries is found in the attached white paper (Attachment B).

MRDG Step 2: Alternative Comparison

Alternative 1:	No Action
Alternative 2:	Fish Removal Using the Fish Toxicant Rotenone
Alternative 3:	
Alternative 4:	

Wilderness Character	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	+	-	+	-	+	-	+	-
Untrammeled	0	0	1	-1				
Undeveloped	0	0	0	0				
Natural	0	0	2	-1				
Solitude/Primitive/Unconfined	0	0	1	-1				
Other Features of Value	0	0	0	0				
Total Number of Effects	0	0	4	-3				
Wilderness Character Rating	0		1					

Traditional Skills	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	+	-	+	-	+	-	+	-
Traditional Skills	0	0	1	0				
Traditional Skills Rating	**0**		**1**					

Economics	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Cost				

Safety of Visitors & Workers	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Risk Assessment	Low	Low		

MRDG Step 2: Determination

Refer to the **MRDG Instructions** before identifying the selected alternative and explaining the rationale for the selection.

Selected Alternative		
☐	Alternative 1:	No Action
☒	Alternative 2:	Fish Removal Using the Fish Toxicant Rotenone
☐	Alternative 3:	
☐	Alternative 4:	
☐	Alternative 5:	
☐	Alternative 6:	
☐	Alternative 7:	
☐	Alternative 8:	

Explain Rationale for Selection:

This is the only effective practicable alternative for meeting the project objective of complete brook trout removal with the least potential for temporary impacts to wilderness values. Completing this project for the conservation of YCT improves the natural quality of wilderness character in the long term. It also meets the objectives for fish and wildlife management in FSM 2323.3 by helping to conserve a native species that has a potential for future listing under ESA. The short term negative effects to the untrammeled and natural qualities of wilderness character because of the manipulation of natural conditions through introduction of a chemical piscicide are balanced by the improved long term natural conditions of wilderness character through restoration of a native species.

Project Implementation Requirements and Mitigation:

Information about treatment operations would be posted at trailheads, national forest offices, and on forest websites to inform visitors. Roving agency information officers would be present to engage the public.

The safe transport and handling of piscicides and other equipment in wilderness would be accomplished according to practices described in the JHA.

All travel and camping practices would follow Leave No Trace principles and utilize routes and campsites selected by the Forest Service.

Untreated headwater refugia lacking suitable fish habitat would be left in each subwatershed to ensure rapid recolonization of macroinvertebrates.

Describe Monitoring & Reporting Requirements:

Fish populations in the Project Area would be monitored cooperatively by the States of Montana and Wyoming and USFS to determine the success of the project as described in the Soda Butte Creek YCT Restoration EA. Macroinvertebrate sampling using MT DEQ protocols would occur in each project area stream in June or July prior to treatment and in June or July for two years after treatment. Piscicide quantities used would be reported per PUP requirements. The state would report the amount of piscicide they ultimately use to complete this project to the state DEQ.

Approvals

Which of the prohibited uses found in Section 4(c) of the Wilderness Act are approved in the selected alternative and for what quantity?

	Prohibited Use	Quantity
☐	Mechanical Transport:	None
☐	Motorized Equipment:	None
☐	Motor Vehicles:	None
☐	Motorboats:	None
☐	Landing of Aircraft:	None
☐	Temporary Roads:	None
☐	Structures:	None
☐	Installations:	None

Record and report any authorizations of Wilderness Act Section 4(c) prohibited uses according to agency policies or guidance.

Refer to agency policies for the following review and decision authorities:

Prepare	Name	Position	
	Clint Sestrich	Custer Gallatin NF Fisheries Biologist	
	Signature		Date

	Clint Sestrich	3/18/15

Recommended	Name	Position
	Signature	Date

Recommended	Name	Position
	Signature	Date

Approved	Name	Position
	Signature	Date

BIOLOGICAL ASSESSMENT

FOR

TERRESTRIAL WILDLIFE SPECIES

for the

SODA BUTTE CREEK YELLOWSTONE CUTTHROAT TROUT RESTORATION PROJECT

Park County, Montana and Park County, Wyoming

Gardiner Ranger District, Custer Gallatin National Forest

Clarks Fork Ranger District, Shoshone National Forest

Prepared By:

_____

Andrew Pils
North Zone Wildlife Biologist
Shoshone National Forest

Date

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SUMMARY

Determination of Effects

Implementation of the proposed Federal action **MAY EFFECT BUT IS NOT LIKELY TO ADVERSELY AFFECT** the grizzly bear; and will have **NO EFFECT** to the Canada lynx and designated critical habitat for lynx.

Implementation of the proposed federal action is **"NOT LIKELY TO JEOPARDIZE"** the gray wolf on the Shoshone National Forest**.** The gray wolf in Wyoming is listed as a nonessential experimental population, and consultation or conference under section 7 is not required if the determination is not likely to jeopardize the gray wolf (USDI 2005).

Consultation Requirements

Threatened, endangered, and proposed species are managed under the authority of the Federal Endangered Species Act (PL 93-205, as amended) and the National Forest Management Act (PL 94-588). Section 7 of the Endangered Species Act directs federal agencies to ensure actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of their critical habitats (16 USC 1536).

Need For Reassessment Based On Changed Conditions

The Biological Assessment findings are based on the best current data and scientific information available. A revised Biological Assessment must be prepared if: (1) new information reveals affects that may impact threatened, endangered, and proposed species or their habitats in a manner or to an extent not considered in this assessment; (2) the proposed action is subsequently modified in a manner that causes an affect that was not considered in this assessment; or (3) a new species is listed or habitat identified, which may be affected by the action.

INTRODUCTION

The purpose of this Biological Assessment is to review the possible effects of the proposed federal action on threatened, endangered, and proposed species and their habitats. This Biological Assessment analyzes the potential effects of the proposed federal action on all threatened, endangered, and proposed species known or suspected to occur in the proposed action influence area (Table 1).

Table 1. Threatened, Endangered And Proposed Species Known Or Suspected To Occur Within The Influence Area Of The Proposed Action.

Species	Status	Occurrence
Grizzly Bear (*Ursus arctos*)	Threatened	Known resident
Canada Lynx (*Lynx canadensis*)	Threatened; Critical Habitat	Considered occupied habitat; current occurrence unknown
Gray Wolf (Canis lupus)	Nonessential Experimental in Wyoming only (no ESA listed status in Montana)	Known resident

PROPOSED PROJECT AND PROJECT AREA

Soda Butte Creek (Figure 1) originates in Montana and Wyoming near the northeast entrance to YNP. The project area (Figure 2) is adjacent to Cooke City, Montana (approximately 55 miles northwest of Cody, Wyoming) and crosses several jurisdictional boundaries, including the Gardiner Ranger District of the Custer Gallatin National Forest (CGNF), the Clarks Fork Ranger District of the Shoshone National Forest (SNF), Yellowstone National Park (YNP), and private lands. Part of the project area is within the North Absaroka Wilderness on the Shoshone National Forest. The only Forest Service NEPA decision for the project would be made by the Shoshone National Forest, and will be whether to authorize chemical treatment within designated wilderness (as required by agency policy).

The objective of the proposed action would be to restore a non-hybridized population of Yellowstone cutthroat trout to the Soda Butte Creek watershed, upstream of Ice Box Canyon (Figure 2). Although the spatial extent of this project is limited to Soda Butte and its tributaries, the ultimate goal is to eliminate threats to Yellowstone cutthroat trout posed by nonnative fishes throughout the Lamar River drainage. The target species within Soda Butte Creek watershed are brook trout, rainbow trout, and hybrids of Yellowstone cutthroat trout, westslope cutthroat trout, and rainbow trout. The Yellowstone cutthroat trout population within the Soda Butte watershed has shown slight to considerable hybridization, ranging from 1.3 to 12 percent of genes contributed from rainbow trout or westslope cutthroat trout (Montana Fish Wildlife, & Parks, unpublished data). Hybridization greater than 1% makes the population a “conservation population”, which has less conservation value than core, or non-hybridized populations. Fortunately, some isolated non-hybridized populations remain, and may provide a source for restocking Soda Butte Creek.

Brook trout are a highly invasive species, and pose a major threat to native cutthroat trout, especially in headwater streams (Petersen et al. 2004). Until the early 1990s, brook trout were relegated to an unnamed tributary to Soda Butte Creek; however, reclamation of the McLaren Mine tailings removed a chemical barrier that kept brook trout from invading other streams. Mechanical removal of brook trout began soon afterwards. As these efforts were insufficient to stem the spread of brook trout, removal efforts increased substantially in 2004. In addition, an unnamed tributary that was a source of brook trout underwent chemical removal of brook trout.

Nonetheless, brook trout had spread into Soda Butte Creek and were increasing in distribution and abundance. Brook trout are now present in YNP and pose a looming threat to the Yellowstone cutthroat trout within the Lamar River watershed.

The proposed action calls for chemical removal of all fish in the Soda Butte Creek watershed using CFT Legumine, a commonly used formulation of rotenone. Treated waters will include the main stem of Soda Butte Creek, and portions of Sheep Creek, Miller Creek, Woody Creek, Republic Creek, and Guitar Creek. A detoxification station, releasing potassium permanganate ($KMnO_4$), would be established at Ice Box Canyon, and a back up station would be established ½ hour of the stream's travel time downstream of the first station. If toxic levels of rotenone reach the backup station, as indicated by status of sentinel fish, the backup station would release $KMnO_4$ to augment detoxification.

The treatments would take up to 14 days each year, with no more than five days of activity in any single drainage. Treatments would occur over two consecutive years, with potential for a third year if monitoring determines the removals during the first two years were incomplete. Helicopters would be used to transport personnel and equipment into two landing sites in the Sheep Creek drainage of the CGNF. This would require two days of flying each year, with a total of six landings in Sheep Creek. Crew and equipment transport into Republic Creek would be via pack stock and hiking, while all other sites would be accessed via hiking. Project personnel (approximately 30 people total) would mostly be camping in one location (likely the Forest Service administrative site) near Cooke City, with the exception that up to five people would camp for up to two nights in Republic Creek and Woody Creek.

Following successful removal of all fish, non-hybridized Yellowstone cutthroat trout would be restocked in the Soda Butte Creek watershed. Stocking would be accomplished in the year following chemical removal with hatchery trucks where vehicle access is allowed, and using non-motorized transport elsewhere. The stocked fish would come from the best available source of Yellowstone cutthroat trout. Ideally, these would be fish from within the Lamar River watershed, as this project is part of YNP's native fish management plan for the Lamar River (Yellowstone National Park 2011), and the fish would be genetically adapted to the area.

MANAGEMENT RECOMMENDATIONS

1. To prevent bear-human conflicts, all attractants (including food, garbage, and chemicals associated with fish removal) will be stored in compliance with the relevant Food Storage Order for the Custer Gallatin or Shoshone National Forest.

