AMENDED FISHERIES BIOLOGICAL ASSESSMENT

HELENA – LEWIS AND CLARK NATIONAL FOREST, REGION 1, MONTANA

Project Name: Stonewall Vegetation Project

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Ranger District: Lincoln Ranger District **Date Prepared:** August 10, 2016

The following Biological Assessment (BA) is designed to satisfy the requirements of the Forest Service and U.S. Fish and Wildlife Service (FWS). This BA consists of 14 parts.

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1. Project Description

The Stonewall Vegetation Project proposes treatment to 4,868 acres on the Lincoln Ranger District, Helena National Forest. Treatments consist of a mixture of regeneration harvest, commercial thinning, precommercial thinning, and low- and mixed-severity prescribed burns. A combination of activities was selected from each of the action alternatives analyzed in the FEIS; the selected alternative is compared to other alternatives in Table 1. The project area lies within the Beaver Creek (NRCS 170102030303), Lincoln Creek (NRCS 170102030305), Sucker and Keep Cool (NRCS HUC 170102030304) and Humbug Creek (NRCS 170102030301) 6th field HUCs. This grouping of 6th field HUCs lies mostly northwest of the town of Lincoln.

The following purposes for undertaking the Stonewall Vegetation project are:

- Improve the mix of vegetation composition and structure across the landscape that is diverse, resilient, and sustainable to wildfire and insects.
    - Enhance and restore aspen, western larch, and ponderosa pine species and habitats.
- Modify fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape.
- Integrate restoration with socioeconomic considerations.
    - Utilize economic value of trees with economic removal.

Table 1. Comparison of Activities by Alternative and Decision for the Stonewall Vegetation Project.

GROUP #: BRIEF TREATMENT DESCRIPTION HARVEST TREATMENT, FUELS TREATMENT	ALT. 1 NO ACTION ACRES	ALT. 2 ACRES	ALT. 3 ACRES	SELECTED ALTERNATIVE ACRES
Group 1: Intermediate Harvest to Promote Mature Open Forests	**0**	**974**	**232**	**235**
Improvement Cut, Jackpot Burn	0	36	0	0
Improvement Cut, Underburn	0	938	232	235
Group 2: Intermediate Harvest to Thin Young Forests	**0**	**1,132**	**822**	**690**
Precommercial Thin	0	523	409	422
Precommercial Thin, Handpile Underburn	0	0	29	14
Precommercial Thin, Handpiling, Burn Piles	0	78	50	64
Precommercial Thin, Underburn	0	289	141	141
Precommercial Thin, Underburn or Slash Treatment along PVT	0	242	193	49
Group 3: Regeneration Harvest in Areas of High Mortality Retaining Seed and Shelter Trees	**0**	**745**	**664**	**476**
Seedtree with Reserves, Broadcast Burn	0	29	29	29
Seedtree with Reserves, Jackpot Burn	0	73	41	54
Seedtree with Reserves, Slashing, Handpiling, Burn Piles	0	18	18	18
Seedtree with Reserves, Underburn	0	223	207	211
Shelterwood (Group) with Reserves, Jackpot Burn	0	137	137	30
Shelterwood (Group) with Reserves, Site Prep Burn	0	96	96	83
Shelterwood (Group) with Reserves, Slashing, Handpile/Burn	0	25	0	0
Shelterwood (Group) with Reserves, Underburn	0	114	114	21
Shelterwood with Reserves, Site Prep Burn	0	30	22	30
Group 4: Regeneration Harvest in Areas of High Mortality Retaining Rare Live Trees	**0**	**223**	**152**	**184**
Clearcut with Reserves, Broadcast Burn	0	98	80	73
Clearcut with Reserves, Jackpot Burn	0	53	0	39
Clearcut with Reserves, Site Prep Burn	0	54	54	54
Clearcut with Reserves, Underburn	0	18	18	18
Group 5: Intermediate Harvest to Remove Minor Amounts of Dead/Dying Trees	**0**	**25**	**25**	**25**
Sanitation, Slashing, Handpiling, Burn Piles	0	25	25	25
Group 6: Low Severity Prescribed Fire to Create Mortality Patches 5 to 10 acres	**0**	**449**	**326**	**549**
Low Severity Fire, Openings <5 acres	0	326	326	549
Low Severity Fire, Openings <10 acres	0	123	0	0
Group 7: Mixed Severity Fire to create mortality patches up to 5, 10, or 20 acres	**0**	**410**	**36**	**363**
Mixed Severity Fire, Openings <5 acres	0	36	36	36
Mixed Severity Fire, Openings <10 acres	0	48	0	0
Mixed Severity Fire, Openings <20 acres	0	326	0	0
Jackpot Burn	0	0	0	326
Group 8: Mixed severity fire to create mortality patches up to 30 or 75 acres	**0**	**4,604**	**3,265**	**1,288**
Mixed Severity Fire, Openings <30 acres	0	3,371	2,032	1,288

GROUP #: BRIEF TREATMENT DESCRIPTION HARVEST TREATMENT, FUELS TREATMENT	ALT. 1 NO ACTION ACRES	ALT. 2 ACRES	ALT. 3 ACRES	SELECTED ALTERNATIVE ACRES
Mixed Severity Fire, Openings <75 acres	0	1,233	1,233	0
Group 9: Low Severity Prescribed Fire	**0**	**0**	**638**	**0**
Jackpot Burn	0	0	326	0
Underburn	0	0	312	0
Group 10: Intermediate Harvest to Promote Mature Open Ponderosa Pine and Regenerate Aspen	**0**	**0**	**403**	**503**
Improvement Cut, Jackpot Burn (Hand)	0	0	403	0
Improvement Cut, Jackpot Burn (Tractor)	0	0	0	358
Precommercial thin, underburn	0	0	0	98
Improvement Cut, Prune, Pile and Burn	0	0	0	47
Group 11: Whitebark Pine Restoration	0	Included	In	**555**
Improvement Cut (Hand), Pile and Burn, Jackpot burn	0	Group	8	555
Grand Total Project Treatments (acres)	**0**	**8,563**	**6,564**	**4,868**
Total Commercial Harvest Treatments (acres)	**0**	**1,968**	**1,073**	**1,423**
• Tractor logging (total acres)	0	1,305	709	1,002
• Skyline logging (total acres)	0	663	364	421
Total Precommercial Thin Treatments (acres)	**0**	**1,132**	**822**	**690**
• Mechanical	0	639	537	398
• Hand treatments	0	493	285	292
Total Burning Treatments (acres)	**0**	**8,040**	**6,155**	**4,447**
• Total burning after harvest (acres)	0	2,577	1,487	1,692
• Total prescribed burn following hand treatments (acres)	0	5,463	4,668	2,755
○ Total burning in designated IRAs (acres)	0	4,846	3,565	2,144
Total Road Miles Used for Haul	**--**	**48.2**	**44.2**	**32.4**
• Roads Built for Project Use then Obliterated (miles)	--	2.6	0.4	0.9
• Road Maintenance (miles)	--	45.6	43.8	31.5
Timber Volume (Ccf)	**0**	**22,022**	**14,299**	**18,498**

For the most part, the most vigorous and generally the heathiest and largest trees on the landscape will be left to attain a wide range of beneficial uses. The primary treatment emphasis would be removing understory trees to reduce ladder fuels and stand density competition while also addressing public's desire to retain old, large trees. Seral species would be favored, in particular ponderosa pine, whitebark pine, and aspen.

General Mitigation – BMPs & RHCA Boundaries

The following measures should reduce the potential impact of the proposed vegetation management project. INFISH (USDA 1995) standards will be met. A key component of INFISH for this project includes measures to address roads that have high risk for sediment delivery to surface waters. Mitigation measures originally proposed in the draft and FEIS included the road maintenance and improvement best management practices (BMPs) that would be applied to all roads used in the

project, including application of aggregate at road/stream crossings and other sediment delivery points. While road/stream crossings typically are high probability locations for sediment delivery points, field inspections identified additional locations based on existing drainage patterns that could be treated to lower effects.

In addition, some project design features (pdfs) have undergone substantial modification since the FEIS that apply to the Record of Decision. The pdfs that have been modified and have the greatest relevance to this Biological assessment include the three below:

S/WS/F -16 RHCAs

INFISH (USDA 1995) Riparian Habitat Conservation Areas (RHCAs) will be maintained in all units and marked. Where dead trees in RHCAs are determined to be a hazard, they will be felled and left onsite. A clear means of identifying hazard trees that are to be cut and left on site will be recognized and coordinated with wildlife staff. The portions of dead hazard trees cut that are not blocking roads will not be removed from the RHCAs. No green commercial trees within the RHCAs will be removed. No pre-commercial thinning will occur within RHCAs. In burn units, no ignition will occur within RHCAs. Efforts will be taken to restrict fire from backing into RHCAs. No log landings will be located in RHCAs.

S/WS/F -17 RHCAs

Additional areas requiring INFISH buffers are likely to be found during vegetation unit layout that are not currently identified on project area maps. These areas will be identified during implementation and the appropriate buffers and mitigations applied to them to meet INFISH (USDA 1995) and Helena Forest Plan standards.

RHCA boundaries

-Category 1--Fish bearing streams have a RHCA width of 300 feet either side of the stream or the 100-year floodplain whichever is greater.

-Category 2--For perennial streams not supporting fish, the RHCA is 150 feet either side of the stream.

-Category 3-- For lakes and wetlands greater than one acre, the RHCA is a minimum of 150 feet but can be larger and extend to the outer limits of riparian vegetation, the extent of seasonally saturated soil, the extent of highly unstable areas, or the distance equal to the height of one site-potential tree.

-Category 4--For Seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides and landslide prone areas, the RHCA boundary is a distance equal to the height of one-half site potential tree from the edges of the stream channel, wetland, landslide, or landslide prone area, or a 50-foot slope distance, whichever is greatest.

The following documents the specific treatment of dead hazardous trees within INFISH Categories 1-4 RHCAs associated with streams.

Situations where dead trees may be felled and comply with or exceed INFISH standard RA-2.

If the tree is between the creek and the road, within a tree length of the road, leaning toward the road, and is not within a tree length of the creek and does not fall into what is considered a wider floodplain category (the situation where side channel development is possible) then the tree may be felled but kept on site.

If the tree is between the creek and the road, within a tree length of the road, not within a tree length of the creek, is on a bench elevated above the floodplain, and is leaning toward the road, the tree can be felled, but must remain on site.

Dead hazard trees within the RHCA can be felled in the situation where the road is between the creek and the tree, but must remain on site. Any portion of the tree spanning the stream will be left in place.

	For the situation where the road parallels a stream and then crosses a tributary to the stream, the dead hazard trees on the uphill side of the road, including those within a tree length of the tributary, can be cut, but left on site. In all situations, that portion of the tree that obstructs the road will be moved off the road but remain on site.
S/WS/F -18 Stream Management Zones	The State of Montana Stream Management Zone (SMZ) Law (2007) prohibits broadcast burning in SMZs (see Rule 3 (26.6.603), specific to prescribed burning). During broadcast or underburning, no ignition will take place in an SMZ; although some fire may back into the SMZ, efforts will be taken to restrict fire from backing into the SMZ.

Additional changes in the boundaries of the vegetative harvest treatment units were made from those identified in the draft and FEIS for the implementation units that would be marked on the ground to remove the RHCAs from within the boundaries of harvest units. This effort will continue as additional boundaries are being ground-truthed and flowing or intermittent streams (INFISH Category 4) inside implementation units are examined, identified and the appropriate buffers applied to them.

2. Watershed Description

The Blackfoot River is a 4th code hydrologic unit within the Columbia River Basin and is a direct tributary to the Clark Fork River. The basin encompasses approximately 2,400 square miles, roughly 1,536,000 acres (Pierce and Schmetterling 1999). The Blackfoot flows 132 miles in a westerly direction from its source near the continental divide to its confluence with the Clark Fork River and is a free flowing river since the removal of Milltown Dam near the confluence with the Clark Fork.

There are a large number of tributary streams. Some of the larger tributaries in the Blackfoot watershed include Landers Fork, Copper Creek, Nevada Creek, North Fork of the Blackfoot River, Monture Creek, Clearwater River, Belmont Creek, and Gold Creek. The total stream network is approximately 4,740 miles (Forest Service Data) with 1,900 perennial stream miles capable of supporting a fishery (Pierce and Schmetterling 1999). The Blackfoot River drainage contains more than 60 6th code hydrologic units.

Fish populations in the Blackfoot River vary greatly in terms of species composition and overall fish density. The differing fisheries of the Blackfoot are a product of habitat characteristics, recruitment sources, and human influences such as environmental degradation, stocking of non- native fish species, and fishery exploitation. Twelve native fish, 12 nonnative fish, as well as rainbow - cutthroat trout and brook - bull trout hybrids are present in the Blackfoot River drainage. The river is managed as a wild trout fishery with no fish planting (Pierce et al. 1997).

Streams currently known to support fisheries located within this analysis area include the Blackfoot River, Beaver Creek, tributaries to Beaver Creek which include Yukon Creek, Theodore Creek and Klondike Creek as well as Stonewall, Liverpool, and Park creeks (tributaries to Keep Cool Creek) (Table 2). The lower reaches of streams in the Beaver and Keep Cool Creek 6th code HUCs on private and Montana DNRC school trust lands go subsurface seasonally or have very low flows due to natural conditions or as a result of irrigation withdrawals. This dewatering limits connectivity with lower Keep Cool Creek and the mainstem Blackfoot River. Small reaches of the Blackfoot River lie within the Stonewall Vegetation Project Area and are designated critical habitat for Foraging, Migrating and Overwintering.

