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. *Road density and location* addresses the potential contributions of warm water discharges from stormwater ponds.

6. ***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 (e.g., less than 12 percent) of fine substrate less than 0.85 mm (0.03 in.) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.***

The analyses for *sediment* and *substrate embeddedness* 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 assessment of these indicators will clarify substrate composition and amounts. Analysis of *streambank condition* will provide insight into the amount of fine sediment contribution.

7. ***A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.***

The analysis of *change in peak/base flows* considers changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography. Analyses of *floodplain connectivity, increase in drainage network, road density and location, disturbance history,* and *riparian conservation areas* provides further information regarding possible interruptions in the natural stream hydrology. *Floodplain connectivity* considers the hydrologic linkage of off-channel areas with the main channel. 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.

8. ***Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.***

The quantity of permanent water will be considered in the analyses for PCE 4 natural hydrograph and PCE 5 springs, seeps, and groundwater, which include *floodplain connectivity, changes in peak/base flows, drainage network increase, disturbance history,* and *disturbance regime.* Analysis of *temperature, sediment, and chemical contaminates and nutrients* consider the quality of permanent water. Current listing under 303(d) and 305(d) status should be considered, as well as the causes for that listing. Analysis pertinent to sediment should address turbidity.

9. ***Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.***

This PCE is addressed in terms of the subpopulation characteristics, as analyzed in *life history and diversity* and *persistence and genetic integrity.* Sufficiently low levels of occurrence of nonnative predatory (e.g. lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g. brook trout); or competing (e.g. brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout. Analysis of these indicators and the associated baseline provides an understanding of biological implications of non-native species. Non-native species can be affected by changed habitat conditions in a subwatershed and the population status can provide information on the existing condition of a local population.

Table 3. The Primary Constituent Elements and Associated Watershed Condition Indicators

PCE	PCE Description	Watershed Indicators
1	Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.	Chemical contaminants, physical barriers, substrate embeddedness, channel conditions and dynamics (streambank condition, floodplain connectivity), Flow/hydrology, road density and location, riparian conservation areas.
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.	Water quality (temperature, sediment, chemical and nutrient contaminants), physical barriers, change in peak/base flow, width/depth ratio, refugia
3	An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.	Water quality (temperature, sediment, chemical and nutrient contaminants), physical barriers, substrate embeddedness, pool frequency and quality, floodplain connectivity, riparian conservation areas
4	Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.	Large woody debris, pools frequency and quality, large pools, off-channel habitat, channel conditions and dynamics (width/depth ratio, streambank condition, floodplain connectivity), disturbance history, riparian conservation areas, disturbance regime.
5	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.	Temperature, large pools, refugia, channel conditions and dynamics (width/depth ratio, streambank condition, floodplain connectivity), change in peak/base flows, road density and location, riparian conservation areas.
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 minimal amount of fine sediment, generally ranging 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, streambank condition.
7	A natural hydrograph, including peak, high, low, and base flows within historic and	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and drainage network increase),

PCE	PCE Description	Watershed Indicators
	seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.	watershed conditions (road density and location, disturbance history, riparian conservation areas, disturbance regime).
8	Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and drainage network increase), water quality (Temperature, sediment/turbidity, Chemical Contaminants and Nutrients), disturbance history, disturbance regime.
9	Sufficiently low levels of occurrence of nonnative predatory (e.g. lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.	Physical barriers, refugia, persistence and genetic integrity.

Factors affecting critical habitat are similar to those described above under the species. It is not feasible to provide a detailed accounting of factors affecting each critical habitat unit within the action area, nor is it necessary under this programmatic effort. Pre-project checklists and discussions within Level 1 teams will cover site specific factors for each project conducting under the Program. Table 2 provides summary information regarding the condition of the sediment and physical barrier indicators for all subbasins within the action area, and shows that for most of the subbasins the two indicators are functioning at risk or not functioning appropriately. These two indicators are the primary watershed condition indicators, along with the subsequent effects to chemical contaminants and substrate embeddedness that may be affected during project implementation. Substrate and physical barriers are therefore the two watershed condition indicators that are the focus of the affects analysis. It is assumed herein that for projects completed under the Program that will occur within bull trout critical habitat, PCE #2 is impaired to some degree. Project sites are likely crossings that impede migration either through complete upstream blockage (blockage may also occur seasonally or may variably affect size classes of bull trout) or by leading to water quality conditions that impede migration. Migration barriers on poorly designed roads/trails, and overall habitat connectivity, are the most important limiting factors being addressed in this Program.