2. Any incident involving a grizzly bear or black bear will be reported to the Forest Service representative within 24 hours. Project activities may be immediately temporarily suspended or modified if such an action is necessary in order to prevent bear-human conflicts.

3. Helicopter use for transporting personnel and equipment into the Sheep Creek drainage will be limited to 2 days annually between July 1-August 22. Daily helicopter flight paths will follow the shortest practical and safe route between landing zones.

4. Fish killed through chemical treatment will be collected within 24 hours and disposed of in accordance with applicable food storage order requirements. This applies to all portions on National Forest Lands of Soda Butte Creek and the lower ¼ mile of all its tributaries that would be treated.

5. All participants in project activities would be trained in bear safety practices and the proper use of bear pepper spray, and will carry bear pepper spray at all times while working outside of vehicles or developed areas.

SPECIES ASSESSMENT

Grizzly Bear (*Ursus arctos*)

Population and Habitat Status

The grizzly bear was listed as a threatened species under the ESA in the lower 48 states in 1975. The Grizzly Bear Recovery Plan (USDI 1993) delineated grizzly bear recovery zones in 6 mountainous ecosystems in the U.S., including the Greater Yellowstone Area (GYA). The GYA grizzly bear recovery zone covers parts of Montana, Idaho and Wyoming, and includes portions of five national forests (including the Custer Gallatin and Shoshone), two national parks, state and private lands, and lands managed by the BLM.

The GYA grizzly bear population met recovery objectives and was petitioned for delisting by the U.S. Fish & Wildlife Service in 2005. A Final Rule designating GYA grizzlies as a Distinct Population Segment and removing this segment from the threatened species list was published in March 2007. However, a 2009 court order vacated the delisting and reinstated threatened species status for grizzly bears in the GYA.

The GYA grizzly bear population was estimated at approximately 741 bears in 2013 (Haroldson et al. 2014, page 17) using updated population estimation methods. A recent demographic review concluded that the population growth rate decreased from an estimated 4-7% for the 1983-2001 period, to near or slightly above 0% for the 2002-2011 period (Interagency Grizzly Bear Study Team 2012, pages 34-35). This change from a growing population to a nearly stable one was attributed to the effects of the population reaching biological carrying capacity, declines in food resources, or some combination of those effects.

Affected Environment

The project area is inside the Grizzly Bear Recovery Zone, which is also known as the Primary Conservation Area (PCA). Areas inside the PCA were divided into Bear Management Subunits Units (BMS's) for the purpose of analyzing and monitoring changes in habitat. The assessment area lies within the Lamar #1 BMS (Figure 3), which includes portions of the SNF, CGNF, and Yellowstone National Park within the Soda Butte Creek watershed. This BMS supports high densities of bears, and contains high quality habitat for grizzly bears in all seasons.

Habitats consists of a mosaic of subalpine forest stands, some of which are in early successional stages after burning in 1988, along with riparian corridors adjacent to perennial streams in the drainage bottoms, and mature whitebark pine stands at the higher elevations. Riparian areas are well used during the summer months, while whitebark pine stands are known to be heavily used by bears in this area during late summer/fall in years of good whitebark pine cone production.

Cutthroat trout have been identified as one of four key food sources for grizzly bears in the Greater Yellowstone Ecosystem (Interagency Conservation Strategy Team 2007, page 48). In places where cutthroat trout are adundant and accessible during their spawning season, they are extensively preyed on by grizzly bears due to their high digestibility and protein and lipid content. Currently, the upper Soda Butte watershed is a book trout fishery that does not provide foraging opportunity for grizzly bears due to the small size of the fish.

There is considerable human development within and adjacent to the towns of Cooke City and Silvergate, which are both in close proximity to the proposed treatments. The combination of considerable human development within high quality habitat that is heavily used by grizzly bears has led to a considerable history of bear-human conflicts and management removal of bears in the Cooke City Basin. Many of these conflicts have been related to unsecured attractants on private lands, where there is no legal requirement for attractant storage.

Applicable Direction

Land management direction specific to grizzly bear habitat within the grizzly bear recovery zone is contained in the Gallatin Forest Plan, Appendix G: Grizzly Bear Standards and Guidelines (USDA 1987), Appendix H: US Fish and Wildlife Service Biological Opinion (USDI 1986), Forest Plan Amendment No. 19 (USDA 1996) and the Biological Opinion on Amendment No. 19 (USDI 1995).

The SNF revised its Forest Plan in 2015, and as a result has updated direction for management of grizzly bear habitat. Standards and guidelines from the Final Conservation Strategy for the Grizzly Bear in the Yellowstone Area (Interagency Conservation Strategy Team 2007) are now the basis for grizzly bear habitat management on the SNF. On the CGNF, Conservation Strategy direction is considered as best available science but is not part of the forest plan.

Additional guidance in the management of helicopter use in grizzly bear habitat is provided in the Guide to Effects Analysis of Helicopter Use in Grizzly Bear Habitat (USDA and USDI 2009).

In addition, special orders regulate the storage of food and other attractants on Custer Gallatin and Shoshone National Forest lands. Food storage orders have been effective at minimizing conflicts between humans and bears.

Methodology for Analysis

The Lamar #1 BMS was used as the analysis area for direct, indirect, and cumulative effects of project activities. BMS's are typically used for analysis boundaries for projects throughout the grizzly bear recovery zone because they were delineated in part for this very purpose.

The major factor used to evaluate the effects of fish removal treatments on grizzly bears is helicopter use and its potential to displace grizzly bears. The Guide to Effects Analysis of Helicopter Use in Grizzly Bear Habitat (USDA and USDI 2009) was used for a consistent approach to effects analysis to proposed helicopter use in grizzly bear habitat.

Additional factors addressed in the analysis were the effects to grizzly bear food sources, the potential for toxic effects to grizzly bears resulting from chemical treatments, and the potential for bear-human conflicts to result from accumulation of dead fish or attractants associated with project activities.

Direct and Indirect Effects Analysis

Effects on secure habitat, disturbance, and displacement

Management of motorized access has long been an emphasis for grizzly bear recovery. The primary focus of access management currently involves providing adequate secure habitat. Secure habitat is defined as any area >500 meters from an open or restricted (i.e. gated or administrative) motorized access route or reoccurring helicopter flight line during the non-denning season and >10 acres in size (Interagency Conservation Strategy Team 2007, page 146). A major goal of the Conservation Strategy was to maintain levels of secure habitat within each subunit that existed in 1998 when bears met demographic recovery criteria (Interagency Conservation Strategy Team 2007, page 39). The premise was that secure habitat and other habitat parameters in 1998 were sufficient to achieve recovery of the bear population. The purpose of managing for secure habitat is to provide adequate area for bears to meet their biological requirements with low levels of disturbance and interaction with humans, especially for adult females (Interagency Conservation Strategy Team 2007, page 43). Bears that avoid human disturbance in more developed landscapes would have ample habitat available provided there is adequate secure habitat present in the area.

A helicopter would be used to transport personnel and equipment into the Sheep Creek drainage. According to the Guide to Effects Analysis of Helicopter Use in Grizzly Bear Habitat (USDA and USDI 2009), effects of low level helicopter flights may include awareness of the aircraft, flight response, or temporary displacement from the area. The Guide (USDA and USDI 2009) projects that helicopter operations at altitudes less than 500 meters, with or without landings, tend to elicit a response by bears which could be adverse depending on the duration or frequency of helicopter use. Duration of helicopter use of more than two days or less was considered short duration, and was characterized as less likely to affect bears.

The proposed helicopter use would be within grizzly bear secure habitat in the Lamar #1 BMS, but would be of short duration rather than re-occurring as flights would occur over two days and

include three trips to two different landing zones per day. It therefore would not be considered an activity that detracts from secure habitat, there would be no reduction in secure habitat, and the application rules for temporary reductions in secure habitat would not apply. Displacement of bears would be expected, but the duration of helicopter use would be short enough that displacement would be temporary and not lead to long term avoidance of otherwise important habitat. The Sheep Creek drainage has large stands of whitebark pine trees that are known to be heavily used by grizzly bears during years of good cone production. To avoid displacing bears from this important late summer/fall food source, helicopter use would not be allowed after August 22. Costello et al. (2014) considered August 24 to be the early onset of grizzly bear whitebark pine use based on an analysis of bear locations in whitebark pine habitat from 2000-2011. With this mitigation measure in place, little grizzly bear displacement from whitebark pine habitat would be expected.

Bear-human conflict potential

Grizzly bears regularly use the riparian corridors in the areas proposed for treatment during the time when chemical fish removals would be conducted. If dead fish were to concentrate in proximity to developed areas where human presence is likely, it could attract bears and thereby increase the potential for bear-human conflicts resulting in human injury or bear mortality. To minimize this potential, dead fish would be collected from the areas proximate to human developments along Soda Butte Creek. Fish carcasses collected would then be disposed of in a manner consistent with Food Storage Order requirements. Fish collection would not be necessary in backcountry areas associated with tributary streams subject to treatment, as the potential for bear-human conflicts would be much lower in these areas. Past projects involving chemical fish removal in grizzly bear habitat on the CGNF and SNF have not resulted in large concentrations of dead fish being available to bears because they tend to settle out in deep pools and decompose fairly quickly. The potential for bear-human conflicts resulting from bears feeding on fish killed by chemical treatments would therefore be low.

The Food Storage Order for the SNF and CGNF would be applied to all project activities. This would include the storage of chemicals prior to their use in treatments. Additionally, all participants in project activities would be trained in bear safety practices and the use of bear pepper spray. These measures would effectively reduce the potential for bear-human conflicts and human injury or bear mortality.

Effects on key food sources

The removal of brook trout from the Soda Butte Creek watershed would have no effect on grizzly bear foraging, because bears currently do not fish there. Because cutthroat trout are one of the four key food sources for bears in the Greater Yellowstone Ecosystem, re-establishment of a Yellowstone cutthroat fishery following chemical removal of brook trout could increase foraging opportunity for bears. There could be some beneficial effects on grizzly bear key food sources.

Effects of toxicity

As grizzly bears are opportunistic scavengers, there is potential for them to consume fish killed through chemical treatments. However, rotenone has very low toxicity to mammals (Ling 2003).

Additionally, several chemical removal projects have been implemented in grizzly bear habitat on the CGNF and SNF with no known incidents of bears or other wildlife being poisoned. Secondary poisoning or toxic effects to grizzly bears would not occur.