Two fires occurred in the 6th code HUCs of the project area in 2015; the largest was the Sucker Creek Fire which burned 1,819 acres within a perimeter of 2,302 acres in the Keep Cool 6th code HUC in the Sucker and Keep Cool creeks drainages and represented nearly eight percent of the HUC. The Sucker Creek Fire burned 92 acres within the Project Area Boundary. In the Beaver Creek 6th code HUC, the Klondike Fire burned approximately 253 acres in the Klondike and Theodore creeks drainages, representing two percent of the HUC. Overall, the two fires burned approximately 3.6 percent of the HUCs that contain the Project Area. Studies suggest that in larger watersheds, significant changes in water yield, peak flows, and flow duration following wildfires or other disturbances are not generally detectable until 15 percent or more of the vegetation in the watershed is removed. Mulching and seeding techniques such as those implemented on the Sucker Creek Fire have been determined to be the most effective tools to minimizing erosion that would result in sediment delivery to surface water. Any sediment that reached surface waters from the burned areas would have a high probability of being stored higher in the watershed than any known bull trout occupied reaches because of topography.

Table 2. Salmonid species present and Sediment Rating* in each 6th code HUCs in the project area.

6th HUC ID	6th HUC name	Sediment habitat indicator rating* & % fines in streams	Salmonid species known to be present in Project Area of the HUC
170102030303	Beaver Creek	FUR - Beaver Creek - 27% fines below project area, 30.6% fines above and in project area	Westslope cutthroat trout, brook trout, bull trout (historical)
		Yukon Creek - 34.2% fines	Westslope cutthroat trout, brook trout
		Theodore Creek -32% fines	Westslope cutthroat trout, brook trout, bull trout (historical)
		Klondike Creek – 34% fines	Westslope cutthroat trout, brook trout, bull trout (historical)
170102030301	Humbug Creek	FA – Blackfoot River - 31% fines	Westslope cutthroat trout, brown trout, bull trout, sculpin, mountain whitefish
170102030304	Keep Cool Creek	FUR –Stonewall Creek - 31% fines	Westslope cutthroat trout
		Keep Cool Creek - 47% fines	Westslope cutthroat trout, brook trout
		Liverpool Creek - 34% fines	Westslope cutthroat trout, brook trout
		Park Creek - 45% fines	Westslope cutthroat trout,
170102030305	Lincoln Creek	FUR	None

***(FA= Functioning appropriately, FAR= Functioning at Risk, and FUR= Functioning at Unacceptable Risk). Includes percent fine sediment less than ¼ inch in spawning gravels.**

Stream and Aquatic Habitat Description

Beaver Creek

This stream forms near Reservoir Lake and is a third-order tributary to Keep Cool Creek, entering 0.7 miles upstream of the Keep Cool Creek confluence with the Blackfoot River (river mile 105.2). Beaver Creek has a total of 20.1 stream miles of which 14.3 miles are perennial. In the Beaver Creek drainage on NFS land, past and present road construction, timber harvest and livestock grazing have influenced habitat conditions by increasing the sediment delivered to the stream. The lower reaches of Beaver Creek are located on private and State lands that support agricultural uses. There are some reaches where livestock grazing has negatively influenced bank stability (Peters 1990) and some isolated bank damage occurs from livestock grazing on the Forest. Bank trampling from livestock is limited in the higher reaches due to the inherent resistance of the stream channel type and the vegetation adjacent to the streambank. Water diversions below the Forest boundary have sufficient capacity to dewater the stream during low flows. A diversion was recently upgraded to provide fish passage. Beaver Creek maintains a moderate gradient originating at Reservoir Lake.

Fish habitat is in relatively good condition with good quality cover for fish present throughout the reaches evaluated. The amount of cover present is somewhat low on some of the reaches with quality pools estimated to be present at around 15 to 20 percent. Past beaver activity has been very important in the formation of habitat on selected reaches downstream of Yukon Creek. Spawning gravels contain an average of 30.6 percent fines. Recreational fishing does occur on this stream within the Forest, but the intensity of fishing and the amount of harvest is unknown. Downstream of NFS lands, Beaver Creek is at least partially dewatered for irrigation and the stream gradient drops to near 1 percent in the vicinity of beaver activity (USDA 1995b).

Discharges measured from 2011 to 2014 near where FS-4043 crosses Beaver Creek show very low minimum flows, which varied from 0.1 to 1.3 cubic feet per second. Fine sediment levels in spawning gravels were found to average 33 percent in Beaver Creek with a range of 17 to 55 percent. In comparison, an unmanaged drainage of similar geology that had undergone high sediment delivery from fire averaged 27 percent with a range of 19 to 32 percent (Peters 1990).

Theodore Creek

The Theodore drainage shows past timber activity in the lower reaches. The lower reaches are located in the Stonewall allotment. This stream is a tributary to Beaver Creek that originates south of the Scapegoat Wilderness. The entire drainage lies within the Forest. Electro-fishing evaluations have shown that the lower reaches are dominated by genetically pure westslope cutthroat trout with a few brook trout also present. The upper reaches were found to support cutthroat trout exclusively. Fish distribution extends upstream into section 21 (T15N R9W). Abundance of salmonids over 6 inches in length was estimated at 160 per mile of stream while the maximum size obtained was around seven inches. It is likely that some of the westslope cutthroat trout from Theodore Creek recruit downstream to Beaver Creek. Historical sampling in 1987 documented three bull trout in Theodore Creek below the road culvert on FS-4106 near the mouth.

Habitat conditions on the reaches evaluated were very good in Theodore Creek. Much of the pool habitat in the stream is formed by large rubble cascades and woody debris. Spawning gravels were found to average 32.1 percent fines. Theodore Creek is too small to support much if any recreational fishing and no evidence of use by anglers was noted during survey evaluations (USDA Forest Service1995b). In August 2015, the culvert crossing on the Beaver Creek Road 4106 was removed and a bridge replaced the culvert to provide Aquatic Organism Passage and sized to pass a 100 year event.

Yukon Creek

This drainage is entirely within the Forest and is a tributary to Beaver Creek. The lower reaches show evidence of some timber harvest activity. The lowest reaches are within the Stonewall allotment. Yukon Creek is dominated by westslope cutthroat trout with some brook trout present in the lower reaches. Abundance was estimated at 220 fish per mile of stream over 6 inches in length. Fish distribution extends upstream into section 17 with the headwater reaches likely supporting only westslope cutthroat trout. This stream is important for providing recruitment of westslope cutthroat trout to Beaver Creek. Walk-through evaluations indicate that habitat is in good condition. Some sediment delivery to the stream is still occurring at the upper culvert site which was constructed several years ago, however seeding the site has helped to mitigate the delivery.

Spawning substrates contain 34.2 percent fine sediment on the average. Yukon Creek is large enough to support some recreational fishing, but no evidence of fishing use was observed. In 1992, two instream pool structures were constructed to increase fish habitat capability (USDA Forest Service 1995b). In August 2015, the existing undersized culvert crossing on the Beaver Creek Road 4106 was removed and a bottomless arch structure following Stream Simulation Methods to provide for a stable stream crossing that corrects road drainage problems, delivery of sediment, provides for Aquatic Organism Passage and restores the natural channel morphology.

Unnamed Tributary to Yukon Creek

This stream is a tributary to Yukon Creek and is located entirely on the Forest. This drainage shows evidence of past timber harvest activity. Only the lowest reach containing the confluence with Yukon Creek is located in the Stonewall allotment. This is a very small stream that was found to support only westslope cutthroat trout. Abundance of fish over 6 inches in length is 70 per mile of stream. The distribution of fish extends upstream in section 19 (T15N R9W). This stream probably provides for recruitment of westslope cutthroat trout to Yukon and Beaver Creeks. Walk-through evaluations indicate that habitat is in relatively good condition. Spawning gravels measure 35.1 percent fines (USDA Forest Service1995b).

Klondike Creek

This drainage shows evidence of past timber harvest activity. The lower reaches are located within the Stonewall allotment. This stream is a tributary to Beaver Creek and is entirely located on the Forest. The stream is dominated by westslope cutthroat trout with an occasional brook trout. Historical sampling in 1987 documented a single bull trout in Klondike Creek. Fish distribution likely extends upstream into section 20. The maximum size of fish obtained during sampling was just less than 7 inches in length. Abundance of fish over 6 inches in length was estimated at 120 per mile of stream. This stream also provides recruitment of cutthroat to Beaver Creek. Walk-through evaluations indicate that habitat conditions are relatively good with numerous small pools formed by large rubble and woody debris. Spawning gravels averaged 34 percent fines. Klondike Creek is too small to support recreational fishing, but in an attempt to increase habitat capability eight instream pool structures were constructed in 1992 (USDA Forest Service 1995b). In 2013, a bridge replaced the existing crossing on the Beaver Creek Road FS-4106 to provide Aquatic Organism Passage and pass a 100 year flow event.

Stonewall Creek

Stonewall Creek has a total stream length of 9.0 miles of which 3.8 miles are perennial. The lower portion on Forest lands below an irrigation diversion typically is dewatered following spring runoff. The Stonewall drainage shows evidence of past timber harvest in the middle reaches. A portion of the lower reaches is located in the Stonewall allotment. A small patented mine is located in the upper reaches. The lowest reaches are located on private ranch land and are seasonally dewatered before reaching Keep Cool Creek. In Stonewall Creek, fine sediment levels were found to average 31 percent

with a range of 21 to 50 percent as compared to an undisturbed stream of similar geology having an average of 20 percent with a range of 11 to 26 percent. Other habitat parameters have not been measured. Westslope cutthroat trout are common in the drainage (USDA Forest Service 1995b). On private land, Stonewall Creek shows effects from agricultural uses. Stonewall Creek flows through a large wetland on private land before its confluence with Keep Cool Creek. Plans have been developed for a screen on the irrigation diversion on Forest Lands to eliminate fish entrainment into the ditch; normal operation of the structure would allow some water and fish to return to Stonewall Creek downstream of the diversion.

Park Creek

Park Creek is a second-order tributary to Stonewall Creek. Park Creek has a total stream length of 6.1 miles, of which 2.9 miles are perennial. The headwaters and upper reaches of Park Creek are located on the Forest; the lower reaches are located on private land. The creek may be dewatered in the lower reaches. Spawning gravel quality has not been measured. Cutthroat trout have been determined to be genetically pure but are uncommon in Park Creek.

Liverpool Creek

The headwaters and upper reaches of Liverpool Creek are located on the Forest, and the lower reaches are located on private land. This drainage is located within the Keep Cool Liverpool allotment. The stream has been channelized by mining on the Forest. Eight drop-log structures have been built in the creek to provide much needed pool habitat. One downed tree was placed in the creek to provide for rearing habitat. A portion of the area mined has been reclaimed, but occasional suction dredging continues in the channel. Spawning gravels are common in the stream. Below the area mined spawning gravel quality measured 42.7 percent fines. Above the mined area spawning gravels measured 25.4 percent fines suggesting negative effects from mining activities on the quality of spawning habitat in Liverpool Creek. Westslope cutthroat trout are common both above and below the mined area (USDA Forest Service 1995b).

Sucker Creek

Sucker Creek has a total length of 3.0 miles, of which 2.5 miles are perennial. Only the headwaters of Sucker Creek are located on the Forest. The middle and lower reaches are located on private land. Timber harvest and road construction has taken place in the drainage. Sucker Creek drainage is located in the Keep Cool Liverpool allotment. Spawning gravel quality has not been measured. Cutthroat trout are rare in some reaches and in higher densities in other reaches and are presumed genetically pure in Sucker Creek (USDA Forest Service 1995b).

Keep Cool Creek

Keep Cool Creek is the largest spring creek in the Lincoln Valley. It forms north of Lincoln from both an alluvial groundwater aquifer and small basin-fed streams in its headwaters. It is joined at the mouth by Beaver Creek (mile 0.7) and Lincoln Spring Creek (mile 0.5) before entering the Blackfoot River at river mile 105.2. The combined flow of this stream system provides a significant percentage of the upper Blackfoot River flow during low flow periods. Excessive livestock access to riparian areas has degraded portions of Keep Cool Creek and its tributaries. Other mainstem fisheries-related impairments include channel alterations and irrigation practices.

Keep Cool Creek has a total length of 10.7 miles, of which 2.0 are perennial. The upper and middle reaches of Keep Cool Creek are located in the Helena Forest. The lower reaches are located in private land. The upper elevations of the drainage show evidence of timber sale activity and are heavily and roaded. The drainage is within the Keep Cool Liverpool allotment. Spawning gravels just above the Forest boundary measure 47.2 percent fines. Spawning gravels are common in this area; however, the

flows become very low early in the season. Westslope cutthroat trout are common in Keep Cool Creek (USDA Forest Service 1995b).

Radio telemetry has confirmed bull trout from the Blackfoot River use the lower portion of Keep Cool Creek (Pierce et al. 2004). Water temperature monitoring at two locations found maximum summer temperatures of 75.2 ^{o}F in Keep Cool at the Sucker Creek Road compared to a high of 62 ^{o}F downstream at the Beaver Creek Road. This cooling results from large inflows of groundwater between these two sites (Pierce et al. 2004).