Changes in hydrology and temperature caused by changing climate have the potential to negatively impact aquatic ecosystems in Idaho, with salmonid fishes being especially sensitive. Average annual temperature increases due to increased carbon dioxide are affecting snowpack, peak runoff, and base flows of streams and rivers (Mote et al. 2003, p. 45). Increases in water temperature may cause a shift in the thermal suitability of aquatic habitats (Poff et al. 2002, p. iii). For species that require colder water temperatures to survive and reproduce, warmer temperatures could lead to significant decreases in available suitable habitat. Increased frequency and severity of flood flows during winter can affect incubating eggs and alevins in the streambed and over-wintering juvenile fish. Eggs of fall spawning fish, such as bull trout, may suffer high levels of mortality when exposed to increased flood flows (Independent Scientific Advisory Board 2007, p. iv).

2.5 Effects of the Proposed Action

Effects of the action considers the direct and indirect effects of an action on the listed species and/or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

2.5.1 Bull Trout

2.5.1.1 Direct and Indirect Effects of the Proposed Action

Activities that occur as part of this Program have the potential to affect four watershed indicators, or habitat conditions, including: sediment/turbidity, chemical contamination/nutrients and substrate embeddedness (all sediment related); and physical barriers. Although the Program may affect chemical contamination/nutrients indicator, those effects are expected to be related to sediment as the potential pollutant of concern, and chemical leaks from equipment. Substrate embeddedness may be also be affected by sediments released during activities. Accordingly, our analysis is focused on sediment related effects and temporary (occurring during construction phase) passage barrier effects. Changes to these habitat conditions are likely to adversely affect bull trout that may be present at project sites in occupied habitats. In addition to effects to habitat, direct effects to bull trout may occur during fish clearing operations and from increased turbidity downstream of projects. All potential effects to both habitat conditions and bull trout will be short term in nature with beneficial or neutral impacts to habitat following project completion.

The Service does not expect that every project carried out under the Program will have adverse effects to bull trout. Even for projects in occupied habitats there will be a range of effects depending on the size of the stream, the geology of the basin, soil types, condition of the riparian area, the type of crossing project, the nature of bull trout use at the project site, the ability of fish to escape to unaffected areas, the type of habitat provided at the site, and other factors. In some cases the effects to bull trout will be insignificant because of their limited extent or discountable when fish are unlikely to be present or absent. In other circumstance, such as a project going in occupied spawning and rearing habitat, the temporary (occurring during project implementation) effects are likely to be adverse. The programmatic nature of this consultation limits our ability to consider the site specific factors. For the section 7(a)(2) analysis of this Program, it is prudent to anticipate that every project that occurs in occupied habitat has equal potential to affect bull trout, and that effects of similar magnitude and duration will occur at each project in occupied habitat. Accordingly, we have analyzed what we consider to represent the most severe effects expected to occur throughout the action area.

The Assessment (pp. 15-24) identifies seven construction phases that may occur for any given project implemented under this Program. These include: site preparation, fish avoidance, dewatering, construction activities, flow reintroduction, site rehabilitation, and maintenance. For a complete list of construction procedures, sequences and design features intended to minimize effects to listed fish species, refer to the Assessment, pp. 14-25.

Each of these construction phases may have a different likelihood of producing conditions that adversely affect bull trout, which will depend on site specific conditions. In the discussion of potential effects described below we identify the particular construction phase and component that is most likely to be associated with that effect, if it is known. Table 4 summarizes effects to watershed condition indicators. The term "short-term" is used to describe potential effects that may occur within one year of project implementation while "long-term" describes effects occurring beyond one year post-construction to allow for the action to be exposed to a full range of seasonal conditions. An "X" signifies that the watershed condition indicator will be maintained and no significant effects to the indicator are expected.