Cumulative Effects Analysis

Cumulative effects to grizzly bear habitat in the Lamar #1 BMS have resulted from past natural events and anthropogenic activities including natural forest succession, large wildfires during 1988, wind events, forest insects & disease, and limited timber harvest. These changes to habitat undoubtedly have affected how grizzly bears use the landscape, but have not major effects on key food sources. One exception is the loss of whitebark pine due to the 1988 fires. Mountain pine beetle mortality has also killed whitebark pine trees, although un-burned stands in the Cooke City Basin generally have not been affected as much as many other portions of the ecosystem. Unpublished research shows that bears still make considerable use of whitebark pine in this area (Dan Tyers, personal communication).

Additionally, the towns of Cooke City and Silver Gate are within this BMS, along with numerous residences associated with scattered parcels of private lands. There are also numerous developed sites on National Forest and National Park lands including 3 campgrounds, 10 trailheads, 9 administrative sites, and 9 other developed sites (day use picnic areas, interpretive sites, packing areas, mining sites, etc). A wide variety of recreational activities occur in association with these developed sites. Developments with high human activity levels also influence how bears use the landscape. Some bears will simply avoid these areas, while others may use them at night when human activity levels are low (Schwartz et al, 2010*b*). In some cases bears may habituate to human activity and use developed areas despite high levels of human activity. Survival modelling showed that bear mortality is higher in proximity to developed sites (Schwartz et al, 2010*a*), and the conflict history within the Cooke City Basin supports this finding.

The Lamar #1 BMS contained 89.9% secure habitat as of 2013 (L. Landenburger, personal communication, 3/16/2015). This is an increase from the 1998 baseline value of 89.4% and above the 2013 average value for the PCA of 87%. The relatively high secure habitat values mean that the subunit has adequate habitat where bears can use the landscape relatively free from human disturbance associated with developed sites. There are no Forest Service projects currently on-going or planned that would result in permanent or temporary reductions in secure habitat within this subunit.

Overall cumulative effects to grizzly bears from the project are expected to be very low. The potential for bear human conflicts and bear mortality would not be measurably different from the baseline condition. There would be no reduction in secure habitat, and any bears temporarily displaced by project activities should have adequate secure habitat available in adjacent areas.

Determination of Effects

I have determined implementation of the proposed Federal Action **MAY EFFECT BUT IS NOT LIKELY TO ADVERSELY AFFECT** the grizzly bear**.** My determination is based on

the following rationale: 1) there would be no change in secure habitat; 2) effects of helicopter use would be temporary and not significant due to the short duration, and mitigations that would be in place to avoid adverse effects on bear use of whitebark pine habitat; 3) individual bears displaced by project activity, particularly the helicopter use, would have large areas of secure habitat available in immediately adjacent proximity, 4) mitigation measures would be in place that would effectively limit the potential for bear human conflicts and bear mortality, 5) effects to grizzly bear food sources would be beneficial; and 6) no toxic effects to bears would occur.

Canada Lynx (*Lynx canadensis*)

Population and Habitat Status

On March 24, 2000 the U.S. Fish and Wildlife Service (USFWS) published its determination on the status for the contiguous U.S. distinct population segment of the Canada lynx. The lynx has since been listed as a "threatened" species in the contiguous United States. On September 12,2014, the final rule designating revised critical habitat for lynx became effective.

Lynx generally occur in cool, moist coniferous forest, above the dry montane types and below the alpine zone. Primary lynx habitat in Montana east of the Continental Divide consists of subalpine fir (*Abies lasiocarpa*) as the dominant tree species, intermixed with Engelmann spruce (*Picea engelmannii*) and lodgepole pine (*Pinus contorta*). Secondary habitat includes aspen (*Populus tremuloides*), willow (*Salix spp.*), and moist, cool, Douglas-fir (*Pseudotsuga menziesii*) stands (Ruediger et. al. 2000).

Lynx are physiologically adapted to key in on one particular prey species, the snowshoe hare (*Lepus americanus*). Prey availability appears to be a primary limiting factor for lynx in the Northern Rockies. This is especially true in the Greater Yellowstone Ecosystem, where habitat is naturally marginal with highly fragmented foraging habitat (USDI 2014). The main cause of lynx mortality is starvation (USDA 2007a). For this reason, vegetation management projects that affect snowshoe hare habitat are the most important concern for lynx habitat management in the area.

Affected Environment

The proposed treatments would be within the Beartooth Lynx Analysis Unit (LAU) on the SNF, and the Absaroka-Beartooth Wilderness LAU on the CGNF. Portions of both LAU's burned during the 1988 fires, and some of these stands are still in the stand initiation structural stage and do not provide snowshoe hare habitat. Un-burned stands are generally mature, multi-storied mesic subalpine conifers stands. Although data on snowshoe hare densities and habitat conditions are lacking, many of these stands appear to be fairly productive, have high horizontal cover, and be capable of supporting snowshoe hares.

The U.S. Fish & Wildlife Service released a final rule identifying revised critical habitat for the lynx on September 12,2014 (USDA 2014). The Beartooth and Absaroka-Beartooth Wilderness LAU's are within designated critical habitat for the Greater Yellowstone Area. These areas were designated because they contain boreal forest landscapes with a mosaic of different successional

stages and supporting snowshoe hares, with winter snow conditions that are generally deep and fluffy for extended periods of time, having abundant coarse woody debris for denning habitat, and "matrix" habitat (non-lynx habitat) between patches of boreal forest. These characteristics were determined to be the "primary constituent element" for the lynx because on the critical habitat unit scale (the Greater Yellowstone Area critical habitat unit), they were thought to provide adequate prey resources necessary for the persistence of local populations and metapopulations of lynx, act as a possible source of lynx for more peripheral boreal forested areas, enable the maintenance of home ranges, incorporate snow conditions for which lynx are highly specialized for, provide denning habitat, and provide habitat connectivity (USDI 2014). Under Section 7 of the Endangered Species Act, the effects of a proposed action on designated critical habitat must be analyzed.

The historical presence of lynx near the analysis area is documented by a few observations of tracks and 1 sighting on the Beartooth Plateau (Reeve et al. 1986). Holmes and Berg (2010) reported that they conducted snow tracking surveys in these LAU's during 2009, and detected possible lynx tracks on the CGNF near Cooke City. If lynx are currently present, they occur at extremely low densities.

Direct and Indirect Effects Analysis

No vegetation management would occur as part of the project. Therefore, snowshoe hare and lynx habitat would not be directly or indirectly modified. Additionally, the project would not operate in the winter, and would not result in additional snow compaction. Vehicular traffic volume related to the project is not expected to increase from the baseline, and would not measurably increase the likelihood of vehicle-lynx collisions. Additionally, application of rotenone would not injure or kill Canada lynx since the chemical has an extremely low toxicity to wildlife species (Ling 2003).

Cumulative Effects Analysis

Because there would be no direct or indirect effects, there would be no cumulative effects to Canada lynx either.

Determination of Effects

The proposed Yellowstone cutthroat trout restoration activities would have **NO EFFECT** on the threatened Canada lynx or designated revised critical lynx habitat**.** The determination is based on the following rationale: 1) the project is in compliance with the NRLMD; 2) snowshoe hare habitat would not be reduced; 3) trail use, camping and dispersed off-road activities would be consistent with existing travel management direction; and 4) activities would occur during spring, summer, and fall.

GRAY WOLF (*Canis lupus*)

Population and Habitat Status

Wolves were reintroduced into the Yellowstone area in 1995. As of the end of 2013, there were an estimated 440 wolves in the Greater Yellowstone Area (U.S. Fish & Wildlife Service et al. 2014, page 6). Recovery criteria established for wolves in the Yellowstone area have been met since 2002. However, gray wolves are currently protected under the Endangered Species Act (ESA) in Wyoming, where they are designated a "non-essential, experimental population" on the Shoshone National forest. Wolves within the experimental population geographic area (including the Shoshone National Forest) are treated for management purposes as though they are proposed for listing. In Montana, including the CGNF, wolves were delisted through an act of congress in 2011 and are currently managed by the state.

Affected Environment

The analysis area is outside of the core territory of any known wolf pack, although the territories of several packs are adjacent to the area. It is likely that wolves travel through the analysis area and perhaps hunt there during the summer months, when their ungulate prey would be present.

Gray wolves may be affected by a variety of human activities that cause disturbance. Noise and human presence associated with project activities, including helicopter use, could cause disturbance and/or displacement of gray wolves and/or their prey species.

Applicable Direction

Management of wolves in Wyoming, since relisted under the Endangered Species Act, will follow direction found in the Wolf Recovery Plan (USDI 1987).

Methodology for Analysis

The analysis boundary for direct, indirect, and cumulative effects to wolves and their habitat is the same as for grizzly bears.

Analysis Parameters

Gray wolves are habitat generalists, and make use of a wide variety of habitat types throughout the course of their lives. Management emphasis for gray wolves is directed at maintaining sustainable populations of wolf prey species, primarily ungulates. Other key ungulate habitat components including cover, security areas, and road densities would remain unchanged with the proposed treatments. Accessibility of wolf habitat (i.e., road densities) is a factor limiting wolf recovery in some areas (USDI 1987).

Because the proposed treatments would occur outside of the denning season for wolves and there are no known wolf dens or rendezvous sites in the project area, this issue was not evaluated further.

Direct and Indirect Effects Analysis

There would be no changes to key components of ungulate habitat including road densities, hiding cover, or foraging areas. The proposed would have no effect on elk, other than temporary displacement due to project activities.

The analysis area has large areas of roadless and wilderness lands with high security values. These areas would be available to wolves if they were temporarily displaced by project activities. Wolf mortality due to project activities would not be expected.

Cumulative Effects Analysis

Several factors influence the potential for wolf mortality. The most important is probably the presence of livestock. There are no livestock allotments within the analysis area.

Human-caused mortality of wolves is generally higher in areas with greater open motorized route densities, but may also occur in backcountry areas away from open motorized routes. Wolf hunting and trapping is allowed in the Montana portion of the analysis area outside of Yellowstone National Park, but not in the Wyoming portion where wolves are still listed under the ESA. Collisions with vehicles have been a mortality factor for wolves on highways with federal, state, or county jurisdiction (not on Forest Service roads).

Cumulative effects to wolves from project activities would be discountable.

Determination of Effects

The proposed action is **NOT LIKELY TO JEOPARDIZE THE CONTINUED EXISTENCE OF THE GRAY WOLF**. There will be no impact to prey base or open road density. The project would have no effects to den or rendezvous sites.

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Appendix 1 – Maps

Figure 1. Vicinity map.