Lincoln Gulch

Lincoln Gulch is a second-order tributary in the Lincoln Creek 6tjh Code HUC that enters the Blackfoot River at river mile 103.6. The upper 4.4 miles of Lincoln Gulch watershed is located on the Forest. Lincoln Gulch drains the eastern slopes of Black Mountain. The lower 2.6 miles flows through private agricultural land and a residential housing area. Lincoln Gulch shows impacts from mining, grazing and agricultural activities. In the headwater areas mining impacts and channelization are extensive. Fish surveys found brown trout and sculpin at mile 0.1. Surveys conducted higher in the watershed found no fish (Pierce and Podner 2006).No fish have been sampled on Forest lands in Lincoln Gulch.

Blackfoot River

Two short reaches of the Mainstem Blackfoot River lie within the project area boundaries in the Hogum Creek 6th Code HUC. In this area, Highway 200 is adjacent to or in the near vicinity of the river, affecting natural stream dynamics. Species know to use this reach of the Blackfoot River include mountain whitefish, sculpin, westslope cutthroat trout, brown trout, and bull trout (MFWP, MFISH Database). This reach of the river includes bull trout critical habitat for foraging, migrating and overwintering (FMO) as designated by the Fish and Wildlife Service in 2010. In this reach of the Blackfoot River, fine sediment levels in spawning gravels based on 107 samples averaged 31 percent.

Action Area Description

The ESA Action Area is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” (50 CFR§402.02). This is the area where the action and any interdependent and interrelated actions will result in direct or indirect effects to listed species or designated critical habitat.

The Stonewall Vegetation Project Action Area was selected based upon providing a sufficient reach to provide attenuation of project related effects where they would be no different than natural effects at the bottom of the downstream boundary. The action area is situated within a single 5th code HUC watershed (the Blackfoot-Keep Cool USGS watershed - #1701020303) and is defined as the portions of the four 6th code HUCs containing the project area, plus that portion of the downstream 6th code HUC (Blackfoot River – Little Moose Creek) made up of the mainstem Blackfoot River. The five sub-watersheds are listed below:

Beaver Creek 170102030303
Humbug Creek 170102030301
Keep Cool Creek 170102030304
Lincoln Creek 170102030305
Blackfoot River- Little Moose Creek 170102030310

The boundary for the Action Area was chosen because nearly all potential effects would likely be substantially or totally diminished at the mouth of Keep Cool Creek when it enters the Blackfoot River simply by the dilution that would occur at the mouth. The portion of the main river chosen to be

included in the action area is Functioning Appropriately based on sediment data representing the entire 17.7 river miles of the Blackfoot River to the bottom of the Action Area. The only exception to impacts entering the river through Keep Cool Creek would be approximately 80 acres of a low severity burn unit that could potentially drain directly towards the Blackfoot River; the lowest site anticipated it could enter would be 15 river miles above the downstream Action Area boundary. The Project Design Features, the RHCA buffer, and the paved highway located between the unit and the Blackfoot River reduces the probability effects reaching fish habitat in the Project and Action Area. Consequently, since delivery of sediment from the project area would only be delivered by surface waters during high flow events when streams are directly connected to the Blackfoot River, the amounts generated would not be measureable in much of the Action Area when the hydrograph is elevated.

3. Species Descriptions and Habitat Requirements

Bull trout, (*Salvelinus confluentus*) were listed as a threatened species within the Columbia River and Klamath River Basins effective on July 10, 1998 by the United States Fish and Wildlife Service (USFWS 1998a). Then in November, 1999 all populations of bull trout were listed threatened within the coterminous United States pursuant to the Endangered Species Act of 1973 (USFWS 1999). Section 7(a)(2) of the Endangered Species Act (ESA) of 1973 as amended requires all federal agencies to review actions authorized, funded, or carried out by them to ensure such actions do not jeopardize the continued existence of listed species.

The following discussion of bull trout habitat requirements in Montana is taken from the Montana Bull Trout Scientific Group's summary report (MBTSG 1998) including new information used in developing the revised draft recovery plan for bull trout (USFWS 2014). Bull trout express both resident and migratory life history strategies. Migratory bull trout spawn in tributaries where juvenile fish rear for 1 to 4 years before migrating to lakes or rivers, while resident forms complete their entire life cycle in the tributary streams in which they spawn and rear. The majority of migratory bull trout spawning in Montana occurs in a small percentage of the total stream habitat available. Migratory and resident forms may be found together.

Of native salmonids in the northwest of the United States, bull trout have the most specific habitat requirements (Rieman and McIntyre 1993), referred to as the "four C's": Cold, Clean, Complex, and Connected habitat. Compared to other salmonids, bull trout depend on colder water temperatures. Preferred spawning habitat consists of clean loose gravel with water temperatures of 4° to 10°C during spawning season (Goetz 1989, Howell et al. 2010). Such areas often are associated with groundwater upwelling and cold-water springs (Rieman et al 1997, Baxter et al. 1999). Water temperatures of 1.2° to 5.4°C have been documented for incubation, with optimum temperatures for best embryo survival reported from 2° to 4° C (Fraley and Shepard 1989, McPhail and Baxter 1996). Goetz (1989) advised optimum water temperatures for juvenile rearing of about 7° to 8° C. Temperatures above 15° C appear to limit juvenile bull trout distribution, which partially explains patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre 1993). Warmer temperatures are associated with lower bull trout densities and can increase the risk of invasion by other species that could displace, compete with, or prey on juvenile bull trout.

Spawning adults require low gradient areas (< 2%) of clean gravel/cobble substrate with water depths between 0.1 and 0.6 m and velocities from 0.1 to 0.6 m/s. Spawning takes place from late August to early November, principally in third and fourth order streams. Female bull trout deposit their eggs as deep as 25.0 cm below the streambed surface, and the incubation period is normally 100 to 145 days depending on water temperature (Pratt 1992). However, fry can remain in the substrate after hatching such that time from egg deposition to fry emergence can exceed 200 days. Spawning adults alter

streambed characteristics during redd construction to improve survival of embryos, but conditions in redds often degrade during the incubation period. Pratt (1992) indicated increases in fine sediment reduces egg survival and fry emergence. A significant inverse relationship exists between the percentage of fine sediment in the incubation environment and survival to emergence of bull trout fry. Successful incubation of bull trout embryos requires clean gravels with no more than 35-40% of sediments smaller than 6.35 mm in diameter, and high gravel permeability. Gravel substrates having less than 12% of fines less than 0.85 mm in diameter is necessary for optimum egg incubation and juvenile rearing to support individual and population growth (WFPB 1997). Other than deposition of fine sediments or organic materials, egg or fry mortality can also be caused by scouring during high flows, freezing during low flows, or superimposition of redds. Entombment appeared to be the largest mortality factor in incubation studies in the Flathead drainage (MBTSG 1998). Groundwater influence plays a large role in embryo development and survival by mitigating mortality factors.

Bull trout require complex forms of cover at all life stages. These include stable overhanging banks, abundant large woody debris, deep pools, boulders, and the cleanest stream substrates (USFS 2013). Adult and juvenile bull trout frequently inhabit side channels, stream margins and pools with suitable cover (Sexauer and James 1997). Newly emerged fry seek protection in clean substrates along stream edges and side channels, and juveniles are found mostly along the bottom of pools as well as riffles and runs associated with overhead cover such as large woody debris and riparian vegetation (McPhail and Baxter 1996). Unembedded cobble/rubble substrate is preferred for cover and feeding and also provides for higher invertebrate production. Jakober (1995) reported bull trout overwintering in deep beaver ponds or pools characterized by abundant large woody debris. Proximity of cover for the adult fish before and during spawning is an important habitat component. Bull trout migrating to spawning habitats have been documented staging two to four weeks at the mouths of spawning tributaries in deeper pools or near logs and debris that provide cover (Fraley and Shepard 1989, Knotek 2011). Habitat characteristics important for juvenile bull trout of migratory populations are also important for stream resident sub-adults and adults. However, stream resident adults are more strongly associated with deep pool habitats than are migratory juveniles.

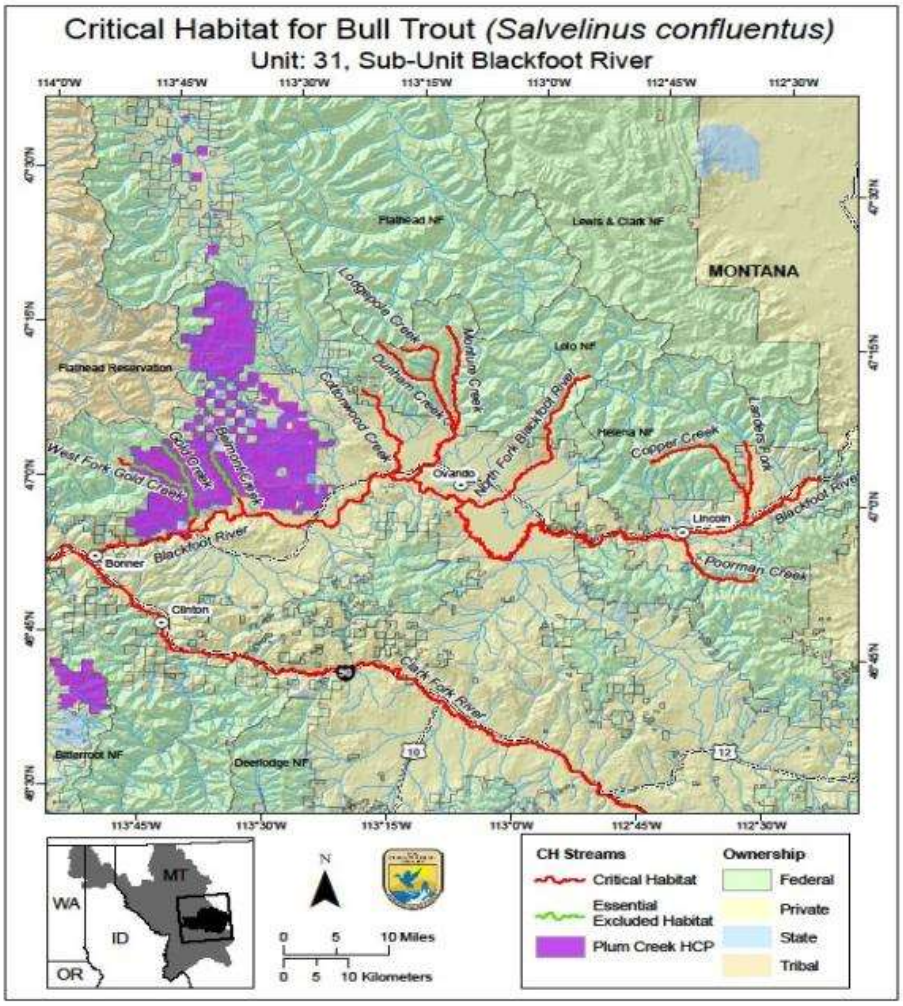
Conditions that result in highly variable streamflow, reduction in large woody debris, increased bedload movement, and other forms of channel instability tend to limit the distribution and abundance of bull trout (Rieman and McIntyre 1993). For example, altered stream flow during adult spawning migrations can disrupt normal bull trout spawning behavior, and channel instability may decrease egg and first year juvenile survival in the gravel bottoms of rearing habitat during winter through spring (Fraley and Shepard 1989, Pratt and Huston 1993).

Open migratory corridors, both within and among tributary streams, larger rivers, and lake systems are critical for the persistence of bull trout populations. Bull trout rely heavily on migratory corridors in meeting the life-cycle requirements of the species. Both migratory and stream-resident bull trout move in response to developmental and seasonal habitat requirements needed for spawning, rearing, foraging, and overwintering. Migratory individuals can move great distances (up to 250 km) among lakes, rivers, and tributary streams to fulfill their spawning, rearing, and adult habitat needs (MBTSG 1998). Stream-resident bull trout migrate within tributary stream networks for spawning purposes, as well as in response to changes in seasonal habitat requirements and conditions. These streams are typically smaller with higher gradients than those used by fluvial or adfluvial bull trout populations. In these headwater systems, deep pools and instream cover are essential to resident bull trout persistence (McPhail and Baxter 1996). The use of migratory corridors by bull trout is also important to facilitate gene flow among different local populations and reestablishing those local populations that may become extirpated by catastrophic events (Rieman and McIntyre 1993, MBTSG 1998).

Critical habitat was designated in 2010 that included federal lands on the Helena National Forest. While bull trout are known to be present in the Blackfoot River, none have been observed in

tributaries in the Stonewall Vegetation Project Area since 1987 despite sampling efforts (Table 2). No tributary in the project area was designated critical habitat; however, that portion of the project area that includes the Blackfoot River also is FMO critical habitat (Figure 1).

Figure 1. Designated bull trout critical habitat in the Blackfoot River sub-unit.



4. Forest Plan Standards

Direction for fisheries management under the Helena National Forest Plan emphasizes "maintenance or enhancement of cold-water habitat and water quality to meet the needs of fisheries" (Forest Plan pages II-1 and II-4). The general Forestwide standard (p. II-22) states: "Maintain quality water and habitat for fish by coordinating activities and by direct habitat improvement."