Table 4. Watershed Condition Indicators and Effects of Program Actions

Watershed Condition Indicators	Effects of the Program Actions		
	Degrade	Maintain	Restore
Water Quality			
Temperature		X	
Sediment	Short-Term		Long-Term
Chemical Contaminants/Nutrients	Short-Term		Long-Term
Habitat Access			
Physical Barriers	Short-Term		Short- and Long-Term
Habitat Elements			
Substrate Embeddedness	Short-Term		Long-Term
Large Woody Debris		X	
Pool Character and Quality		X	
Off Channel Habitat		X	
Refugia			Long-Term
Channel Condition /Dynamics			
Width/Depth Ratios		X	
Streambank Condition		X	
Floodplain Connectivity		X	
Flow/ Hydrology			
Changes in Peak/Base Flows		X	

Watershed Condition Indicators	Effects of the Program Actions		
	Degrade	Maintain	Restore
Drainage Network Increase		X	
Watershed Conditions			
Road/Density/Location		X	
Distrubance history		X	
Disturbance Regime/History			Long-Term
Riparian Reserves		X	
Bull Trout Population Characteristics			
Subpopulation Size	Short-Term		Long-Term
Growth and Survival			Long-Term
Life History			Long-Term
Genetic Integrity			Long-Term

2.5.1.1.1 Beneficial Effects to Bull Trout and Bull Trout Critical Habitat

It is important to note that the explicit purpose of the Program is to restore fish passage and improve aquatic function at degraded sites within the action area. All potential adverse effects are expected to be short term (less than a year) in nature and projects completed under this Program are expected to have beneficial effects for bull trout. Most watershed condition indicators, as shown in Table 4 are not expected to be affected by individual projects. The following list identifies the expected beneficial effects to bull trout when projects are completed under the Program.

1. Passage rehabilitation and improved connectivity between habitats upstream and downstream of the existing road crossing.
2. Improved potential for genetic exchange.
3. Improved stream functioning (physical characteristics and processes), including bedload and woody debris material transport.
4. Increased availability and diversity of habitat for bull trout, including potential refugia.
5. Restoration of natural bedload size and quantity capacity in road crossing structure.
6. Decreased habitat disturbance associated with regular maintenance at undersized crossings and decreased sediment delivery.
7. Decreased potential for roadfill failure and associated sedimentation.

This action will address population and habitat fragmentation factors that contributed to the federal listing of the bull trout. Implementation of this action could restore connectivity and passage for up to 1,560 culverts (and an unspecified number of miles of habitat) over the next 10 years. Connectivity has been identified by the Service as a critical need for enhancing the likelihood of survival and recovery of bull trout. Restoring passage through culverts and other structures will provide access to historically important habitat, which will result in immediate expansions in the distribution of bull trout in some cases while, in other cases, this action will restore connectivity between existing bull trout subpopulations. In either case, the Service expects this action to improve the number, distribution, and reproductive potential of bull trout in Idaho despite anticipated short-term adverse effects to bull trout and bull trout critical habitat.

2.5.1.1.2 Sediment Related Effects

A short-term increase in suspended and deposited sediment, and associated stream turbidity, is expected when crossings are removed or replaced under this Programmatic. Program activities that may cause sediment input to the stream and increased sediment include: site preparation, dewatering the stream, construction activities, reintroduction of flow, and maintenance activities. Sediment controls measures associated with these actions will minimize effects, but will not capture all sediment that is released by the activities. Increased turbidity and sediment deposition will likely occur downstream of each project site, the severity and extent of which depends on site specific factors such as flow, geology, substrate, slope, etc.

General Sediment Effects

Sediment is a very important stressor to salmonids and can affect them in both direct and indirect ways. Bull trout are highly susceptible to sediment inputs and require the lowest turbidity and suspended sediment levels of all salmonids for spawning, incubation, and juvenile rearing. The Service knows of no positive effects to salmonids from increased sediment; while the potential negative impacts of increased suspended sediment on bull trout and other salmonids have been well documented (e.g., Bakke et al. 2002, p.1; Newcombe and MacDonald 1991, pp. 72-73; Newcombe and Jensen 1996, p. 700-715, Bash et al. 2001, p. 24).