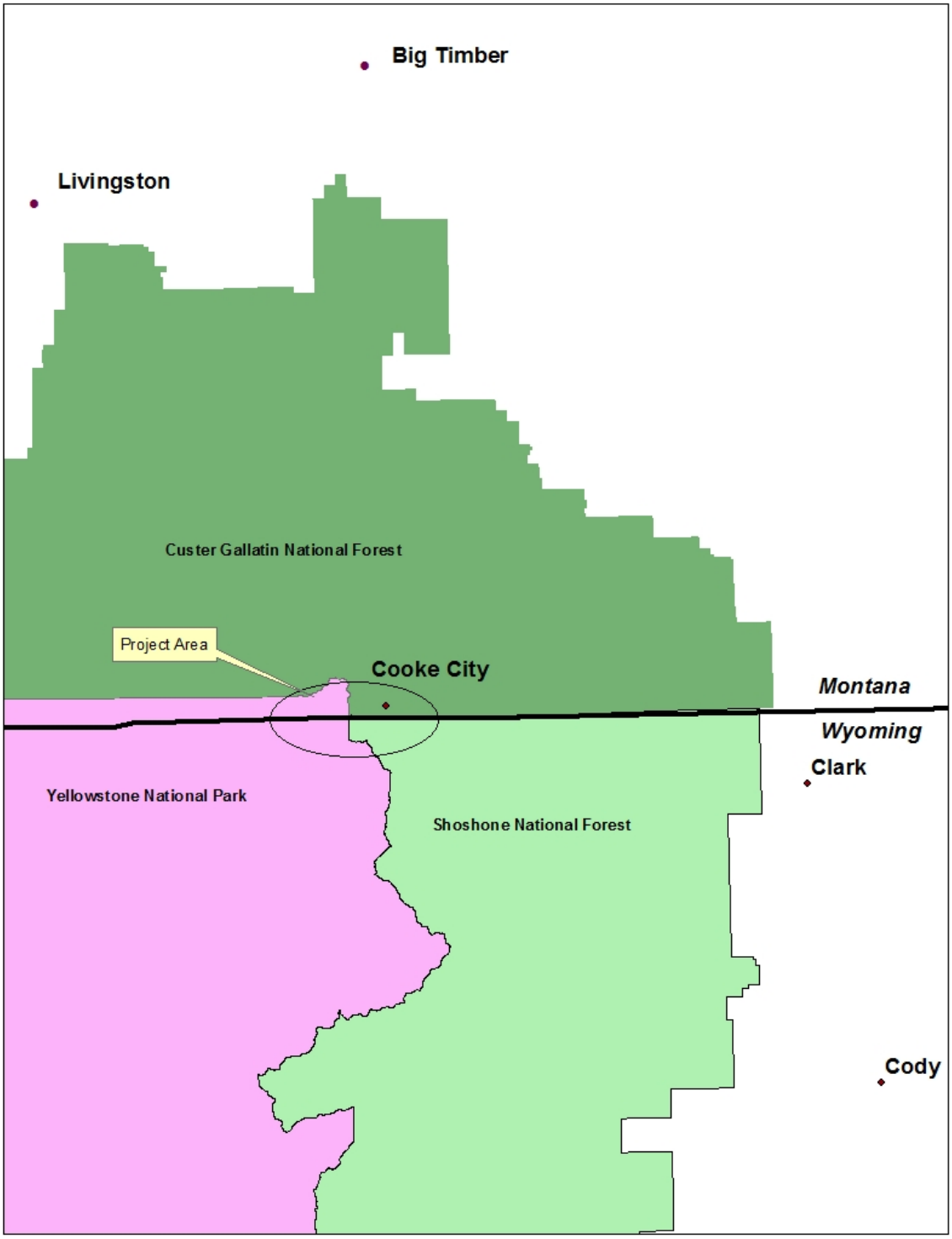


Figure2. Map of the proposed project area.

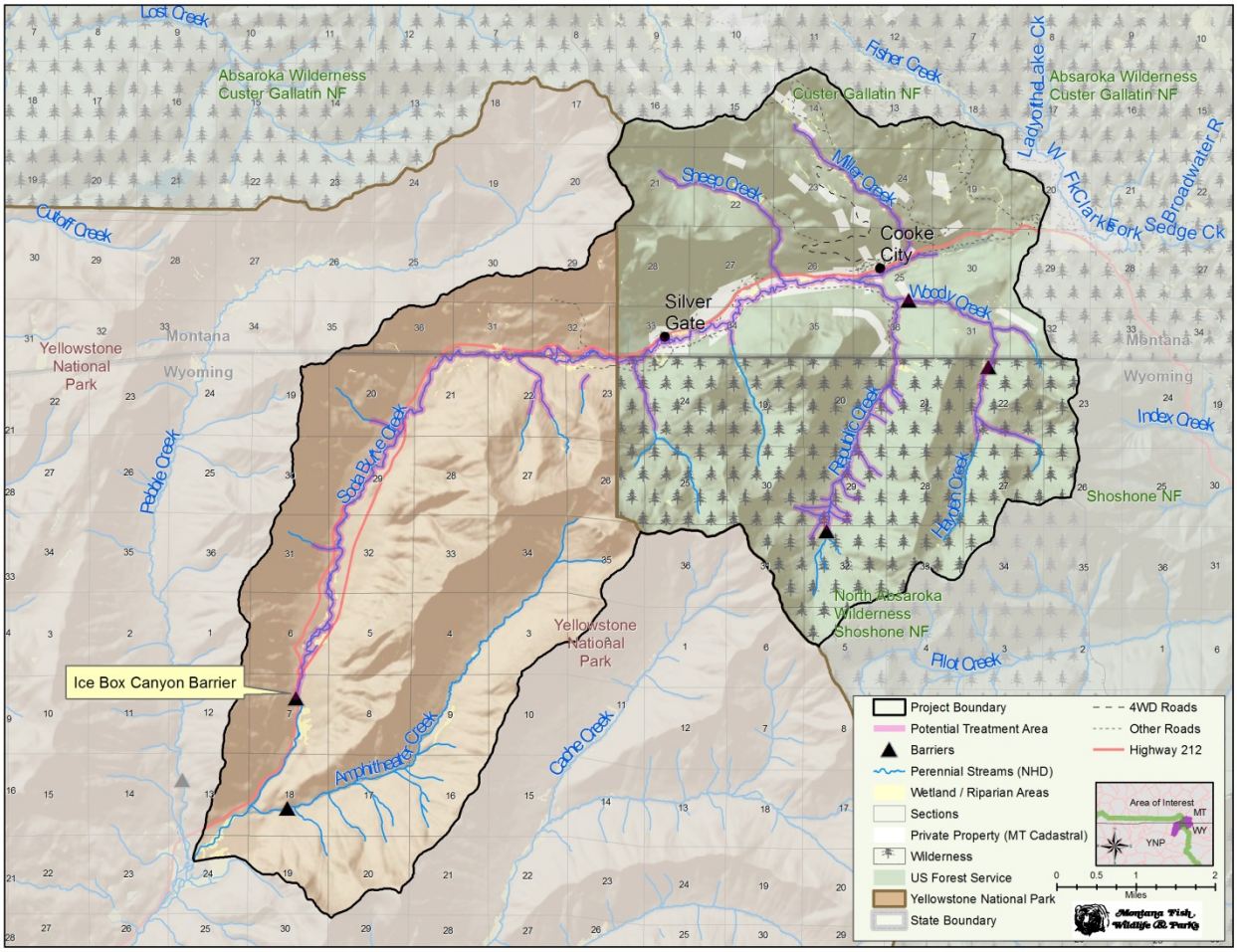
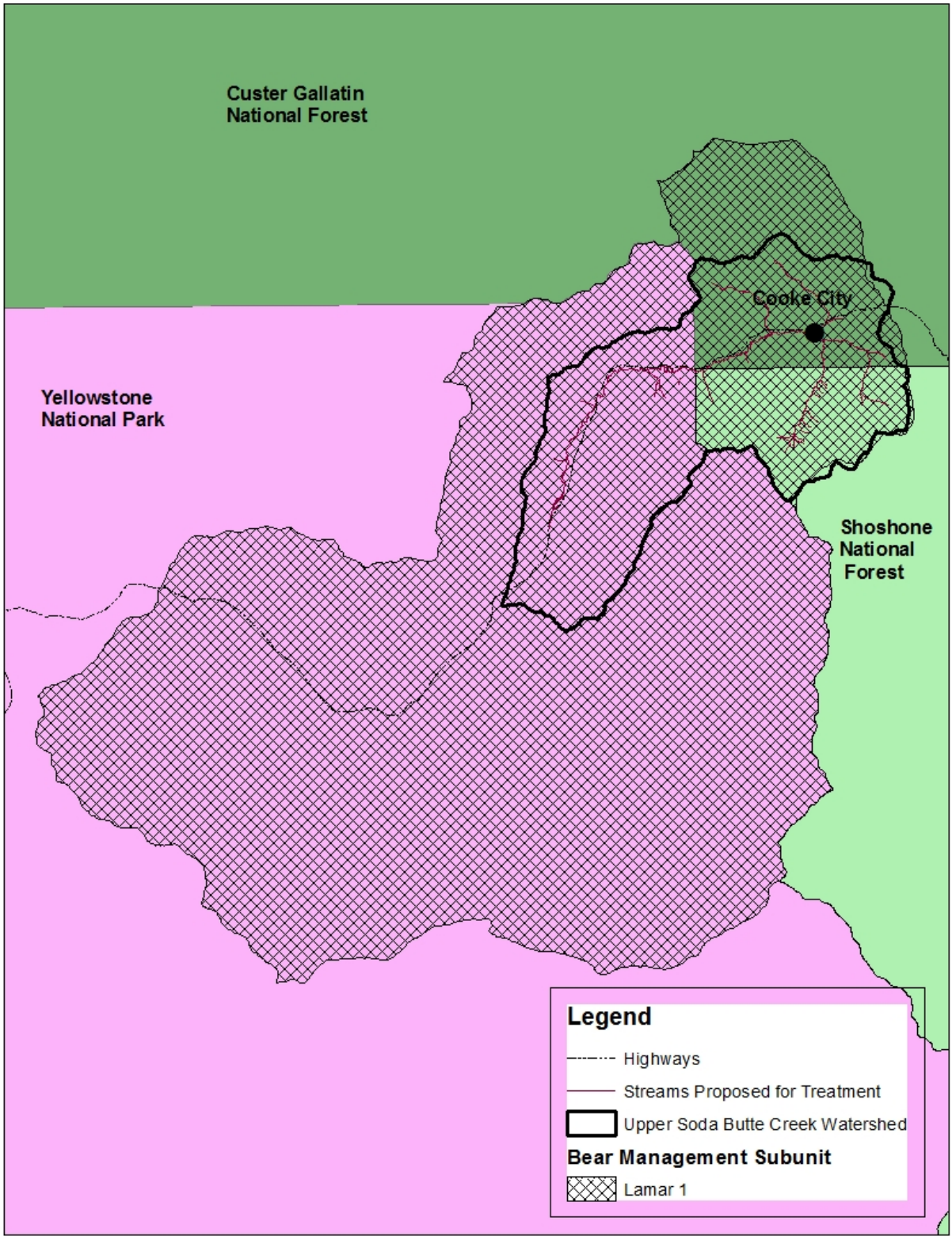


Figure 3. The Lamar #1 Bear Management Subunit relative to the proposed chemical fish removal treatments in the Soda Butte Creek watershed.