Under general watershed guidance (p. II-25), the Forest Plan states, "projects involving significant vegetation removal will, prior to including them on implementation schedules, require a watershed cumulative effects feasibility analysis to ensure that water yield or sediment will not increase beyond acceptable limits. Fisheries research and investigations focus on the pervasiveness of *excessive* sediment generated by human (anthropogenic) activities in mountain watersheds. The major threat to

fish is to their reproductive success and loss of rearing habitat. The ultimate objective for fisheries management is to promote effective management of sediment inputs to streams to preserve biological productivity. Any instream work must provide maximum protection of spawning habitat and not impede upstream fish migration."

For road management (pp. II-31 to II-32), the Plan states, "Unacceptable damage to soils, watershed, fish, wildlife, or historical/archaeological sites will be mitigated by road restrictions or other road management actions as necessary. Forest specialists representing soils and watershed shall provide input to the road maintenance planning process to verify standards, identify rehabilitation needs, and designate roads that should be permanently closed for resource protection."

In riparian areas, p. II-35 of the Forest Plan specifies, "wet meadows and wet areas are closed to off-road vehicle (ORV) use. Construction of roads will avoid stream course encroachment and channelization, including the avoidance of all riparian areas except to cross them." In addition, the Plan states, "the Forest will provide for vegetative cover adjacent to streams to serve as a filter strip for sediment and maintain optimum water temperatures, as well as provide large debris for long-term instream fish cover and pooling." For stream crossings, Plan standards call for stream crossing structure design that allows free water flow and fish passage.

The Helena Forest Plan (1986) was amended on August 30, 1995 by the Inland Native Fish Strategy (INFISH, USDA Forest Service 1995). This strategy provides additional protection for existing populations of native trout, outside the range of anadromous fish, on 22 national forests in the Pacific Northwest Region, the Northern Region and the Intermountain Region. Implementing this strategy was deemed necessary because these species were at risk due to habitat degradation, introduction of exotic species, loss of migratory forms and overfishing. INFISH established riparian management objectives (RMOs) and riparian habitat conservation areas (RHCA) for drainages west of the Divide in the interior Columbia River Basin. The project area is not within INFISH priority drainage; however, RHCA measures for all perennial streams, seasonally flowing or intermittent streams, and wetlands less than 1 acre, landslides and landslide prone areas would apply.

In April, 2014 the Helena and Lewis & Clark National Forests commenced preparing a combined assessment report as phase one (of three) of the planning framework for Forest Plan Revision. Both forests are currently combining as one unit and working on developing a revised Forest Plan expected to be complete by the end of 2018. In support of the 2014 Revised Draft Recovery Plan for Bull Trout (USFWS 2014), the Bull Trout Conservation Strategy on USFS land in western Montana (USDA FS 2013) was developed for the Montana portion of the geographic area covered by the USFWS's recovery plan. The USFS Bull Trout Conservation Strategy will, in general, be incorporated into the revised Forest Plan for the Helena-Lewis & Clark NF.

5. Environmental Baseline

The environmental baseline section of this BA addresses all of the 6th code hydrologic units in the Blackfoot Section 7 Watershed and Blackfoot Core Population area where all or part of a 6th code is located on lands administered by the Helena National Forest. The specifics regarding bull trout habitat indicators are addressed for each of the 6th code hydrologic units in those baselines (USDA 2000) and subsequent updates to the various 6th code HUCs in those baselines that are on file with the U. S. Fish and Wildlife Service as a function of biological assessments submitted since 2000.

Blackfoot Core Area

Bull Trout in the Blackfoot River are included as a core population in the Revised Draft Bull Trout Recovery Plan. There are several local populations identified within the Blackfoot Core Bull

Trout Population; including the North Fork of the Blackfoot River, Monture Creek, Landers Fork/Copper Creek, Copper, Cottonwood Creek, Belmont Creek, and Gold Creeks. The only local population of bull trout located on the Helena Forest is the Landers /Copper Local population; the remainder located downstream of this project area.

There are a number of other streams throughout on the Helena Forest that are known to support bull trout, but are not identified as local populations in the Draft Recovery Plan. Examples include, but are not limited to Beaver Creek, Arrastra Creek, Poorman Creek, South Fork Poorman Creek, Sauerkraut Creek, Dry Creek, and Nevada Creek. Of these watersheds, Poorman Creek, Arrastra Creek, Beaver Creek, and the upper reaches of Nevada Creek on the Forest were identified as "Special Emphasis Watersheds" as required by USDA and USDI 1999. Having these emphasis watersheds was an additional means of identifying a refugia network of streams to assist in the protection and recovery of bull trout and identified under additional agency commitments in the 1998 Biological Opinion (USDI 1998 page 24).

There is a substantial amount of additional information regarding many aspects of bull trout and bull trout habitat within the Blackfoot Core Area in the Watershed Baseline (USDA 2000a) and various updates to 6th code HUCs since 2000 that have been submitted to the FWS with various federal project proposals.

Sampling efforts within the project area subwatersheds suggests that bull trout could potentially remain in very low numbers in the Beaver Creek and the lower reaches of its tributaries, Theodore and Klondike creeks; the last observations in these waters occurred in 1987. The only other waters known to be used by bull trout are the lower portion of Keep Cool Creek and the Blackfoot River (Pierce et al. 2004). Additional fish distribution and probability of occurrence of bull trout information for streams and rivers in the Stonewall Project Area waters is presented in Table 3.

Table 3. Fish species distribution by stream in the Stonewall Project Area.

Stream	Salmonid Fish species present on forest based on sampling *	WCT genetic status	Comments
Lincoln Gulch	No fish on forest		Intermittent flows and extensive mining impacts limit fishery throughout much of the Lincoln Gulch drainage.
Unnamed tributary NW ¼ S 20 T14N R9W	No fish, but does have perennial flow		
Unnamed tributary SW ¼ S8 T14N R9W	No fish; intermittent flows		
Unnamed tributary SW ¼ S9 T14N R9W	eb		
Beaver Creek	Wct, eb, bt, LL	Genetically pure	Bull trout are known to have been present in Beaver, Klondike, and Theodore creeks.
Theodore Creek	Wct,eb, bt	Genetically pure	
Yukon Creek	Wct, eb	Genetically pure	
Klondike Cr	Wct and bt	Genetically pure	
Unnamed tributary to Yukon Creek	Wct	Assumed Pure	

Stream	Salmonid Fish species present on forest based on sampling *	WCT genetic status	Comments
Stonewall Creek	Wct	Genetically Pure	Probability of bull trout to be present is low on Forest and the lack of connectivity downstream of Forest lands further limits that potential.
Park Creek	Wct	Genetically Pure	Probability of bull trout to be present is low on Forest and the lack of connectivity downstream of Forest lands further limits that potential.
Liverpool Creek	Wct	Genetically Pure	Probability of bull trout to be present is low on Forest and the lack of connectivity downstream of Forest lands further limits that potential.
Sucker Creek	Wct	Assumed pure	Probability of bull trout to be present is low on Forest and the lack of connectivity downstream of Forest lands further limits that potential. Bull trout may be present off forest.
Keep Cool Creek	Wct and eb	Genetically pure	Bull trout are known to be present on nonfederal lands below the Forest.
Blackfoot River	Wct, LL, bt, mw	Possibly slightly hybridized	Bull trout are known to be present and is designated FMO critical habitat.

* - Fish Species: wct–westslope cutthroat trout, eb-brook trout, LL-brown trout, bt-bull trout, mw-mountain whitefish

Species Indicators:

The following descriptions correspond to the 4 species indicators listed on the FWS Matrix of Diagnostic of Diagnostics/Pathways and Indicators for bull trout (USFWS 1998). Each species indicator for the existing condition are described and rated at a single scale: the Bull Trout Population for the "Core Area" as defined in the Draft Bull Trout Recovery Plan (USDI 2005). The ratings below are **discussed in relation to how the entire Core Bull Trout Population is functioning**. FUR is Functioning at Unacceptable Risk, FAR is Functioning at Risk, and FA is Functioning Appropriately.

1) *Subpopulation Size:* Functioning at Risk*:* There are several local bull trout populations in the Blackfoot River (Copper/Landers, North Fork of the Blackfoot, Monture Creek, Belmont Creek, and Cottonwood Creek. Based on redd counts and limited electrofishing efforts, it is likely that there are somewhere between 400 to 500 adult bull trout between the 5 local populations. Additional adult bull trout are in numerous other streams throughout the core population area, and in some of the designated INFISH Priority Watersheds and Special Emphasis Watersheds, as well as in undesignated streams. The overall number of bull trout adults included in all of the streams

throughout the Blackfoot drainage is probably less than 800 when combined with the adults in the local populations. Recent redd surveys suggest that four of the five Local Populations have been declining somewhat while the Copper/Landers population has been improving. Bull trout may suffer from some competition with brown trout and predation in the main stem Blackfoot River although there is no field documentation of this hypothesis. Both species occupy some of the same habitat and eat some of the same foods and both species are highly piscivorous. Consequently, the hypothesis seems reasonable. With temperatures in the main stem Blackfoot rising based on information collected by the Montana Department of Fish Wildlife and Parks over the last 10 years (Pierce et al. 2008, pages 32 and 33); brown trout may be gaining some competitive edge over bull trout.

Interactions of bull trout with brook trout occur mostly in tributary streams rather than the main stem Blackfoot River. Brook trout are present in some of the local bull trout populations and many of the other streams in the Blackfoot River drainage so there is some additional threat of decreased bull trout production due to hybridization.

2) *Growth & Survival:* Functioning at Risk- the Copper Creek local population is doing well but in recent years the populations in Monture Creek and the North Fork of the Blackfoot have declined. Additionally, the main stem Blackfoot River has been showing indications of increasing water temperatures over the last 15 years. The elevation in water temperatures in the main River is not optimal for bull trout sub-adult growth while brown trout occupying the same waters have potential to fare better. The abundance of brown trout in some portions of the river poses risk to bull trout due to predation by brown trout. The 2003 fire in the Copper/Landers Local Population has resulted in some temperature increases that appear to be beneficial for sub- adult bull trout growth and survival. The temperature increases in this local population do not currently appear large enough to allow for upstream movements into the drainage by brown trout.

3) *Life History Diversity & Isolation:* Functioning at Risk. There is good connectivity within the Blackfoot River which allows for several age classes of the local populations to mingle as well as adults and sub-adult bull trout from other miscellaneous streams in the Blackfoot drainage. However, the FA matrix component related to a large number of individuals creating high potential for straying does not appear to be met with information currently available. Additionally, findings from MDFWP over the last 20 years suggest that increased maximum summer water temperature in main stem Blackfoot is putting the migratory corridor at some undetermined level of risk.

4) *Persistence and genetic Integrity:* Functioning at Risk. There is connectivity between local populations of bull trout. However, numbers appear to be declining in the Monture Creek and North Fork Local populations. Additionally, there is likely competition with brown trout and predation by brown trout on bull trout in the main stem Blackfoot River. The competitive edge may be moving in favor of brown trout as temperatures in the main stem Blackfoot have been rising based on information collected by the Montana Department of fish Wildlife and Parks over the last 20 years. Some brook trout are present in some of the local populations so there is some additional threat of decreased bull trout production due to hybridization.

6. Status of INFISH Riparian Management Objectives (RMOs)

Specific information regarding available information on the RMOs can be obtained for each of the 6th code hydrologic units from the baseline conditions discussed in USDA 2000 along with updates to those 6th code baselines since 2000. However, in general the Riparian management Objectives (RMOs) do vary somewhat between the various streams and even reaches of individual streams within any given 6th code hydrologic unit.

7. Direct, Indirect, and Cumulative Effects

Introduction and Background Information

Existing fisheries habitat conditions throughout areas west of the continental divide within the analysis area have been described in the following document: The Watershed Baseline Condition for the Blackfoot River Section 7 Watershed (USDA 2000). The baseline and updates to the baseline are assumed to depict the effects of past and ongoing activities. The habitat element related to fisheries assumed to be most at risk to be affected in the Stonewall Vegetation Project decision is the sediment habitat indicator. It is commonly accepted among fishery professionals that elevated sediment levels in stream substrates can have negative effects to salmonid fish populations. Consequently stream sediment is used as an overall means to estimate effects to fisheries for this project. The rating for sediment in each 6th code HUC is depicted in Table 2. In general many of the streams have been substantially impacted by a variety of human related activities and habitats have been degraded below that considered optimum for salmonids. The mean percent fines in spawning gravels of several fish supporting streams in the project area show elevated levels when compared with reference standards even when taking into account the natural variation in the gravels (Table 4).

Trout habitat in the project area is essentially the product of interactions among underlying geologies, soils, topography, vegetation, climate and hydrology unique to the area's watersheds (Meehan 1991, pg. 5; Swanston 1991, pg. 139). These drainage characteristics and processes remain fairly constant setting up conditions for optimum production of aquatic life forms (Meehan 1991, pg. 5). When natural disturbance reshapes stream channels, the actual effects on aquatic organisms are often short-lived. In their natural context, accessory processes like fire, flood flows, insect infestations, disease, wind throw, and animal activities (e.g. beaver) operate on the stream system to produce improved habitat quality and productivity in the long term (Swanston 1991, pgs. 139-142).

Human land-use activities can disrupt the delicate balance of these interactions producing persistent changes in habitat that can reduce natural fish production and population viability (Meehan 1991, pgs. 1-6; Waters 1995, pgs. 1, 17). The Stonewall Vegetation Project area traditionally has been managed for non-fishery resources. These include timber harvest, mining, livestock grazing, historically mining related residences, forest transportation and recreation. Other human activities that affected fish habitat included beaver removal, irrigation withdrawals, development activities on private property, and utility corridors.