Increased sediment and suspended solids have the potential to affect primary production and benthic invertebrate abundance, due to reductions in photosynthesis within murky waters. Thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961, pp. 189-190; Lloyd et al. 1987, p. 18; Henley et al. 2000, pp. 129-133). Sediment can also reduce health of in-stream plants, reducing cover for fish making them more vulnerable to predation (Waters 1995, pp. 111-116). Pools, which are an essential habitat type, can be filled by sediment and degraded or lost (Megahan 1982, p. 114).

Increases in suspended sediment have been shown to affect salmonid behavior in several ways. Social (Berg and Northcote 1985, p. 1410) and feeding behavior can be disrupted by increased levels of suspended sediment. Fish may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991, p. 483-485). Even small elevations in suspended sediment may reduce feeding efficiency and growth rates of some salmonids (Sigler et al. 1984, p. 142). Based on their experiments with juvenile rainbow trout (*Oncorhynchus mykiss)*, Suttle et al. (2004, p. 973) concluded that "fine sediment deposition, even at low concentrations, can decrease growth and survival of juvenile salmonids." They found "no threshold below which fine-sediment addition is harmless."

Sediment introduced into streams does not just adversely affect fish at an individual physical level but can adversely affect fish populations. Deposition of silt on spawning beds can fill interstitial spaces in spawning areas with sediment (Phillips et al. 1975, p. 461; Myers and Swanson 1996, p. 245; Wood and Armitage 1997, p. 203) impeding water flow, reducing dissolved oxygen levels, and restricting waste removal which reduces the survival of fish embryos (Chapman 1988, pp. 1-5; Bjornn and Reiser 1991, p. 98).

Newcombe and Jensen (1996, pp. 720-727) and Bash et al. (2001, p. 24) provide syntheses of research that has been conducted on the effects of suspended sediment on the physical condition of salmonids. Newcombe and Jensen (1996) used their syntheses of field and laboratory data on effects from sediment to develop a dose response model and described 14 severity levels of effects, ranging from "no behavioral effects" (0) to greater than 80 to 100 percent mortality (14). This range is divided into four major categories, including "nil effect," "'behavioral effects," "sublethal effects," and "lethal and Para lethal effects." Bash et al. (2001, p. 2) further refine the categories by describing whether the effect is behavioral, physiological, or habitat-based. For example, Newcombe and Jensen (1996, pp. 694-698) report that suspended sediment concentrations of 500 mg/l for 3 hours caused signs of sublethal stress in adult steelhead, which we would also expect for bull trout. If suspended sediment concentrations reach 3,000 mg/l for up to an hour it may cause moderate physiological stress (Newcombe and Jensen 1996, pp. 698-702), and could result in gill trauma and/or temporary adverse changes in blood physiology such as elevated blood sugars, plasma glucose, or plasma cortisol (Servizi and Martens 1987, p. 16; Servizi and Martens 1992, pp. 1389-1390; Bash et al. 2001, p. 17). Lethal effects can occur if suspended sediment concentrations reach 22,026 mg/l at any one time, or remain at concentrations of 3,000 mg/l for 3 hours (Newcombe and Jensen 1996, pp. 698-702).

There are several difficulties in using this information to try and anticipate what amount of sediment in the water column is likely to be produced by a project and what impacts they might cause to fish. First, field turbidity monitoring uses turbidimeters that record data in nephelometric turbidity units (NTUs) while Newcombe and Jensen's data is in milligrams/liter (mg/l). And second, turbidity as a result of project implementation is not consistent and can be present in short intense bursts or at lower level over long periods of time.

While there is a relationship between suspended solids measured in mg/l and NTUs, it is highly variable because of differences in many factors including water temperature and particle size. While developing Total Maximum Daily Load (TMDL) criteria for the Umatilla River Basin, Oregon used regression analysis to express the suspended solids (in mg/l) that represented 30 NTU for 14 watersheds (Oregon Department of Environmental Quality, p. A6-3). Values ranged from 60 to 110 mg/l for the target value of 30 NTUs. If a similar relationship existed with Newcombe and Jensen's data, their 3 hour lethal range of 3,000 mg/l could equate to an NTU reading of between 833 and 1,764 which is a very wide potential range of values.