White Paper: Removal of Fish using Chemical and Mechanical Means

A Description of Methodologies, Effects on the Environment, Wildlife, Designated Wilderness, and Comparison of Cost Effectiveness of Each Method

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1 Introduction

Yellowstone cutthroat trout are a subspecies of cutthroat trout native to portions of Wyoming, Idaho, Montana, Utah, and Nevada. Like other cutthroat trout subspecies, the Yellowstone cutthroat trout have experienced marked declines in distribution and abundance (Figure 1-1). Yellowstone cutthroat trout currently occupy approximately 44% of their historic range in streams (Endicott et al. DRAFT). Core populations, which are those with tested or presumed hybridization of less than 1%, occur in an estimated 22% of historically occupied stream miles.

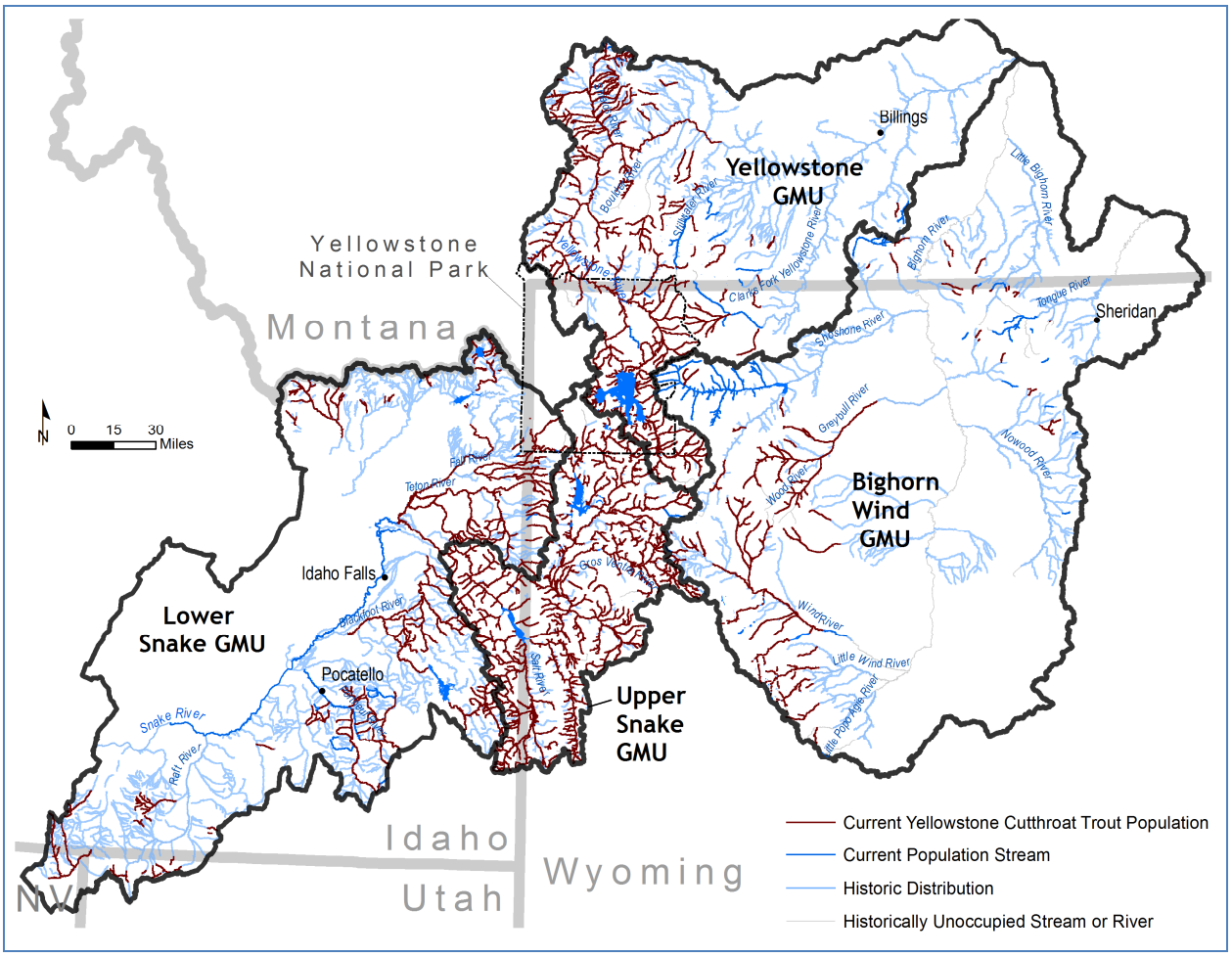

Figure 1-1. Comparison of historic and current distribution of Yellowstone cutthroat trout across their historic range.

Several factors have led to declines in stream populations of Yellowstone cutthroat trout. Hybridization with rainbow trout is the primary cause of their decline (Kruse et al. 2000). Other nonnative species, especially brook trout, have also been detrimental. Brook trout are a highly invasive species, and pose a major threat to native cutthroat trout, especially in headwater streams (Dunham et al. 1997; Petersen et al. 2008; Shepard 2010). Brook trout removal efforts

are among the most common planned or ongoing cutthroat trout conservation actions in western states. Other factors contributing to declines in Yellowstone cutthroat trout populations include overharvest, dewatering, habitat degradation, and degradation of water quality.

Sympatry with nonnative species is common across the current range of Yellowstone cutthroat trout. Potential and tested core populations share an estimated 22% of currently occupied stream miles with nonnative species. In most cases, coexistence with rainbow trout is incompatible due to the irreversible effects of hybridization. Likewise, brook trout have considerable overlap with cutthroat trout in their ecological niches with cutthroat trout (Shepard 2010). Brook trout outcompete cutthroat trout for limited resources, and can eliminate cutthroat trout from headwater streams within 20 years following their invasion of those waters (Endicott et al. 2012).

Nonnative brown trout are also sympatric with Yellowstone cutthroat trout within their historic range, and pose a threat through competition and perhaps predation. Overall, brown trout pose less of a risk to Yellowstone cutthroat trout than rainbow trout and brook trout, although brown trout tend to displace native fish in lower elevation streams (Behnke 1992; de la Hoz Franco and Budy 2005; Wood and Budy 2009) and this tendency appears to hold true for brown trout and Yellowstone cutthroat trout.

Although brown trout present some risk to Yellowstone cutthroat trout, especially at lower elevations, Yellowstone cutthroat trout are able to persist in sympatry in with brown trout in some higher elevation streams. Nonetheless, brown trout typically outnumber cutthroat trout. Lately, brown trout seem to be exhibiting a trend of increasing in abundance compared to Yellowstone cutthroat trout. Streams in 2 tributary watersheds of the Yellowstone River provide examples. Yellowstone cutthroat trout persisted in sympatry with brown trout in Lower Deer Creek for several decades, with brown trout being more abundant in lower reaches, and rarer at higher elevations. In the 2000s, brown trout began to increase in number in the higher elevation portions of the watershed. In addition, invasion of hybrids of rainbow trout and Yellowstone cutthroat trout put the genetic integrity of the nonhybridized Yellowstone cutthroat trout at risk. The combination of the increase in brown trout distribution and abundance, and the invasion of rainbow trout genes prompted barrier construction and fish removal in 2010 and 2011 respectively.

East Fork Duck Creek provides a more alarming example of brown trout displacing Yellowstone cutthroat trout. In the mid-1980s, Yellowstone cutthroat trout substantially outnumbered brown trout in the higher elevation portions of this stream, with Yellowstone cutthroat trout being 7 times more abundant than brown trout (White 1984). By 2007, brown trout were 3 times more abundant than Yellowstone cutthroat trout (FWP, unpublished data).

Although more research is needed, fisheries managers should be vigilant in protecting Yellowstone cutthroat trout populations in streams that also support nonnative trout. Climate

change presents a potential threat to Yellowstone cutthroat trout, which are less tolerant of warm water than nonnative trout (summarized in Endicott et al. 2012). The apparent trend of increases in brown trout numbers and invasion of brook trout may be related to changes in water temperature, or alterations in stream flow regime associated with reduced snowpack and earlier spring runoff (Stewart et al. 2004; Knowles et al. 2006).

Reclaiming streams that have experienced invasion, or purposeful stocking, of nonnative fishes is a vital part of fisheries management and native species conservation. Fisheries biologists have two options of nonnative fish removal. Chemical removal using a piscicide, such as rotenone, is one tool to remove nonnative fishes. Alternatively, mechanical removal, using electrofishing, traps, and nets, is another approach. Both bring disturbance and ecological alterations to streams.

Implementation of projects that conserve or restore native cutthroat trout are required by law, policies, and conservation planning documents developed by state and federal agencies. In Montana, planning documents (Table 1-1) include an agreement among state and federal agencies, to include conservation of cutthroat trout in their activities. Signatories include state and federal agencies, conservation groups, and industry, such as agriculture or silviculture.

Table 1-1. Planning and strategy documents with relevance to cutthroat trout conservation in Wyoming, Montana, and YNP.

Agency	*Citation*	*Website*
Montana Cutthroat Trout Steering Committee (MCTSC)	Memorandum of understanding and conservation agreement for westslope trout and Yellowstone cutthroat trout in Montana (2007)	http://fwp.mt.gov/fishAndWildlife/management/yellowstoneCT/
FWP	Yellowstone cutthroat trout conservation strategy for Montana (2013)	http://fwp.mt.gov/fishAndWildlife/management/yellowstoneCT/
FWP	Statewide fisheries management plan (2014)	http://fwp.mt.gov/fishAndWildlife/management/fisheries/statewidePlan/
YNP	Native fish conservation plan environmental assessment (2011)	http://parkplanning.nps.gov/document.cfm?parkID=111&projectID=30504&documentID=37967
WGFD	A Plan for the Conservation and Management of Yellowstone Cutthroat Trout in Wyoming (2014)	Website pending

The goal of this document is to provide the best scientific evidence to inform decision-making with regard to the preferred method of fish removal in designated wilderness. Relevant topics include the potential of mechanical and chemical removal to alter nontarget species composition, stream ecology, water quality, stream morphology, and the duration of alterations to these

aspects of ecology and stream function. In addition, consideration of the effect of fish removal methodology to affect wilderness values is a major consideration.