Cumulatively, these activities impair natural stream functions to varying degrees in the analysis area by accelerating erosion and sedimentation, altering surface flows, reducing vegetation cover, and destabilizing or degrading stream channels. In general, any ground disturbing activity has potential to increase erosion and exacerbate excess sediment delivery within a watershed, in turn lowering the natural fish production capabilities (carrying capacity) of streams (Hicks et al. 1991). Hence, *excessive* sediment delivery that persists beyond natural background levels becomes the common denominator of various land-use activities affecting fish habitat (Meehan 1991).

Forest roads have been tagged as producing the majority of excess sediment amongst forest activities and management practices (Anderson 1971, Anderson et al. 1976, Cederholm et al. 1981, Furniss et al. 1991, Waters 1995) followed by past mining disturbance and streambank destabilization/degradation in active grazing allotments. The degree to which road construction/maintenance has on altering sediment production in a watershed varies substantially and is not possible to quantify accurately. In general, the magnitude and risk for sediment

delivery from roads, including other land use activities, is a function of the amount of surface disturbance (acres disturbed) and proximity to streams within a given sub-watershed.

Table 4. Summary of mean % fines (<1/4 inch dia.) in spawning habitat of select streams as an indicator of cumulative effects from past and ongoing effects in each 6th field HUC.

6th Field HUC sub-watershed (name)	Stream(s) sampled for sediment analysis	Mean % fines in spawning habitat *	USEPA reference Standard (%) **	Roadless Area reference (%)
170102030303 (Beaver Creek)	Beaver Creek	30.6	32.5	31.9
	Yukon Cr	34.2		
	Trib. to Yukon Cr	35.1		
	Theodore Cr	32.2		
	Klondike Cr	33.8		
170102030301 (Humbug Creek)	Blackfoot River	30.5	32.5	31.9
170102030304 (Keep Cool Creek - Stonewall/Park)	Stonewall Cr	31.6	32.5	31.9
	Park Cr	45.4		
170102030305 (Lincoln Gulch)	-	Not sampled as no fishery present in most of the drainage	32.5	31.9
170102030304 (Keep Cool Creek - Sucker/Liverpool)	*Liverpool SW¼ S 31*	*42.7*	*32.5*	*31.9*
	Liverpool NW¼ S 31	25.4		
	Sucker Cr	Not sampled		
	Keep Cool Cr	47.2		

*Averages for individual years are detailed in Fish Information for Stone Dry Watershed Analysis (Burns 2006).
** Reference standard developed from Helena National Forest Data in the Lake Helena Watershed

The road-fisheries relationship extends beyond the risk of chronic excess sedimentation. A second risk element is road proximity to streams. When roads are constructed adjacent to a stream they constrain the channel resulting in a stream limited in its ability to access its historic floodplain and often result in the removal of riparian vegetation to accommodate the road right-of-way. Such roads change the physical attributes of trout habitat by reducing pools, meanders, undercut banks, streamside vegetation/shading, large woody debris recruitment, and result in higher energy gradients all rendering the stream less productive for fisheries.

Stream crossings represent a third road risk factor to stream and bull trout habitat and populations. Roads that cross streams most frequently rely on culverts that often disrupt upstream fish migration. This limits access to habitat types needed to fulfill their life stage requirements for spawning, rearing, feeding, over-wintering, security and escapement. Additionally, stream crossings, particularly culverts, can result in chronic sedimentation impacts during typical water years and catastrophic effects when floods trigger crossing failure (USDA –Forest Service 1998, pg. 2). Ford crossings, especially unimproved fords, directly alter the bed and banks of fish

habitat and act as chronic sources of sediment delivery. Ford crossings located in or near spawning and nursery areas are particularly risky to sensitive incubating salmonid embryos and fry due to direct vehicular disturbance to the streambed and banks, and traffic generally causes the streambanks to widen as the banks break down and wash away (Clarkin et al 2006. pg. 5-1).

As shown in Table 2 sediment levels are judged to be functioning at unacceptable risk for all the 6th code HUCs in the project area except for the HUC containing the reaches of the mainstem Blackfoot River, which was judged to be functioning appropriately. Comparing fine sediment levels in spawning habitat of streams sampled in the project area with reference standards (Table 4) after taking into account the natural measure of variation for fisheries management goals , assumed to be approximately ±9.9%, the cumulative effects from past and ongoing effects can be identified.

For the Stonewall Vegetation Project, the risk of sediment delivery to streams varies by 6th code hydrologic unit, by road, and by specific locations on roads. The variation in magnitude of risk for sediment delivery and subsequent effect to fish habitat is projected to be a function of:

- the magnitude of ground disturbance associated with activities,
- the degree to which soil from the disturbed sites may be routed to ephemeral channels, perennial streams, or road drainage ditches,
- the magnitude and the timing of log hauling,
- the location of the road in relation to streams,
- the current condition of the road and its drainage features,
- level of road maintenance/improvements that occur in various subwatersheds prior to hauling,
- the level of continued road maintenance once the project ends,
- and cumulative effects on non-federal ownerships.

The elements of the proposed action that have potential to change sediment delivery to streams in the project and effected area include vegetation management (timber harvest and prescribed fire) and road related work including BMP implementation, temporary roads, and culvert related work. Implementing project design features effectively is of great importance in minimizing the risk of adversely affecting bull trout. It is important to note that there is high probability that project design features will be implemented successfully, but there is some minor level of risk that project design features will not be fully implemented. Based on the results from previous audits, we expect that there is a 90-95% chance that BMPS and maintenance activities will be fully implemented and/ successful in controlling sediment delivery to streams for the Stonewall Vegetation Project.

Assumptions used in this Biological Analysis

- The primary effect to salmonid fish and bull trout habitat is associated with sediment delivery from high risk roads (within RHCAs) and the presence of stream-route intersections.
- Sediment delivery and deposition in stream channels are an important source of mortality to trout and can affect both individual fish and at the population level. Other variables (dissolved oxygen, food, cover, and angler harvest) are outside the scope of this analysis.
- Critical channel reaches (core sampling reaches) within a watershed can be used to estimate sediment effects on the entire stream.
- Road maintenance (blading, culvert-cleaning) and improvements (surfacing, culvert replacement) may result in temporary increases in sediment delivery to streams, but would result in a long-term (3-5+ year) reduction in sediment delivery from project area roads.
- Sediment delivery can be reduced to varying degrees through improved road drainage improvements for road segments identified as high risk (within RHCAs) for negatively affecting bull trout.

- Several major road crossing structures that included sediment delivery points have been recently updated in the project area, improving fish passage and reducing sediment loading (see Appendix).

Direct and Indirect Effects

As mentioned earlier, vegetative management elements have the potential to provide adverse effects to bull trout and bull trout habitat. The selected alternative's project design features for INFISH and SMZ buffers, which were substantially modified for the Record of Decision (ROD) from those in the FEIS, are more restrictive for timber harvest than INFISH standards and guidelines. In addition, timber harvest implementation units have been modified and would be marked so they are outside of RHCAs, which provides little to no chance of sediment delivery to streams, no change in forest canopy or large woody debris recruitment. The project design features for prescribed fire would comply with INFISH's FM-4 standard, if the fire prescription was maintained. Consequently, only insignificant or discountable effects to bull trout would be expected from vegetative management treatments.

Following submission of the original Biological Assessment submitted to the Fish & Wildlife Service dated April 20, 2015, an analysis of road information included in the ROD provided a substantial modification that reduced the magnitude of haul roads, the miles of roads within the INFISH buffers, and the number of stream crossings and sediment delivery points (Table 5.) The Lincoln Creek 6th Code HUC has the greatest miles of haul roads, haul roads within the INFISH Buffers, as well as stream crossings and sediment delivery points, followed by the Beaver Creek 6th Code HUC. The Lincoln Creek 6th Code HUC has the least amount of perennial and fish bearing streams. Log hauling and road use has the greatest potential to influence sedimentation during implementation of the Stonewall Vegetation Project. Furthermore, it is possible that road maintenance and log hauling will occur at times while there is continuous flow and connection with tributary streams in the project areas subwatersheds with the reaches of Keep Cool Creek and the Blackfoot River that are known occupied bull trout habitat.

Table 5. Haul road information in each 6th Code HUC subwatershed of the Stonewall Vegetation Project for the Selected Alternative.

6th-HUC	6th-HUC watershed name	Haul roads (miles)	Roads within INFISH buffer of stream (miles)		Number of stream crossings	Number of sediment delivery points
			150 ft	300 ft		
170102030303	Beaver Creek	9.3	0.6	1.1	5	6
170102030308	Humbug Creek	0.3	0.3	0.3	0	0
170102030304	Keep Cool Creek	3.1	0.2	0.4	0	2
170102030305	Lincoln Creek	19.7	1.2	2.8	9	9
TOTAL	-	32.4	2.3	4.6	14	17

The selected alternative includes 0.9 miles of temporary roads that will be built for project use (Table 6) as a haul route and then obliterated. None of those temporary roads would be within INFISH Buffers and none would be within 300 feet of any Category 1-4 RHCA. Consequently, these road segments built in upland locations without surface hydrologic connection to any stream channel are not predicted to convey sediment to stream channels.

Table 6. Road obliteration and maintenance for project area haul roads for the Selected Alternative.

	Roads Built for Project Use then Obliterated (miles)	Road Maintenance (miles)	Total (miles)
Project Decision	0.9	31.5	32.4

BMP maintenance would occur on approximately 31.5 miles of haul road (Table 6). Project-related road improvements include surface grading, re-establishment of drainage features (grade dips and ditch-relief culverts), and application of gravel at stream crossings and other sediment delivery points. Sediment levels may increase during the project as a result of ground disturbance during maintenance and culvert cleaning work, but would be offset by long-term benefits those improvements provided.

WEPP modeling estimated the average annual sediment delivery from roads to streams for both NEPA Alternatives 2&3 could potentially increase the amount by 20 tons annually over existing conditions, but implementation of improvements and BMPs would result in an overall reduction in sediment delivery of 2 tons when compared to existing conditions (Table 7). Reductions were identified in Keep Cool and Beaver Creek 6th code HUCs (Table 7). The selected alternative will utilize only 32.4 miles for haul roads compared to 48.2 and 44.2 miles for alternatives 2 and 3, respectively. We anticipate that the selected alternative will deliver somewhere between 0-2 tons less sediment from roads than existing conditions since fewer roads will be used for haul roads, reducing the magnitude of the sediment delivery increase for the action, but fewer BMPs and road improvements will be implemented, reducing those beneficial effects that would allow changes in baseline conditions. The reduction in beneficial effects diminishes improvements to the current baseline determinations in the Lincoln, Keep Cool and Beaver Creek 6th code HUCs, all of which are Functioning at Unacceptable Risk, and maintains the adverse effects to bull trout in those HUCs.

While part of the Humbug Creek 6th code HUC is included in the project area, no forest roads used in the proposed project are located within the RHCA of the HUC and the regeneration harvest implementation unit has been modified to exclude that portion of the unit that was in the HUC. Although Highway 200 is within the RHCA, the potential sediment delivery expected to the Blackfoot River from such use is expected to be an insignificant effect due to the design, location and condition of the paved highway in the Humbug Creek 6th code HUC that has a sediment habitat indicator baseline determination of Functioning Appropriately.

Table 7. Estimated average annual sediment delivery from roads to stream channels by sub-drainage for existing conditions and alternatives 2&3.

6th-HUC	Watershed	Existing Sediment Delivered For Total Road Length (Tons)	Alternatives 2&3 Sediment Delivered For Total Road Length (Tons)	Project Road Sediment after BMPs Upgrades
170102030305	Lincoln Creek	1	2	1
170102030304	Keep Cool Creek	6	18	5
170102030303	Beaver Creek	4	11	3
	Total	**11**	**31**	**9**

Trout use redds, which are nests dug by fish in streambed gravels, in flowing waters for their reproductive strategy. When excessive sediment accrues to spawning and rearing sites, trout embryo and fry success decline below natural rates. Additionally, other trout life history elements such as juvenile survival, growth, and adult survival also can be at risk if excess sediment reduces cobble spaces in riffle areas and pool volumes. Everest et al. (1987, p. 133) concluded that salmonid

species can cope with the natural variability in sediments, but their populations can be reduced substantially by persistent sedimentation that exceeds the natural levels under which they evolved. Average fine sediments in trout spawning habitat within the project areas streams may show short term increases in fines at depth in some stream reaches due to road improvement and BMP implementation. No culverts would be replaced or upgraded as part of this project: short term effects from Aquatic Organism Passage structures installed on Theodore, Klondike and Yukon creeks within the last three years. In the long term stream channels could remain static but likely would show gradual decreases in the levels of fines as project area roads would deliver roughly up to 2 tons less sediment per year and as other human caused disturbances are mitigated. This may have no change in existing conditions mean percent fines in spawning habitat in streams such as Park, Liverpool and Keep Cool creeks that show sediment levels above the reference standards and the typical natural measure of variation (Table 4) and the HUCs with sediment habitat indicator ratings at functioning at Unacceptable Risk (Table 2).