Because culvert replacement and removal is one of the most common construction activities in fish bearing streams, there is more specific information on the amount of sediment released, degree of turbidity, turbidity plume length and plume duration generated by culvert projects. Culvert removal has a high potential for releasing sediment because the soil is disturbed when removing large culverts, soil is disturbed when the channel is reconfigured and then water is reintroduced into that disturbed site.

Bakke et al. (2002, p.1) reported maximum suspended sediment levels of 514 to 2,060 mg/l associated with culvert removals near Olympia, Washington. These concentrations did not last for more than one hour. Both Jakober (2002, p. 6) and Casselli et al. (2000, pp. 8-9) reported that turbidity dissipated within a few hours of peaking and decreased to pre-project levels within about 24 hours after flow reintroduction. Casselli et al. (2000, pp. 8-9) noted that sediment levels remained at pre-project levels about 1.5 miles downstream of the project site. Idaho's Department of Environmental Quality adopted turbidity criteria of 50 NTU for protection of cold water biota (Bash et al. 2001, p. 67). That NTU level was based on data from Lloyd et al. 1987 (*in* Bash et al. 2001, p. 67) suggesting that salmonids reacted negatively by beginning to move away from areas when the turbidity reaches 50 NTU.

The Emmett Ranger District on the Boise National Forest monitored turbidity on Renwyck Creek during a culvert replacement project in August and September 2006 (Yenko 2007, entire). As expected, turbidity was very low, near baseline conditions, while water was diverted around the work site and spiked when the worksite was re-watered. NTU peaked at 249.5 immediately downstream of the site (50 meters) when the stream was re-watered and was down to 23.6 NTU within one hour as the sediment plume dissipated. Within two hours NTU was down to 11.1 and it continued to fall substantially that day.

Two crossings were monitored for turbidity changes on Carmen Creek, a tributary to the Salmon River, near Salmon, Idaho in October 2011 (Foltz et al. 2012, entire). Turbidity readings measured at the end of the mixing zone during construction activities did not exceed 50 NTU above the background levels, although both sites came very close. Turbidity samples were taken 10 meters downstream of the bypass culvert outlet and 100 meters downstream of the construction zone, the point chosen with the expectation that it was near the end of the mixing zone. Sampling criteria for the Parmenter Lane location was every 15 minutes or when the turbidity visually increased. When the turbidity was visually high, a sample was taken at least every 5 minutes until the stream cleared up. The Archie Lane sampling criteria was modified to sample every 30 minutes or when the turbidity was visually increased. Turbidity at Parmenter Lane was highest when the excavator was working in-stream and when the final remnants of the temporary dam were removed. Turbidity at Archie Lane was highest while the bypass dams were being installed and when the water was released from the bypass dams after the bridge was completed.

All three of these recent studies indicate that sediment plumes or spikes do occur during crossing replacements and occur when equipment is in live water and when water is reintroduced into the new stream channel. They also indicate that plumes dissipate very quickly at 50 and 100 meters below the construction sites. Studies also indicate that sediment mitigation measures, such as working in a dewatered zone, applying retention material, re-watering the stream slowly, etc., were successful in reducing turbidity values.

Project Specific Effects

It is likely that stream crossing structure removal and replacement projects carried out under this Program will result in increased sediment levels similar to those reported in Yenko (2007) and Foltz *et al.* (2012), but could be higher, such as those reported in Jakober (2002), Casselli *et al.* (2000) and Bakke *et al.* (2002), depending on substrate, geology, slope, flows, etc. at a given site. Minimization measures proposed for this consultation such as the use of Sedimat downstream of the project site, stream dewatering or bypassing prior to excavation, and pre-washing the newly simulated channel before re-watering occurs, will significantly reduce the suspended sediment concentrations that may occur during project implementation. The projects described in the two recent studies in Idaho (Yenko 2007 and Foltz *et al.* 2012) had similar minimization measures in place. Bank disturbance during site preparation, prior to stream dewatering, during diversion construction, excavation, construction of approaches, and during rehabilitation of the crossing may also create short-term pulses of turbidity.