2 Chemical Removal

Rotenone is a commonly used piscicide, and FWP and WDGF have a long history of using rotenone to manage fish populations, spanning as far back as the 1940s. The departments have administered rotenone projects for a variety of reasons, but rotenone is principally applied to improve angling quality or for native fish conservation. Both states use piscicide in projects aimed at restoring cutthroat trout to waters where they have been extirpated or are threatened by nonnatives. In addition, rotenone has been applied in waters upstream of barriers to increase occupied stream miles within the species' historic range.

Rotenone is a naturally occurring substance derived from the roots of tropical plants in the pea family (Fabaceae), such as the jewel vine (*Derris* spp.) and lacepod (*Lonchocarpus* spp.), which are found in Australia and its surrounding Pacific islands, southern Asia, and South America. Native people have used locally available rotenone for centuries to capture fish for food. Fisheries managers in North America have used rotenone since the 1930s. Rotenone is also a natural insecticide, and was formerly used in organic gardening and to control parasites such as lice on domestic livestock (Ling 2002).

Rotenone acts by inhibiting oxygen transfer at the cellular level. Fish are especially vulnerable to low levels of rotenone, as they readily absorb rotenone into the bloodstream through the thin cell layers of the gills. Many gilled invertebrates are also vulnerable to rotenone, although many are not nearly as sensitive as fish. In addition, amphibians respire with gills during their earliest life history stage, and are vulnerable to rotenone. Mammals, birds, reptiles and other non-gill breathing organisms lack this rapid absorption route into the bloodstream, and can tolerate exposure to concentrations that are much higher than levels that are lethal to fish.

2.1 Formulation for Rotenone Treatment

CFT Legumine is a brand of rotenone commonly used for nonnative fish removal across the range of Yellowstone cutthroat trout. The concentration of CFT Legumine applied follows manufacturer recommendations for "normal pond use" of up to 1 part per million (ppm) of the CFT Legumine formulation. Once diluted in drip stations and treated waters, the effective concentration of rotenone is typically between 25 to 50 parts per billion (ppb), which is roughly equal to ¼ to ½ of a grain of table salt per liter.

Drip stations placed at regular intervals, from 1 to 2 hours of water travel time, deliver the diluted rotenone solution (Figure 2-1). Regularly spaced drip stations are necessary because of rapid natural breakdown, dilution, and detoxification of rotenone in stream environments. Each drip station dispenses a precise amount of dilute rotenone over 4 to 8 hours. The required

concentration of CFT Legumine in drip stations depends on existing stream flow, measured in cubic feet per second, and the results of on-site bioassays.

Figure 2-1: Example of a drip station used to deliver CFT Legumine.

Powdered rotenone mixed with sand, and gelatin, is used in several situations. The rotenone sand matrix is placed at the mouths of small tributaries or seeps, to prevent fish from finding refugia from lethal concentrations of rotenone.

Rotenone detoxifies through three mechanisms: natural oxidation, dilution by freshwater, and introduction of a strong oxidizing/neutralizing agent, such as postassium permanganate $KMnO_4$. Factors influencing natural oxidation include water temperature, water chemistry, and exposure to organic substances, air, and sunlight (Engstrom-Heg 1972; Gilderhus et al. 1986; Loeb and Engstrom-Heg 1970; ODFW 2002; Ware 2002). Dilution results from contributions of water from tributaries or upwellings of groundwater.

2.2 Field Methodology and Associated Logistics

Field application of rotenone requires considerable planning, and enough fieldworkers to monitor drip stations. The first component is a bioassay designed to determine the minimum effective concentration of rotenone needed to kill fish. Rotenone concentrations typically range from 25 ppb to 50 ppb.

The piscicide treatment begins in the headwaters, and tributary streams in the headwaters are treated first. Because rotenone degrades rapidly, drip stations are typically placed 1 to 2 miles apart to ensure that chemical from upstream drip stations overlaps with that from downstream

drip stations. Drip stations placed at the mouths of tributary streams prevent fish from invading the treated portion of streams. The treatment proceeds downstream in steps, until all surface waters have been treated. Wetlands require a different approach to achieve a total fish kill. Fieldworkers treat wetlands using backpack sprayers delivering the 25 to 50 ppb of CFT Legumine.

Piscicide treatments need a consistent and sufficient flow of solution to promote a full fish kill. CFT Legumine uses solvents and dispersants to keep the relatively insoluble rotenone in solution, and allow it to spread through the water. These inert ingredients can gel, especially at colder temperatures. Therefore, drip stations require constant monitoring to ensure the diluted rotenone formulation does not clog the aperture dispensing rotenone. To provide a steady supply of rotenone, fieldworkers monitor each drip station, and unclog the aperture as required. In addition, drip station attendants monitor the sentinel fish upstream of the drip station, to ensure toxic concentrations of rotenone are maintained between drip stations.

Detoxification entails applying $KMnO_4$ at the downstream end of the project area, which limits the spatial extent of stream experiencing toxic levels of rotenone. Full neutralization of rotenone requires a short mixing zone, which extends to the distance stream flow travels downstream in 1/2-hour. Application rates of $KMnO_4$ are based on stream flow and natural background levels of oxidation. A small handheld colorimeter measures levels of $KMnO_4$ to guide application rates.

Caged cutthroat trout allow evaluation of the toxicity and detoxification within the project area, and downstream of the project area. These sentinel fish are placed upstream of drip stations to ensure toxic concentrations of rotenone are maintained between stations. During treatment, the status of sentinel fish downstream of the detoxification station indicates when the water is no longer toxic. The CFT Legumine label specifies that once caged fish show no signs of distress for 4 hours, stream detoxification can cease.

The goal is to eradicate fish with the first treatment. Nonetheless, occasionally some fish escape lethal exposure making additional treatments necessary to fulfill the project's objectives. Continued monitoring guides determination of the need for additional treatments, which may be re-treating discrete reaches where fish persist.

Once fish are eradicated, nonhybridized Yellowstone cutthroat trout are stocked in the project area. In streams where nonhybridized, aboriginal populations of Yellowstone cutthroat trout remain, these fish are salvaged before rotenone treatment, and then returned to the stream. Release of the salvaged fish typically occurs soon after treatment. Salvage does not occur in streams where hybridized Yellowstone cutthroat trout are present, and hybrids are among the target species for removal. These streams are restocked with fish obtained from the best available source. Potential sources include streams in the same watershed, neighboring streams, or brood stock acquired from wild fish.

2.3 Toxicity, Persistence, and Fate of CFT Legumine and Its Inert Ingredients in Treated Waters

CFT Legumine is currently the most commonly used rotenone formulation in Montana. The EPA has registered this formula (Reg. No. 75338-2), and approved its use as a piscicide. Information on its chemical composition, persistence in the environment, risks to human health, and ecological risks come from a number of sources, including the material data safety sheet (MSDS) and manufacturer's instructions. An MSDS is a form detailing chemical and physical properties of a compound, along with information on safety, exposure limits, protective gear required for safe handling and procedures to clean up spills safely. In addition, Fisher (2007) analyzed the concentrations of major and trace constituents in CFT Legumine, evaluated the toxicity of each, and examined persistence in the environment.

The MSDS for CFT Legumine lists three categories of ingredients for this formula (Table 2-1). Rotenone comprises 5% of CFT Legumine by weight. Associated resins account for 5%, and the remaining 90% are inert ingredients. The MSDS confirms rotenone's extreme toxicity to fish.

Table 2-1: Composition of CFT Legumine from the material safety data sheet (MSDS)

Chemical Ingredients	*Percentage by Weight*	*CAS. No.*[1]	*TLV*[2] *(units)*
Rotenone	5.00	83-79-4	5 mg/m^3
Other associated resins	5.00		
Inert ingredients including n-methylpyrrolidone	90	872-50-4	Not listed

[1]Chemical abstracts number
[2]A TLV reflects the level of exposure that the typical worker can experience without an unreasonable risk of disease or injury

Analysis of the chemical composition of CFT Legumine found that on average, rotenone comprised 5% of the formula (Table 2-2), consistent with MSDS reporting. Other constituents were solvents or emulsifiers added to assist in the dispersion of the relatively insoluble rotenone. DEGEE, or diethyl glycol monoethyl ether, a water-soluble solvent, was the largest fraction of the CFT Legumine analyzed. Likewise, n-methylpyrrolidone comprised about 10% of the CFT Legumine. The emulsifier Fennedefo 99 is an inert additive consisting of fatty acids and resin acids (by-products of wood pulp and common constituents of soap formulations), and polyethylene glycols (PEGs). PEGs are common additives in consumer products such as soft drinks, toothpaste, eye drops, and suntan lotions. Trace constituents included exceptionally low concentrations of several forms of benzene, xylene, and naphthalene. These organic compounds were at considerably lower concentrations than measured in Prenfish, another commercially available formulation of rotenone that uses hydrocarbons to disperse the piscicide. Their presence in trace amounts in CFT Legumine relates to their use as solvents in extracting rotenone from the original plant material.

Table 2-2: Average percent concentrations and ranges of major constituents in CFT Legumine lost (Fisher 2007).

Major CFT LegumineFormula Constituent	***Rotenone***	***Rotenolone***	***n-methylpyrrolidone***	***DEGEE[1]***	***Fennedefo 99***
Average %	5.12	0.718	9.8	61.1	17.1
Range	4.64-5.89	0.43-0.98	8.14-10.8	58.2-63.8	15.8-18.1

[1]diethyl glycol monoethyl ether

Persistence in the environment and toxicity to nontarget organisms are major considerations in determining the potential risks to human health and the environment. Rotenone is a highly reactive molecule, a factor that favors its rapid breakdown in the environment. The molecular constituents of rotenone are carbon, hydrogen, and oxygen and detoxification entails breaking rotenone into these nontoxic components.

Several factors influence the persistence of rotenone. Rotenone has a half-life of 14 hours at 24 °C, and 84 hours at 0 °C (Gilderhus et al. 1986, 1988), meaning that half of the rotenone is degraded and is no longer toxic in that time. As temperature and sunlight increase, so does degradation of rotenone. Higher alkalinity (>170 mg/L) and pH (>9.0) also increase the rate of degradation. Rotenone tends to bind to, and react with, organic molecules rendering it ineffective, so higher concentrations are required in streams with increased amounts of organic matter. Without detoxification, rotenone degrades to nontoxic levels in one to several days due to its break down and dilution in the aquatic environment.

Mitigative actions further reduce the spatial and temporal extent of rotenone toxicity. A detoxification station releases $KMnO_4$ up to the effective concentration of 0.5 to 1 ppm. This strong oxidizer rapidly breaks down rotenone into its nontoxic constituents of carbon, oxygen, and hydrogen, with total breakdown occurring within 15 to 30 minutes of exposure, which is typically ¼ to ½-miles stream travel time. $KMnO_4$ in turn breaks down into potassium, and the solid manganese dioxide, which are common constituents in surface waters (Finlayson et al. 2000). In addition, $KMnO_4$ is a commonly used oxidizer in wastewater treatment plants, so its release into streams and rivers is a regular and widespread phenomenon. The result of release of $KMnO_4$ on water quality is the elimination of toxic concentrations of rotenone. An additional, back up detoxification station provides a safeguard if sentinel fish show signs of rotenone toxicity.