Although we expect some reduction in sediment delivery to streams from current levels for at least the mid-term (1-3 years) for some roads in some of the 6th code HUCs, that conclusion is difficult to maintain with certainty as some sediment delivery can occur solely as a function of implementing road maintenance activities as discussed in the Programmatic Biological Assessment for Road Maintenance Activities (USDA 1999). Thus, the improvement work itself can result in some short term, temporary sediment increases, but generally results in reductions in sediment delivery over the course of a season due to improved drainage. Also, even with improvements there is potential for some sediment delivery to occur, as a function of increased use on the roads by other uses. However, potential increases in sediment delivery from increased use is projected to be very small, similar to current levels, or less than what is currently occurring due to implementation of best management practices and improvements.

Ongoing negative effects to bull trout resulting from existing roads and current use of roads have been occurring for decades. The Stonewall Vegetation Project and use of haul roads will result in continued potential risk for sediment delivery to some streams and as a result continue to have some negative effects on fish and fish habitat on specific streams within some 6th code HUCs. Project design features are intended to provide longer-term reductions in sediment delivery to streams at the cost of short-term increases during implementation. In a worst case scenario, if all BMP upgrades were to fail, the Beaver Creek and Keep Cool Creek 6th Code HUCs would be at the greatest risk; those streams in the project area with unnaturally high fines in spawning habitat would not be adversely affected since they have no haul roads within their drainages.

Based on the number of acres that would be treated in the project area watersheds, it is highly unlikely there would be a cumulative increase in water yield that would be detectable. The estimated water yield increase for project watersheds under the selected alternative is 1.7%, which is lower than either Alternative 2 (2.13%) or Alternative 3 (1.75%), and is substantially below the DEQ-recommended threshold of 10 percent. Streams emanating from project watersheds lose flow as they move from the steeper, mountainous areas and enter alluvial valley floor sediments. Considering the dry (losing stream) nature of the channels in the Stonewall Project area watersheds, the potential increase in water yield would be unlikely to cause any negative effects such as accelerated bank erosion and would likely result in some sediment storage before reaching perennial downstream waters.

A substantial number of the habitat indicators for all 6th code HUCs in the project area, except for the mainstem of the Blackfoot River in the Humbug Creek HUC #170102030301, describe a baseline that is Functioning at Unacceptable Risk (see effects matrices tables in the Appendix). Implementation of the proposed action including the BMPs could result in a short term minor degrade in certain habitat indicators with a long term beneficial effect. However, the resultant

beneficial increase is not judged sufficient to provide a minor restorative effect by the action. Consequently we anticipate the effects of the action will maintain the existing condition level in all 6th code HUCs in the project area? We also expect no changes in the characteristics of riparian areas as a result of the project design features which do not include any harvest activities and protective measures for prescribed fire prescriptions in RHCAs. The implementation of the Stonewall Vegetation Project will also not change or increase the miles of motorized roads in the RHCAs. No temporary roads will be built in riparian areas.

Summary of Effects

The Stonewall Vegetation Project includes portions of encompasses four 6th-field HUCs; Lincoln Creek, Humbug Creek, Beaver Creek and Keep Cool Creek. The action area extends downstream through an additional 6th-field HUC, the Blackfoot River-Little Moose Creek HUC # 170102030310. Treatment consists of a mixture of regeneration harvest, commercial thinning, precommercial thinning, and low and mixed severity prescribed burns. An important consideration in any vegetation project is the matter of access to various proposed treatment units. Resource managers have long recognized that the principle source of chronic fine sedimentation from forest management activities is due to the existing transportation system and new access roads associated with vegetation management.

The fish habitat variable most affected by this proposal, sediment by depth in trout reproductive habitat could be generated from two primary sources: roads and vegetation treatment units. Under the selected alternative, vegetative treatments would have an extremely low probability of any sediment delivery since project design features are more stringent than INFISH standards. Road improvements and BMPs effectively implemented will reduce sediment delivery. In addition, the probability that sediment delivery would actually occur is relatively low. In regard to prescribed fires, relatively rapid recovery of groundcover in burned areas should substantially reduce the potential for soil erosion from treatment units within 2-3 years.

Therefore, this vegetation treatment proposal may result in short-term impacts to fisheries resources from road maintenance treatments. The project incorporates special design elements that reduce sedimentation risks by incorporating additional restrictions in RHCA buffers and the use of low-severity burns. Moreover, slight long-term sediment reductions (improvement), or at worst, maintenance of existing conditions in trout reproductive habitat is predicted due to road BMP measures. Effectiveness of BMPs is critical; resources should be available to monitor and mitigate any failure of BMPs for the duration of the project.

Cumulative Effects

Cumulative effects, as defined by Section 7 of the Endangered Species Act, are the effects of future non-federal actions that are reasonably certain to occur in the project area. The cumulative effects analysis area for fisheries in this Biological Assessment includes non-federal lands within the project area and portions of the Blackfoot Bull Trout Core Area downstream..

The main effect this vegetation project influences is the decrease in water quality and fish habitat due to sediment inputs from roads. The Stonewall Project would be expected to maintain or reduce the cumulative watershed effects of road sediment delivery through maintenance of forest roads as a direct result of this project.

Federal and private roads and culverts constructed at road/stream crossings in the planning area have affected streams and riparian areas. There are several sediment delivery points on existing

roads as described previously, and culverts represent a permanent grade control in the stream channels where they reside. These existing roads also have several road/stream crossings. Past management activities in the planning area that affect baseline water quality, riparian, and aquatic habitat to varying degrees include road construction and maintenance, wildfire and prescribed fire, timber harvest, grazing, mining, and dispersed recreation. Forest and county road systems can adversely affect streams by increasing sediment loads, changing runoff rates, and altering stream channel morphology. Incorrectly installed or undersized culverts may be fish passage barriers that prevent upstream fish passage, which limits the amount of available, suitable fish habitat. Undersized culverts can affect the stream's ability to convey water and sediment, and represent an increased risk of failure and subsequent erosion and deposition of sediment into stream channels. Culverts directly interact with channels and can affect channel morphology and channel migration patterns, and local hydraulics that may influence the stream channel.

Continued grazing in riparian areas and cattle trailing along streams within grazing allotments will likely continue to contribute elevated sediment levels to streams in the watershed; although, adaptive management provisions in allotment management plans should be implemented where necessary to reduce livestock impacts. In the absence of other reductions to sediment delivery in the watershed, streams in several of the watersheds where treatment is planned would continue to receive sediment from anthropogenic sources on and off Forest.

Wildfires that burn within the project or cumulative effects area could also have substantial effects that could deliver sediment to streams and bull trout habitat as well as increase water yield and seasonal timing of flows. In addition, firefighting activities could also have negative impacts, depending on the amount and type of rehabilitation on and off Forest..

Foreseeable timber harvest and prescribed fire activities that could affect the cumulative effects area proposed through BSLRP on National Forest System land are not likely to substantially affect water quality, RHCAs or fisheries due to use of INFISH buffers and strict adherence to forestry BMPs. Timber-sale road improvements included in the project design would be expected to reduce sediment delivery from project-area roads through implementation of road BMPs. Other activities that would serve to reduce sediment delivery to streams in project watersheds are being implemented within the cumulative effects analysis area. Such activities include a watershed and floodplain improvement project on Stonewall Creek , a culvert upgrade on Sucker Creek, erosion control and stabilization of slopes in burned areas following the Sucker Creek Fire, and effectively implemented allotment management plan (AMP) revisions, among others. Additionally, culverts in the project area known to be undersized have been replaced with AOPs in recent years and have resulted in ongoing effects that eliminated sediment delivery points.

Non-federal activities could result in effects on bull trout including additional sediment delivery to streams, reduction of large wood in streams floodplains, dewatering of stream, or conversely, improvement in instream flows as well as other effects on channels and floodplains. The types of future activities that can result in cumulative effects include, but are not limited to, new proposals for residential subdivision, timber harvest and log hauling, use of private roads to gain access to Helena Forest lands, operation and maintenance of irrigation dams and diversions, improvements in efficiencies of irrigation systems, livestock grazing, gravel or other small-scale mining, highway construction, construction or maintenance of utility corridors, crop production, pesticide application, and road and highway maintenance.

The cumulative effects on bull trout habitat quality from all the activities that may occur in the analysis area described above are impossible to predict quantitatively as there is no coordinated long range planning of activities between the various non-federal landowners. It is anticipated that a variety of new activities may occur in the future on non-federal lands with effects on bull

trout ranging from beneficial to adverse depending on the type, magnitude, and timing of the activity.

8. Potential Effects to Species Indicators and Habitat Indicators for the Blackfoot Bull Trout Core Population

Species Indicators :

1) *Subpopulation Size:* MAINTAIN. Some risk for small decreases in bull trout survival in some years in project areas drainages from sediment increases from BMPs, road improvements, and log hauling on roads. Relative risk depends on a variety of factors as detailed in the narrative of Direct and Indirect Effects section of the BA. It is unlikely that Blackfoot Core population will be affected to the degree that changes in the population size will be measurable.

2) *Growth & Survival:* MAINTAIN: It is unlike there would be loss of individual bull trout or any changes to habitat that could affect survival of the Blackfoot Core Population.

3) *Life History Diversity & Isolation:* MAINTAIN. The selected action does not include any actions that will cause instream barriers to migration that may decrease connectivity and access to habitat.

4) *Persistence and genetic Integrity:* MAINTAIN. The magnitude of effects projected is small and bull trout are not likely to occur in many of the streams in the project area, except in those identified in this BA as occupied.

Habitat Indicators: Effects calls on Habitat Indicators for each 6th code hydrologic unit of the Blackfoot River within the project area are included in the Appendix.

9. Matrix Checklists

The matrix checklists and summary tables for baseline conditions and effects are included with the habitat indicators for each 6th code hydrologic unit in the Appendix.

10. Compliance with INFISH

Overall the project meets INFISH standards with the implementation of the project with BMPs and project design features as described in this BA. The increased road maintenance and BMPs needs determined by a Forest wide roads analysis was completed (USDA 2004) and provided a means to assess the risk various road segments presented to fisheries. The roads analysis (USDA 2004) information, along with the monitoring and inventory of other road segments as part of this project, will continue to move the Helena Forest in the direction of meeting the intent of INFISH (1995) road standards RF-2 and RF-3.

11. Bull trout Critical Habitat

General

In the 2010 Final Rule on Bull Trout Critical Habitat, the U.S. Fish and Wildlife Service classified the Blackfoot River, and its tributaries Poorman Creek and Copper Creek as bull trout critical

habitat (Figure 1).

Critical habitat is defined in the ESA as: *(i) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species, and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.*

"Conservation" is defined by the ESA as "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary" (16 U.S.C. 35 §§ 1531 et seq., 1988. Critical habitat receives protection under Section 1536(a) of the ESA through the requirement that federal agencies shall, in consultation with the USFWS, ensure that any action authorized, funded, or carried out is not likely to result in the destruction or adverse modification of critical habitat (16 U.S.C. 35 § 1536, 1988). To be included in a critical habitat designation, the habitat must be "essential to the conservation of the species." Critical habitat designations identify, to the extent known and using the best scientific data available, habitat areas that provide at least one of the physical or biological features essential to the conservation of the species. For bull trout critical habitat, the lateral extent of critical habitat for each stream reach is the width of the stream channel as defined by its bank full elevation (Rosgen 1996). Critical habitat extends from the bank full elevation on one side of the stream channel to the bank full elevation on the opposite side. Adjacent floodplains are not included as critical habitat.

The Stonewall Vegetation Project has low potential to affect bull trout critical habitat to the extent it would degrade the baseline of the Blackfoot River due to the distance of haul roads and sediment delivery points in the project area from designated critical habitat and the use of BMPs and RHCA protection measures to reduce the risk of negative effects. However, four 6th-field HUCs (Lincoln Creek, Humbug Creek, Beaver Creek and Keep Cool Creek) have habitat indicators Functioning at Unacceptable Risk due to historic effects that have degraded existing conditions and all the 6th code HUCs are upstream of the critical habitat. If all BMPs are 100% effective, road sediment delivery will decrease from existing conditions. However, if BMPs are not totally effective, the action could result in maintaining existing or increasing sediment delivery into project area streams. Although most sediment would be stored in downstream reaches of the stream channel, a portion could eventually reach critical habitat when connectivity occurs. Under the Direct, Indirect and Cumulative Effects Analysis and the Species and Habitat Indicators Effects portion of this BA it is reasonable to conclude that the continuation of existing sediment delivery in all streams throughout the project area has varying potential to affect bull trout critical habitat in the project and action area. This conclusion is based on the reduction of existing amounts of sediment delivery associated with the project action with the implementation of BMPs compared to existing conditions. The proposed project could increase sediment delivery over current levels in the short term, some of which could reach bull trout critical habitat. Over the long term, reduced levels of sediment delivery to project area streams would be anticipated, but would depend on continued road and BMP maintenance. Although there is low potential for cumulative effects to critical habitat downstream of the project, there is that potential so risk for effects to certain *Primary Constituent Elements* of bull trout critical habitat are assessed in this Biological Assessment. The risk for effects to bull trout critical habitat is analyzed below with the determination detailed in Part C.