The effective concentration of rotenone is 25 to 50 ppb, which is roughly equivalent to ¼ to ½ of a grain of table salt per liter. The National Academy of Sciences suggested concentrations of 14 ppm (about 8,900 grains of salt per liter) pose no adverse effects to human health from chronic ingestion of water (National Academy of the Sciences 1983). Moreover, concentrations associated with acute toxicity to humans are 300-500 mg per kilogram of body weight (Gleason

et al. 1969), which means a 160-pound person would have to drink over 23,000 gallons in one sitting to receive a lethal dose (Finlayson et al. 2000). Similarly, risks to wildlife from ingesting treated water are exceptionally low. For example, ¼-pound bird would have to consume 100 quarts of treated water, or more than 40 pounds of fish and invertebrates, within 24 hours, for a lethal dose (Finlayson et al. 2000). The EPA, in their recent reregistration evaluation of rotenone (EPA 2007), concluded that exposure to rotenone, when applied according to label instructions, did not present unacceptable risks to humans or wildlife. In summary, applying rotenone according to label instructions has no adverse effect on humans or wildlife associated with ingesting water, dead fish, or dead invertebrates.

Rotenone can bio-accumulate in the fat tissues of fish that are not exposed to toxic levels (Gingerich and Rach 1985) however bio-accumulation of rotenone does not result in threats to human health and the environment, as a complete fish-kill is the goal. Furthermore, application occurs over a short time, so bioaccumulation is not a problem. Moreover, breakdown of rotenone in killed fish and invertebrates is rapid enough that scavenging animals do not experience chronic exposure.

Potential toxicity and persistence of the other constituents of the CFT Legumine formulation are additional considerations. Concentrations of n-methylpyrrolidone (about 2 ppm) have no adverse effects to humans ingesting treated waters. According to the MSDS, ingestion of 1000 ppm per day for three months does not result in harmful effects in humans. In addition, n-methylpyrrolidone does not persist in surface waters given its high biodegradability. This rapid degradation, combined with its low toxicity, makes n-methylpyrrolidone a commonly used solvent in wastewater treatment plants.

Fisher (2007) examined the toxicity and persistence of other major constituents in CFT Legumine, including DEGEE, fatty acids, PEGs, and trace organic compounds, (benzene, xylene, naphthalene). With proposed application of CFT Legumine, none of these compounds violate water quality standards, nor do they reach concentrations shown to be harmful to wildlife or humans. Furthermore, persistence of these chemicals is not a concern. The trace organics degrade rapidly through photolytic (sunlight) and biological mechanisms. Likewise, the PEGs biodegrade in a number of days. The fatty acids also biodegrade, although they would persist longer than the PEGs or benzenes. Nonetheless, these are not toxic compounds, so the relatively longer persistence does not adversely affect water quality.

Treatment concentrations of the trace organics present in CFT Legumine upon dilution in surface waters are low (Fisher 2007), and within human health standards for water quality in Montana (DEQ 2012). Note that human health criteria relate to chronic exposure, and assume a 154-pound person will consume 2 liters a day for 70 years. Exposure during piscicide is short-term, and lasts 1 to 2 days with detoxification. Acute toxicity data developed for laboratory organisms provide a

model to infer the effect of treatment concentrations of organic compounds on human health and the environment.

Benzene is among the trace compounds in the CFT Legumine formulation. Its treatment concentration in streams would reach 3.44 ppb, whereas the human health standard for benzene in Montana is 5 ppb. This means the short-term treatment concentrations are less than levels that result in negative health consequences with long-term exposure. Concentrations resulting in acute toxicity, or death of 50% of tested organisms (LD_{50}) for laboratory rats, range from 232,500 ppb to 279,000 ppb. Mice are substantially more tolerant of ingested benzene than rats.

The concentration of naphthalene in treated water is 0.00225 ppm. As a moderately volatile compound, naphthalene does not break down as rapidly as the highly volatile benzene. Nevertheless, this concentration is exceptionally low, and is undetectable in laboratory analyses. Furthermore, naphthalene concentration of 0.00225ppb is well below the Montana drinking water standard of 0.1 ppm. The naphthalene present in the diluted CFT Legumine is unlikely to be toxic to aquatic life. The LD_{50} for rainbow trout is 1.6 ppm, and the LD_{50} for fathead minnow (*Pimephales promelas*) is 6.14. These concentrations are exorbitantly higher than treatment concentrations of naphthalene.

Trace concentrations of xylene were present in some lots of CFT Legumine (Fisher 2007), but it was not consistently encountered. Similar to benzene and naphthalene, concentrations of xylene, when present, were orders of magnitude lower than human health standards and acute toxicities for tested organisms. Moreover, dilution in stream application, and its high volatility, means xylene does not present a threat to human health and the environment.

The presence and fate of dead fish is another potential alteration of water quality associated with piscicide treatment. Dead fish are unlikely to be a significant attractant to bears in tributary streams, because fish densities are low and fish sink to the bottom of pools where they rapidly decompose. In settings where there is a potential for conflict with bears, collection and secure disposal of dead fish reduces the likelihood of encounters with bears.

Detoxification at the downstream end of the project area limits the spatial extent of toxic water. Even without detoxification, the rotenone dilutes or breaks down in a matter of days through natural oxidation, binding with organic material or dilution, making the effects on water quality short-term and minor. Effective concentrations of rotenone generally do not travel far, which is why drip station spacing is typically at 1 to 2-mile intervals. The other constituents of the CFT Legumine are not toxic at the concentrations applied, and break down rapidly through hydrolysis, bacterial action, and oxidation (Fisher 2007). Likewise, $KMnO_4$ degrades rapidly when applied according to the manufacturer's label. Constituents with longer persistence are nontoxic and do not pose a threat to the environment.

To reduce the potential risks associated with the use of CFT Legumine, the following management practices, mitigation measures, and monitoring efforts are employed.

1. A pretreatment bioassay is conducted to determine the lowest effective concentration and travel time of the chemical in the stream.
2. Signs are posted at trailheads and along the stream to warn people not to drink the water, consume dead fish, or have recreational contact with the water.
3. Piscicide is diluted in water and dripped into the stream at a constant rate using a device that maintains a constant head pressure.
4. A detoxification station is set up downstream of the target reach. $KMnO_4$ neutralizes the piscicide at this location.
5. An additional detoxification is established downstream from the initial detoxification station as a safeguard.
6. Project personnel are trained in the use of these chemicals including the actions necessary to deal with spills, as prescribed in the MSDS for CFT Legumine.
7. People handling the piscicide wear protective gear as prescribed in the CFT Legumine label.
8. Only the amount of piscicide and potassium permanganate that is needed for immediate use is held near the stream.
9. Sentinel fish are located below the detoxification station and within the target reach to determine and monitor the effectiveness of both the rotenone and $KMnO_4$.

2.4 Effects of Rotenone on Groundwater

Rotenone binds readily to soils and is broken down by soil and in water (Dawson et al. 1991; Skaar 2001; Ware 2002). Because of its strong tendency to bind with soils, its mobility in most soil types is only one inch; although, in sandy soils, rotenone can travel up to three inches (Hisata 2002). Combined, the low mobility and rapid break down prevents rotenone from contaminating groundwater.

Groundwater investigations associated with several piscicide projects also indicate application of rotenone, and the inert ingredients, do not threaten groundwater quality. California investigators monitored groundwater in wells adjacent to, and downstream of, rotenone projects, and did not detect rotenone, rotenolone, or any of the other organic compounds in the formulated products (CDFG 1994). Likewise, case studies in Montana have concluded that rotenone movement through groundwater does not occur. For example, FWP monitored a domestic well two weeks and four weeks after applying 90 ppb of rotenone to Lake Tetrault (FWP, unpublished data). This well was down gradient from the lake, and drew water from the same aquifer that drained and fed the lake; however, no rotenone or associated constituents were detectable. FWP has monitored groundwater associated with several other rotenone projects, with wells ranging from

65 to 200 feet from the treated waters. Repeated sampling occurred within periods of up to 21 days, with no detectable concentrations of rotenone or the inert ingredients found.

2.5 Changes In the Diversity or Abundance of Aquatic or Semi-Aquatic Species

Gilled aquatic invertebrates are nontarget organisms with considerable potential to suffer negative effects from piscicide treatment. In streams, benthic populations of true flies, stoneflies, mayflies, and caddis flies are the primary affected taxa. Some controversy exists over the long-term effect of rotenone treatment on macroinvertebrate populations. In general, drawing inference on the effects on aquatic invertebrates from the literature is challenging. Treatments in the scientific literature vary in terms of duration and concentration of rotenone. Moreover, investigations often fail to include information of proximity treated waters to a recolonization source, such as downstream drift, or dispersal by aerial adults. Sampling methodology often differs among studies, and inconsistency in reporting abundance and taxonomic resolution present other confounding factors.

Although differences in formulation, concentration, and duration of rotenone treatment confound making robust predictions on the effects of rotenone on macroinvertebrates, the scientific literature allows for some generalizations. Investigations into the effects of rotenone on benthic organisms indicate that rotenone results in temporary reduction of stream-dwelling invertebrates. In one case, no significant reduction in aquatic invertebrates occurred despite concentrations of rotenone being twice as high as the proposed maximum concentration (Houf and Campbell 1977). In other cases, invertebrates recovered quickly following treatment. For example, following piscicide treatment of a California stream, macroinvertebrates experienced an “explosive resurgence” in numbers, with black fly larvae recovering first, followed by mayflies and caddis flies within six weeks after treatment (Cook and Moore 1969). Stoneflies returned to pretreatment abundances by the following spring. Another mitigative factor is that invertebrates that were most sensitive to rotenone also tended to have the highest rate of recolonization due to short life cycles (Engstrom-Heg et al. 1978). Although gill-respiring invertebrates are a sensitive group, many are far less sensitive to rotenone than fish (Schnick 1974; Chandler and Marking 1982; Finlayson et al. 2010). Due to their short life cycles (Anderson and Wallace 1984), good dispersal ability (Pennack 1989), and generally high reproductive potential (Anderson and Wallace 1984), aquatic invertebrates are capable of rapid recovery from disturbance (Boulton et al. 1992; Matthaei et al. 1996).

Larval drift and reproduction by aerial adults are the primary mechanisms of recovery, and several miles of stream upstream of the treatment area provide a source of invertebrates drifting into reclaimed waters. Likewise, aerial adults from downstream lay eggs and repopulate invertebrate communities. Proximity to adjacent sub-watershed populations further expedites this recovery. Moreover, macroinvertebrates are in a diverse array of life history stages, and recently

emerged adults are be able to reproduce soon after treatment. Observations on Lower Deer Creek documented a substantial hatch of caddis flies and midges the day following treatment of an area (C.L. Endicott, FWP, personal communication).

The well-established ability of macroinvertebrates to recover following disturbance, combined with the lower susceptibility of many taxa to rotenone, contributes to rapid recovery of invertebrate populations. Disturbance is a common occurrence in streams, and includes floods, wildfire, and human-caused alterations such as incompatible livestock grazing practices (Mihuc and Minshall 1995; Wohl and Carline 1996; Minshall 2003). These disturbances have greater potential to have long-term effects on stream-dwelling assemblages than piscicide treatments, given longer-term changes in geomorphology, impairment of riparian health and function, and reduced water quality. Rotenone treatment mimics a pulse disturbance, which is common in streams, and macroinvertebrates have evolved under this type of disturbance regime.

Implementation of a monitoring plan allows evaluation of the short and long-term effects of piscicide treatment on invertebrates. In Montana, sampling follows FWP protocols (FWP 2012). In streams where no sensitive species have been observed, fieldworkers sample invertebrates at 3 locations within the treatment area, and 1 sample outside the treatment area. These sites are resampled the following year. In streams where sensitive species have been collected, the level of effort, and post-treatment monitoring, increase substantially.

Amphibians are closely associated with water, and have potential to be exposed to rotenone during treatment. Species common to Wyoming and Montana include the Columbian spotted frog (*Rana luteiventris*), the western tiger salamander (*Ambystoma mavortium*) and the western toad (*Bufo boreas*). Of these, western tiger salamanders and the Columbian spotted frog have the greatest probability for exposure to rotenone, given their preference for streamside or in-stream habitat, or presence in mountain lakes. Western toads are less dependent on surface water, except for during the breeding season, so these species have a lower probability of encountering rotenone treated waters

Similar to other gill-bearing organisms, amphibian larvae are sensitive to rotenone, and exposure to CFT Legumine at levels used to kill fish is acutely toxic to Columbian spotted frog larvae and western toad larvae (Billman et al. 2012). Although tadpoles may be vulnerable to rotenone, at least some species may be up to 10 times more tolerant than fish (Chandler and Marking 1982). Treatment in late summer or early fall is a recommended practice to prevent effects on amphibians, as they are past the gilled life history stage (Grisak et al. 2007).

Effects on other adult amphibians are insignificant given their low vulnerability to rotenone because of loss of gills, development of lungs, maturation of liver function, mobility, and project timing. Adult Columbian spotted frogs do not suffer an acute response to trout killing concentrations of Prenfish, another commonly used formulation of rotenone that includes organic

compounds (Grisak et al. 2007). Likewise, proposed treatment level concentrations of CFT Legumine is nonlethal to metamorph, juvenile, and adult amphibians (Billman et al. 2011). Adult and metamorphic Columbian spotted frogs did not show a toxic reaction to CFT Legumine. Adult western toads are likely less sensitive than frogs given their impermeable skin (Maxell and Hokit 1999). Moreover, adult toads and frogs have the ability to leave the aquatic environment, which substantially reduces the potential for exposure (Maxell and Hokit 1999).

Western tiger salamanders have potential to be exposed to rotenone in treated mountain lakes. Western tiger salamanders in high elevation lakes areas are in neotenic form, meaning they retain juvenile features such as gills as adults. These lake dwelling salamanders are commonly called axolotls. Although mostly associated with plains, axolotls live in mountain lakes at elevations of over 8,680 ft.

Sampling associated with application of rotenone in a lake indicate western tiger salamanders are likely resilient to piscicide. Despite retaining gills and being obligate lake dwellers, neotenic western tiger salamanders were not eliminated from a lake treated with piscicide, even though the treatment was successful at eliminating fish (J. Olsen, FWP, personal communication). Gillnetting yielded no fish and 40 salamanders. The lake continues to yield only Yellowstone cutthroat trout from the fish plant the following year, suggesting the treatment was successful in removing the nonnatives present in the lake. The absence of predatory fish likely contributed to resurgence of salamanders following piscicide treatment.

Another consideration is the reproductive capacity of some of these species. Similar to invertebrates, Columbian spotted frogs show a prodigious ability to recolonize following piscicide treatment. Columbia spotted frogs rebounded the following spring after application of CFT Legumine in a lake (Billman et al. 2012). These tadpoles were the progeny of adults that overwintered in the area.

3 Mechanical Removal

Mechanical removal entails the use of electrofishing, nets, or traps to capture fish. Under ideal conditions and certain circumstances, mechanical removal has been successful (Shepard et al. 2014). Mechanical removal has the potential to provide an additional means of removing fish from water with simple habitat and limited project length. The difficulty in achieving 100% removal is a primary deficiency in using mechanical removal.

3.1 Methods and Efficacy of Mechanical Removal of Fish in Streams

The level of effort associated with even incomplete mechanical removal can be substantial. For example, FWP mechanically removed brook trout from a nearly four miles of Muskrat Creek (Shepard and Nelson 2001). During the four-year effort, fieldworkers captured nearly 5,400 brook trout and moved them below a barrier falls. By the end of the project, brook trout were still

present above the barrier, and treatment with piscicide became the recommended alternative. Other researchers found five removals were required for successful elimination of rainbow trout from a stream in Tennessee (Kulp and Moore 2000); however, the stream length in this study was about 0.5 miles.

Several factors are critical in the effectiveness of mechanical removal of nonnative brook trout from streams (Shepard et al. 2014). In small streams, crews of 2 to 3 people were able to eliminate brook trout from stream reaches measuring from 1 to nearly 2 miles in as few as 6 or as many as 14 passes. A fish barrier was required at the downstream end of each reach, to prevent reinvasion of brook trout between removal events. Increasing effort from once a year to targeting autumn spawning and winter aggregating behavior also improved efficacy.

Elimination of riparian vegetation and woody debris was a substantial factor leading to successful brook trout removal using electrofishing (Shepard et al, 2014). Before the electrofishing crews began mechanical removal, U.S. Forest Service crews cleared riparian vegetation and woody debris with chain saws. The abundance of woody debris is among the factors limiting the success of removal efforts on most streams. Brook trout seek the cover of woody debris more than cutthroat trout, and abundant woody debris gives brook trout an advantage over cutthroat trout when they are in sympatry (Shepard et al. 1999).

Costs associated with debris removal were considerable (Shepard et al. 2014). When removal of riparian vegetation was unnecessary, mechanical removal cost from $3,500 to $5,500 per kilometer. This amount was comparable to the use of piscicide, including labor, chemical, per diem, and travel costs. When clearing vegetation and wood was necessary to eradicate brook trout, project costs increased to $8,000 to $9,000 kilometer.

3.2 Potential Effects of Mechanical Removal on Stream Ecosystems

Disturbance associated with mechanical removal differs substantially from chemical removal. To be effective, forested streams require the physical removal of riparian vegetation and woody debris. This disturbance has potential for short-term changes in stream ecology, and longer term changes in stream stability and physical habitat. In addition, because removal efforts could take several years, barriers need to be constructed at the downstream end of the treatment reach to prevent reinvasion by brook trout or hybrids between treatments.

Removing the riparian canopy on treated streams increases solar inputs. This change has potential to increase water temperatures, which could negatively affect fish until the canopy recovers. Moreover, in forested headwater streams, macroinvertebrate communities depend on terrestrial sources of forage. With removal of the riparian canopy, in-stream primary production increases in importance. A resulting change in macroinvertebrate populations is a shift from invertebrates eating leaf matter, to species that graze algae from rocks and other substrates within the stream.

Alterations in streamside vegetation also alter food sources for fish. The importance of terrestrial sources of invertebrates for fish decrease, and fish rely more on in-stream invertebrate production.

Removal of woody debris may have consequences for channel stability and fish habitat. Woody debris promotes channel stability during flood events (Heede 1985). Furthermore, woody debris produces scour that promotes the formation of pools and other habitat features (Heede and Rinne 1990). The riparian canopy recovers within a few years; however, recruitment of large woody debris occurs over a substantially longer time.

The influence of the constructed barriers at the downstream end of the treatment reach has potential to affect channel morphology and sediment transport. Barriers used in fish removal projects include wood crib structures and impassable culverts. The wood cribs alter bed load and debris transport, and have the potential to fail during floods. Perched culverts have to be installed where road access is available. Moreover, culverts also have potential to impair transport of bed load and woody debris.

4 Conclusions

Chemical and mechanical methods to remove nonnative fishes are both viable options in management of native fishes. Each brings a level of disturbance that may negatively affect wilderness values. Conversely, restoring the native species to a stream increases its biological integrity and is consistent with the intent of the Wilderness Act of 1964.

Disturbance associated with chemical removal includes introduction of a toxic substance to surface waters, presence of fieldworkers attending drip stations, and potentially 1 to 2 days of helicopter support. Typically, a single treatment lasts 4 to 8 hours, with additional treatments possible in subsequent years, if a full fish kill is not attained in the first year. Fieldworkers trample streamside vegetation while walking to and from drip stations, although vegetation would recover quickly from this disturbance. All fish, and an unknown proportion of the invertebrate community, die from exposure to rotenone. This disturbance is short-term, as fish are restocked using the best available source. Macroinvertebrates communities recover from invertebrates that are not vulnerable to rotenone, larvae drifting from untreated headwaters reaches and dispersal of aerial adults. With application of best management practices, amphibians are be invulnerable to rotenone, or recover through reproduction the following spring.

Mechanical removal brings a number of disturbances with potential alter wilderness values. Because mechanical removal likely requires several years of effort, barriers need to be constructed at the downstream ends of a treatment reach. Construction of wooden crib structures within wilderness requires the use of power tools and several fieldworkers. Furthermore,

placement of impassable culverts where roads exist in the watershed prevent reinvasion, but at considerable cost. Both types of barriers alter bed load and woody debris transport.

Mechanical removal requires considerably more labor than chemical removal. In forested watersheds, mechanical removal is often not effective without removal of streamside vegetation and woody debris, which requires crews using chainsaws. Furthermore, the number of removal events are be considerably more numerous, and cover more years than chemical removal. As a result, humans are present in the watershed for more days per year. Moreover, mechanical removal typically takes 4 or more years to eliminate all fish.

Removal of streamside vegetation and woody debris results in changes in the trophic functioning of streams, increases water temperature, and decreases channel stability. With recovery of the woody canopy, trophic level composition of macroinvertebrates and water temperatures likely return to pretreatment conditions within a few years. Removal of large woody debris and complex woody debris takes considerably longer, as it requires trees to die and fall across or into streams.

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