Rationale, Baseline, and Determination for Critical Habitat Downstream of the Project Area

A. Rationale Action agencies authorizing activities within lands occupied by bull trout are mandated by the Endangered Species Act of 1973, as amended, to consider effects to bull trout that would likely occur as a result of implementing management actions. Agency biologists use the Matrix of Pathway Indicators (matrix) for bull trout to evaluate and document baseline conditions and to determine the likelihood of ”take” of bull trout. Matrix analysis incorporates four (4) biological indicators and nineteen (19) physical habitat indicators. The majority of the matrix analysis consists of specific consideration of the 19 habitat indicators. Analysis of the matrix habitat indicators provides a thorough analysis of the existing baseline condition and potential impacts to bull trout habitat.

While assessing potential effects to bull trout as a species, agency fisheries biologists have concurrently provided an analysis of effects to the Primary Constituent Elements (PCEs) for bull trout critical habitat and related habitat indicators (Table 8). The following table includes the Primary Constituent Elements (PCEs) for bull trout critical habitat and related habitat indicators.

Table 8. Primary Constituent Elements for bull trout critical habitat and associated matrix habitat indicators.

PCE #	PCE description	Associated matrix indicators
1	Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.	-Floodplain connectivity -Change in peak/base flows -Increase in drainage network -Riparian conservation areas -Chemical contamination/nutrients
2	Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.	-Life history and isolation -Persistence and genetic integrity -Temperature; -chemical contamination -Physical barriers; -refugia -Wetted Width/Max Depth Ratio -Change in peak/base flow
3	An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, forage fish.	-Growth and survival -Life history diversity and isolation -Riparian conservation areas -Floodplain connectivity (importance of aquatic habitat condition-indirectly covered by all other PCEs except PCE 9)
4	Complex river, stream, lake, reservoir, and marine shore-line aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates to provide a variety of depths, velocities, gradients, velocities and structure.	-large woody debris -Pool frequency and quality; -Large pools -Off channel habitat; -Refugia -Ave wetted width/max depth ratio in scour pool in a reach -Streambank condition -Floodplain connectivity -Riparian conservation areas
5	Water temperatures ranging from 2-15°C (36-59°F), with adequate thermal refugia available for	-Temperature; -Refugia -Ave wetted width/max depth ratio in

	temperatures that exceed the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage amd form; elevation; diurnal and seasonal variation; shade such as that provided by riparian habitat;and local groundwater influence.	scour pools in a reach -Streambank condition -Change in peak/base flows -Riparian conservation areas -Floodplain connectivity
6	In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimum amount of fine sediment, generally in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.	-Sediment -Substrate embeddedness -Large woody debris -Pool frequency and quality
7	A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.	-Change in peak/base flows, -Increase in drainage network -Disturbance history -Disturbance regime
8	Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	-Sediment -Chemical contamination/nutrients -Change in peak/base flows
9	Sufficiently low occurrences of non-native predatory (e.g. lake trout, walleye, northern pike, smallmouth base); interbreeding (e.g. brook trout); or competing (e.g. brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.	-persistence and genetic integrity -physical barriers

Crosswalk to support primary constituent element analysis through the matrix of pathway indicators for bull trout

This crosswalk provides supporting rationale that the proposed PCEs for bull trout critical habitat are thoroughly addressed in the current matrix analysis and that environmental baseline and determination for effects to the species consists of a biological and habitat component addressing in total the PCEs listed in the proposed rule for Critical Habitat

1. Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.

Flow conditions, such as perennial or ephemeral would be analyzed through *changes in peak/base flows* and addressed in consideration of current base flows. Changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography would be considered. The level of contaminants is addressed directly by the analysis of *chemical contamination/nutrients* and *sediment*. Current listing under 303(d) status should be considered, as well as the causes for that listing. *Sediment* is considered a contaminant especially in spawning and rearing habitat and analysis would apply to this PCE.

2. ***Water temperatures ranging from 2° to 15°C (36° to 59°F), with adequate thermal refugia***

available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade such as that provided by riparian habitat, and local groundwater influence.

This PCE is addressed directly by the analysis of *temperature*. It is addressed indirectly through consideration of *refugia*, which by definition is high quality habitat of appropriate temperature. Availability of refugia is also considered in analysis of *pool frequency and quality* and *large pools*. *Average wetted width/maximum depth ratio in scour pools* is an indication of water volume, which indirectly indicates water temperature, i.e., low ratios indicate deeper water, which in turn indicates possible refugia. This indicator in conjunction with *change in peak/base flow*s is an indicator of potential temperature and refugia concerns particularly during low flow periods. *Streambank condition*, *floodplain connectivity* and *riparian conservation areas* address the components of shade and groundwater influence, both of which are important factors of water temperature. Stable streambanks and intact riparian areas, which include part of the floodplain, typically support adequate vegetation to maintain thermal cover to streams during low flow periods.

3. ***Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures***.
The analysis of *large woody debris*, such as current values and sources available for recruitment, directly addresses this PCE. Large woody debris increases channel complexity and creates pools and undercut banks. *Pool frequency and quality* would also directly address this PCE, showing the number of pools per mile as well as the amount of cover and temperature of water in the pools. *Average wetted width/maximum depth ratio in scour pools in a reach* is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. *Large pools*, consisting of a wide range of water depths, velocities, substrates and cover, are typical of high quality habitat and are a key component of channel complexity (USFWS 1998). An analysis of *off-channel habitat* would describe side-channels and other off-channel areas. *Streambank condition* would analyze the stability of the banks, including such features as undercut banks. The analysis of both *riparian conservation areas* and *floodplain connectivity* would directly address this PCE. Floodplain and riparian functions include the maintenance of habitat and channel complexity, the recruitment of large woody debris and the connectivity to off-channel habitats or side channels (USFWS 1998). Complex habitats provide refugia for bull trout and in turn, *refugia* analysis would assess complex stream channels. All of these habitat indicators consider the numerous characteristics of instream bull trout habitat and quantify critical components that are fundamental to creating and maintaining complex instream habitat over time.

4. ***Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions***.

This PCE is addressed directly by analysis of *sediment* in areas of spawning and incubation and considers directly the size class composition of instream sediments, particularly fine sediments $\leq$6.3 mm. This PCE is also addressed directly by analysis of *substrate embeddedness* in rearing areas, which is a function of sediment size class and bedload transport. Both of these indicators would assess substrate composition and stability in relation to the various life stages of the bull trout as well as the sediment transportation and deposition. *Large woody debris* and *pool frequency and quality* affect sediment transport and redistribution within a stream and would indirectly assess substrate composition and amounts.

5. ***A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if***

regulated, a hydrograph that demonstrates the ability to support bull trout populations.

This PCE is addressed by analysis of *change in peak/base flows*, which considers changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography. Considering *increase in drainage network* and *disturbance history* provides further information. Roads and vegetation management both have effects strongly linked to a stream's hydrograph. *Disturbance regime* ties this information together to consider how a watershed reacts to disturbance and the time required to recover back to pre-disturbance conditions.

6. ***Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.***

This PCE is addressed by analysis of *floodplain connectivity* and *riparian conservation areas*. *Floodplain connectivity* considers hydrologic linkage of off-channel areas with the main channel and overbank flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling and wetlands and contribute to the maintenance of the water table (USFWS 1998). The analysis of *changes in peak/base flows* would address subsurface water connectivity. I*ncrease in drainage network* would address potential changes to groundwater sources and subsurface water connectivity. C*hemical contamination/nutrients* would address concerns regarding groundwater water quality

7. ***Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.***

The biological indicator *life history diversity and isolation* addresses the function of migration and/or subsequent isolation with respect to the population. The biological indicator *persistence and genetic integrity* indirectly reflects the status of migratory corridors. Physical, biological or chemical barriers to migration are addressed directly through water quality habitat indicators, including *temperature*, *chemical contamination/nutrients* and *physical barriers*. The analysis of these indicators would assess if barriers have been created due to impacts such as high temperatures, high concentrations of contaminants or physical barriers. Analysis of *change in peak/base flows* and *average wetted width/maximum depth ratio in scour pools in a reach* would assess whether changes in flow might create a seasonal barrier to migration. An analysis of *refugia*, which considers the habitat's ability to support strong, well distributed, and connected populations for all life stages and forms of bull trout, would also be pertinent to this PCE.

8. ***An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.***

An analysis of *floodplain connectivity* and *riparian conservation areas* would assess these contributions to the food base. Floodplain and riparian areas provide habitat to aquatic invertebrates, which in turn provides a forage base to bull trout (USFWS 1998). This PCE is indirectly addressed through the biological indicator of *growth and survival* and *life history diversity and isolation*. Both of these indicators look at habitat quality and subpopulation condition, which provides information on food base. This PCE is a synthesis of the previous PCEs. It is addressed through the analysis of biological and habitat indicators in that, if a bull trout population either exists or could exist in a watershed, then there is an adequate forage base. A healthy habitat provides a forage base for the target species. Any potential impairment to the forage base has been addressed by way of summarizing the biological and habitat indicators.

9. ***Few or no predatory, interbreeding, or competitive nonnative species present.***

This PCE is addressed specifically by analysis of the biological indicator *persistence and genetic integrity*. This indicator analyzes the probability of hybridization or displacement by competitive species. An analysis of *physical barriers* may indirectly address non-native species in those areas where a barrier may prevent the invasion of non-native species.

B. Summary of environmental baseline for critical habitat

Using the crosswalk above in Section A (Rationale), the baseline for bull trout critical habitat associated with this project is incorporated by referring to Section 5 (Environmental Baselines) of this BA**.**

C. Critical Habitat Assessment and Determination

The risk for effects to bull trout critical habitat in the Blackfoot River for this project is related to risk for sediment delivery to streams and surface water in the Stonewall Vegetation Project Area. In reference to the Habitat Indicator section, *Sediment* is the primary means by which potential effect to bull trout critical habitat could be incurred as a function of activities associated with the proposed vegetation project. The effects to Primary Constituent Elements (PCEs) of critical habitat are addressed using the crosswalk matrix above and descriptions and effects detailed in the Species and Habitat Indicators section of this BA. With regard to sediment increases, the Primary Constituent Elements (PCEs) of critical habitat that could potentially be affected by the federal action include PCE #1, PCE #4, PCE #7, and PCE #8.

Under the Direct, Indirect and Cumulative Effects Analysis and the Species and Habitat Indicators Effects portion of this BA, it is reasonably predictable to conclude that the amounts of sediment disturbed or delivered to streams in the Stonewall Vegetation Project Area upstream of the critical habitat in the Blackfoot River have a low potential to have additional adverse effects on bull trout critical habitat. This conclusion is based on: 1) the amount of sediment delivery projected to be delivered to perennial and ephemeral streams in the Project Area would remain static or be reduced given the mitigation, BMPs, resource protection measures, project design features and INFISH guidelines outlined in this BA, 2) the entire 17.7 river miles portion of the Blackfoot River within the Project Area Boundary and the Action Area is Functioning Appropriately based on sediment data representing the entire reach to the bottom of the Action Area, 3) the historic levels of sediment delivered to critical habitat is greater than or equal to the existing levels and the critical habitat has remained with a functional baseline, and 4) any substantive transport of sediment from streams in the project area would mostly occur when streams are connected to the Blackfoot River during spring high flow conditions when sediment transport is maximized and able to handle sediment loads in a natural manner that maintains the geomorphology of the channel and floodplain. As a result of this proposed project, we anticipate that affected PCEs will be maintained.

The potential for any cumulative effects to Critical Habitat downstream of the project cannot be determined with certainty due to the difficulties detailed in the Cumulative Effects Section of this BA. With regard to non-federal lands within the Stonewall Vegetation Project Area, the cumulative effects analysis points out how continued current and reasonably foreseeable land use activities likely could add to increases in sediment to streams in the Stonewall Vegetation Project Area over time. However, in recent years there has been a concerted effort by the Big Blackfoot Chapter of Trout Unlimited to address issues and reduce sediment point and non-point sources downstream of the project. Nevertheless, cumulative effects to bull trout critical habitat cannot be ruled out.

Although implementation of the Stonewall Vegetation Project will result in BMPs that reduce sediment delivery that in the long term are anticipated to have a restorative effect on several

indicators and resulting in improving trends for several PCEs, other roads that would not be addressed have sediment delivery sites that will continue the ongoing and historic anthropogenic sediment delivery to streams. Such adverse effects have not undergone consultation and as a result, the existing baseline continues to be degraded, resulting in a determination in the Blackfoot River in, adjacent and below the Stonewall Vegetation Project of **May Affect Likely to Adversely Affect** for Bull Trout Critical Habitat in the Blackfoot River Section 7 Watershed and the Blackfoot Core Recovery Area**.**

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13. Summary and Signature

The habitat indicator most affected by this proposal, sediment in spawning habitat is primarily generated from two primary sources: roads and vegetation treatment units. Stringent design features, more stringent than INFISH standards, would provide an extremely low probability of sediment delivery from treatment units and provide for buffers in RHCAs from low-severity burns. Road improvements and BMPs effectively implemented will reduce sediment delivery from the existing transportation system used as haul roads. However, in the Beaver, Keep Cool, and Lincoln Creek HUCs, the existing transportation system along with historic land management actions are included in a degraded baseline resulting in the existing conditions. Additionally, the BMP road improvements could be expected to create short term adverse effects when installed, but provide

beneficial effects over a longer-term. Consequently, even though the proposed project is anticipated to provide beneficial effects, the existing degraded baseline and its effects on bull trout provides for a determination call that the Stonewall Vegetation Project **May Affect Likely to Adversely Affect**.

	Determination of Effects	Potential for Incidental Take?
Bull Trout	**LAA**	**No**
Bull Trout Critical Habitat	**LAA**	

Possible determination of effects on listed fish species:

NE = No Effect

NLAA = May Affect - Not Likely to Adversely Affect

LAA = May Affect - Likely to Adversely Affect

Prepared by: George Liknes Helena National Forest Fisheries Biologist.

Signature Date: 8/10/2016

14. Maps/Appendices

Habitat Indicators and Effects Matrices for each of the 6th code hydrologic units in the Stonewall Vegetation Project Area - Beaver Creek HUC 170102030303.

Diagnostic/Pathways: Indicators	Population and Environmental Baseline			Effects of the Action(s)		
	Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk	Major Effects of the Action*	Minor Effects of the Action*	INFISH Compliance Y/N
Subpopulation Characteristics:						
Subpopulation Size		x			M	
Growth & Survival		x			M	
Life History Diversity & Isolation			x		M	
Persistence and Genetic Integrity			x		M	
Water Quality:						
Temperature		x			M	
Sediment			x		D	
Habitat Access:						
Physical Barriers		x			M	
Habitat Elements:						
Substrate Embededness			x		M	
Large Woody Debris		x			M	
Pool Frequency & Quality		x			M	
Large Pools		x			M	
Off-Channel Habitat			x		M	
Refugia			x		M	
Channel Condition & Dynamics:						
Wetted Width/Max Depth Ratio			x		M	
Streambank Condition			x		M	
Floodplain Connectivity			x		M	
Flow & Hydrology:						
Change in Peak/Base Flows		x			M	
Drainage Network Increase		x			M	
Watershed Conditions:						
Road Density & Location			x		M	
Disturbance History		x			M	
Riparian Conservation Area			x		M	
Disturbance Regime			x		M	
Integrated Primary Habitat Indicator			x		D	
Integration of Species & Habitat Condition			x		M	Y

* - R = Restore, M = Maintain, D = Degrade

Major effects - Changes one level from baseline condition (e.g. FA to FAR). **Minor effects** - Indicates action may result in incremental or cumulative effect, but not in a functional change to the system (no change in functional level).

Habitat Indicators and Effects Matrices for each of the 6th code hydrologic units in the Stonewall Vegetation Project Area - Humbug Creek HUC 170102030301.

Diagnostic/Pathways: Indicators	Population and Environmental Baseline			Effects of the Action(s)		
	Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk	Major Effects of the Action*	Minor Effects of the Action*	INFISH Compliance Y/N
Subpopulation Characteristics:						
Subpopulation Size		x			M	
Growth & Survival		x			M	
Life History Diversity & Isolation			x		M	
Persistence and Genetic Integrity			x		M	
Water Quality:						
Temperature	x				M	
Sediment	x				M	
Habitat Access:						
Physical Barriers	x				M	
Habitat Elements:						
Substrate Embededness	x				M	
Large Woody Debris	x				M	
Pool Frequency & Quality	x				M	
Large Pools	x				M	
Off-Channel Habitat	x				M	
Refugia			x		M	
Channel Condition & Dynamics:						
Wetted Width/Max Depth Ratio	x				M	
Streambank Condition	x				M	
Floodplain Connectivity	x				M	
Flow & Hydrology:						
Change in Peak/Base Flows	x				M	
Drainage Network Increase	x				M	
Watershed Conditions:						
Road Density & Location	x				M	
Disturbance History	x				M	
Riparian Conservation Area	x				M	
Disturbance Regime	x				M	
Integrated Primary Habitat Indicator	x				M	
Integration of Species & Habitat Condition	x				M	Y

* - R = Restore, M = Maintain, D = Degrade

Major effects - Changes one level from baseline condition (e.g. FA to FAR). **Minor effects** - Indicates action may result in incremental or cumulative effect, but not in a functional change to the system (no change in functional level).

Habitat Indicators and Effects Matrices for each of the 6th code hydrologic units in the Stonewall Vegetation Project Area - Keep Cool Creek 170102030304.

Diagnostic/Pathways: Indicators	Population and Environmental Baseline			Effects of the Action(s)		
	Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk	Major Effects of the Action*	Minor Effects of the Action*	INFISH Compliance Y/N
Subpopulation Characteristics:						
Subpopulation Size		x			M	
Growth & Survival		x			M	
Life History Diversity & Isolation			x		M	
Persistence and Genetic Integrity			x		M	
Water Quality:						
Temperature		x			M	
Sediment			x		D	
Habitat Access:						
Physical Barriers		x			M	
Habitat Elements:						
Substrate Embededness			x		M	
Large Woody Debris		x			M	
Pool Frequency & Quality		x			M	
Large Pools		x			M	
Off-Channel Habitat		x			M	
Refugia		x			M	
Channel Condition & Dynamics:						
Wetted Width/Max Depth Ratio		x			M	
Streambank Condition		x			M	
Floodplain Connectivity			x		M	
Flow & Hydrology:						
Change in Peak/Base Flows		x			M	
Drainage Network Increase		x			M	
Watershed Conditions:						
Road Density & Location			x		M	
Disturbance History		x			M	
Riparian Conservation Area		x			M	
Disturbance Regime		x			M	
Integrated Primary Habitat Indicator			x		D	
Integration of Species & Habitat Condition			x		M	Y

* - R = Restore, M = Maintain, D = Degrade

Major effects - Changes one level from baseline condition (e.g. FA to FAR). **Minor effects** - Indicates action may result in incremental or cumulative effect, but not in a functional change to the system (no change in functional level).

Habitat Indicators and Effects Matrices for each of the 6th code hydrologic units in the Stonewall Vegetation Project Area - Lincoln Creek 170102030305.

Diagnostic/Pathways: Indicators	Population and Environmental Baseline			Effects of the Action(s)		
	Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk	Major Effects of the Action*	Minor Effects of the Action*	INFISH Compliance Y/N
Subpopulation Characteristics:						
Subpopulation Size	N/A	-	-		M	
Growth & Survival	N/A	-	-		M	
Life History Diversity & Isolation	N/A	-	-		M	
Persistence and Genetic Integrity	N/A	-	-		M	
Water Quality:						
Temperature			x		M	
Sediment			x		M	
Habitat Access:						
Physical Barriers	x				M	
Habitat Elements:						
Substrate Embededness			x		M	
Large Woody Debris		x			M	
Pool Frequency & Quality		x			M	
Large Pools		x			M	
Off-Channel Habitat		x			M	
Refugia			x		M	
Channel Condition & Dynamics:						
Wetted Width/Max Depth Ratio			x		M	
Streambank Condition			x		M	
Floodplain Connectivity			x		M	
Flow & Hydrology:						
Change in Peak/Base Flows			x		M	
Drainage Network Increase			x		M	
Watershed Conditions:						
Road Density & Location			x		M	
Disturbance History		x			M	
Riparian Conservation Area		x			M	
Disturbance Regime		x			M	
Integrated Primary Habitat Indicator			x		M	
Integration of Species & Habitat Condition			N/A		M	Y

* - R = Restore, M = Maintain, D = Degrade

Major effects - Changes one level from baseline condition (e.g. FA to FAR). **Minor effects** - Indicates action may result in incremental or cumulative effect, but not in a functional change to the system (no change in functional level).

Habitat Indicators and Effects Matrices for each of the 6th code hydrologic units in the Stonewall Vegetation Action Area – Blackfoot River – Little Moose Creek 170102030310.

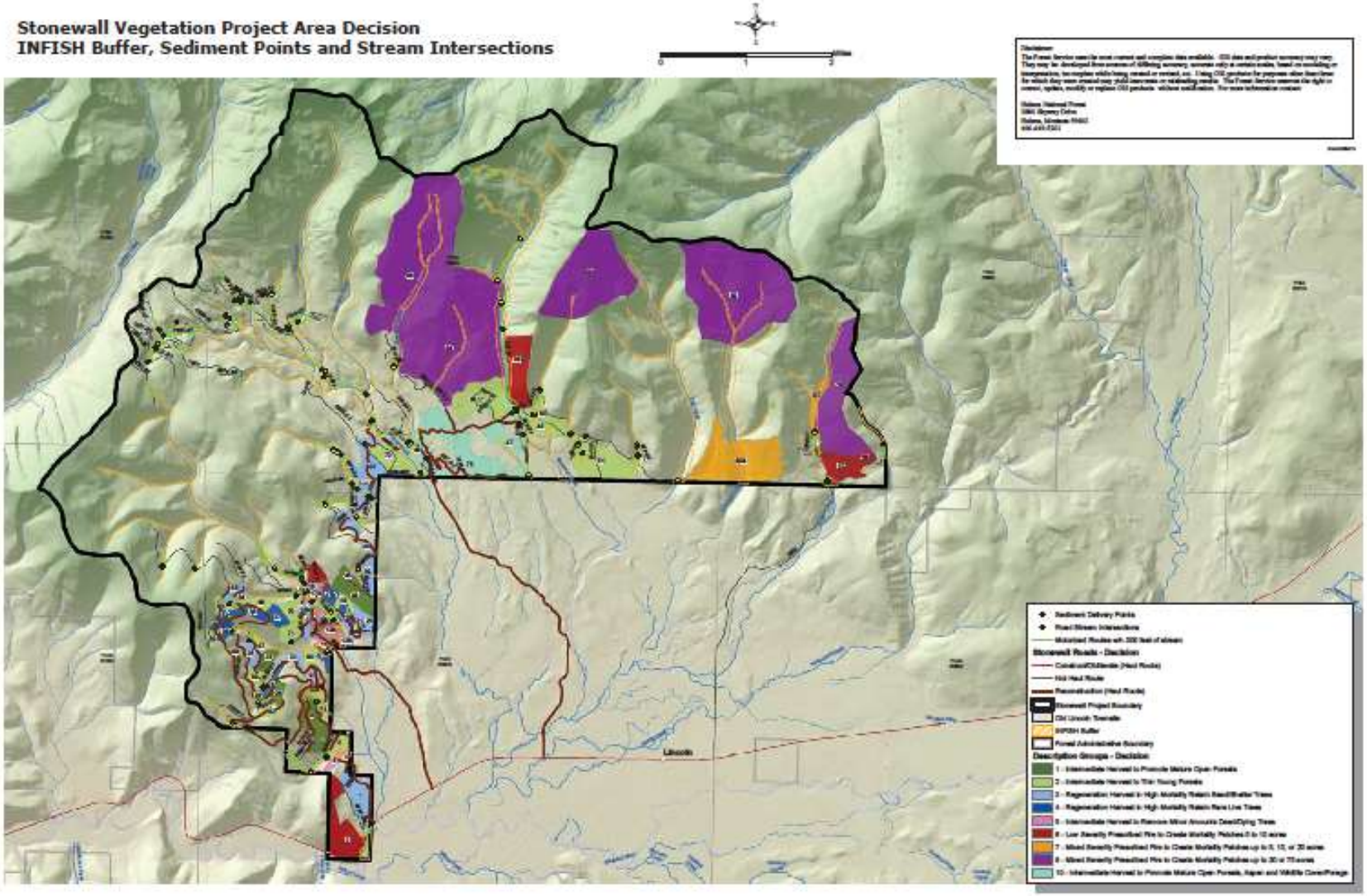
Diagnostic/Pathways: Indicators	Population and Environmental Baseline			Effects of the Action(s)		
	Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk	Major Effects of the Action*	Minor Effects of the Action*	INFISH Compliance Y/N
Subpopulation Characteristics:						
Subpopulation Size		x			M	
Growth & Survival		x			M	
Life History Diversity & Isolation			x		M	
Persistence and Genetic Integrity			x		M	
Water Quality:						
Temperature		x			M	
Sediment			x		M	
Habitat Access:						
Physical Barriers	x				M	
Habitat Elements:						
Substrate Embededness			x		M	
Large Woody Debris		x			M	
Pool Frequency & Quality		x			M	
Large Pools		x			M	
Off-Channel Habitat		x			M	
Refugia		x			M	
Channel Condition & Dynamics:						
Wetted Width/Max Depth Ratio		x			M	
Streambank Condition		x			M	
Floodplain Connectivity			x		M	
Flow & Hydrology:						
Change in Peak/Base Flows		X			M	
Drainage Network Increase		x			M	
Watershed Conditions:						
Road Density & Location			x		M	
Disturbance History		x			M	
Riparian Conservation Area		x			M	
Disturbance Regime		x			M	
Integrated Primary Habitat Indicator			x		M	
Integration of Species & Habitat Condition			x		M	Y

* - R = Restore, M = Maintain, D = Degrade

Major effects - Changes one level from baseline condition (e.g. FA to FAR). **Minor effects** - Indicates action may result in incremental or cumulative effect, but not in a functional change to the system (no change in functional level).

Photos 1-2: Yukon Creek Stream Crossing (stream mile 0.18) Before & After. Upgraded structure opened over 3.0 miles of habitat for pure populations of westslope cutthroat trout. This is an example of ongoing stream crossing improvements within the Stonewall Vegetation Project Area

Boundary that are improving the existing conditions.

Photos 3-4: Theodore Creek (stream mile 0.12) stream crossing before and after. Upgraded structure opened 2.3 miles of habitat for pure populations of westslope cutthroat trout. This is an example of ongoing stream crossing improvements within the Stonewall Vegetation Project Area Boundary that are improving the existing conditions.

Stonewall Vegetation Project Area Decision
INFISH Buffer, Sediment Points and Stream Intersections