Elevated sediment concentrations from Program activities may trigger effects ranging from minor to moderate physiological stress, including increased rates of coughing and respiration, particle build-up on gills, temporary injury associated with avoidance or moving to less turbid areas, and habitat degradation. Effects are not expected to rise to the level of mortality. Another pulse of sediment may occur following precipitation events or in the spring when higher energy spring-flows move through the construction site and these events would likely result in similar effects.

In response to elevated levels of suspended sediment, a reasonable expectation would be that, in order to avoid adverse effects, bull trout juveniles and adults may move away from turbid areas, if possible. Bisson and Bilby (1982, pp. 371-374) found that juvenile coho salmon (*Oncorhynchus kisutch*) avoided increasingly turbid waters in a laboratory setting. But, relocating to avoid sediment may have indirect adverse effects on bull trout. Salmonids exhibit a dominance hierarchy where the dominant fish (usually the largest) maintain the most desirable territories (i.e., defended area) in terms of available cover and food sources (Gilmour et al. 2005, p. 263). Subordinate fish may be excluded from food and cover resources and show reduced fitness and survival (Gilmour et al. 2005, p. 263). Berg and Northcote (1985, pp. 1415-1416) found that dominance hierarchies broke down and territories were not defended when juvenile coho salmon were exposed to short-term sediment pulses. We assume that bull trout behave similarly to other studied salmonids. Based on this assumption, we expect bull trout that abandon territories to avoid turbidity associated with culvert replacement projects may temporarily suffer increased competition, loss of cover, stress, and reduced feeding efficiency.

Increasing suspended sediment in rivers and streams during low-flow periods, when background levels of sediment in the stream system are generally very low or absent, has greater potential to affect fish. Bash et al. (2001, p. 16) reported that background mucus levels of fish are lower during this time period, which may result in amplified effects to fish, associated with the increased sediment inputs. This is in contrast to sediments that may be mobilized during the first high flow events following a construction activity, when background sediment levels are higher. Additional suspended sediment associated with a project is expected to move through the water column, becoming deposited on the substrate in areas of lower velocity, including pools or slack waters. Higher flows within the year following project implementation are expected to remobilize sediments, carrying them further downstream to be deposited. Eventually most sediments mobilized during project implementation will be carried downstream to larger streams, rivers, or water bodies within the watershed. Because high flows that re-mobilize project related sediments are expected to occur when background sediment levels are naturally elevated, they are expected to have less potential for effects to bull trout. High flow events during the spring following project implementation are expected to flush any deposited sediment from the project area.

During the slow re-watering of various worksites, all freshly disturbed substrates within the dewatered worksites will be highly prone to suspension and mobilization in the water column. The Assessment cited personal observations of projects similar to what will be conducted under the Program that observed approximately 90 percent of turbidity and sediment increases occur during flow reintroduction to the dewatered channel. Jakober (2002, p. 6) also found that 95 percent of construction-related sediment was introduced in the first two hours after the diversion was removed and water returned to the new crossing site. Casselli (2000) observed a similar response. In Jakober's study (2002), sediment concentrations instantaneously rose from a background of 1.69 mg/l of suspended sediment pre-diversion removal to a high of 15,588 mg/l for 30 minutes during re-watering of the channel. Suspended sediment levels then continuously dropped over time, decreasing to 105-677 mg/l 1 hour after re-watering, to 17-29 mg/l 2.5 hours after re-watering. In a similar monitoring effort, Bakke (2002) recorded sediment concentrations up to 514 – 2,060 mg/l following removal of culverts. These concentrations reportedly lasted less than 1 hour.

Re-watering of project sites is likely to result in the greatest turbidity/suspended sediment levels achieved during project implementation with values reaching a severity of effects score of up to 8, for approximately 1 hour, based on Newcombe and Jensen (1996) severity of effects analysis. However, intensity levels are expected to be reduced due to conservation measures to minimize sediment effects. Fish exposure may be further minimized as fish are likely to seek less turbid conditions downstream of the generated plume (Servizi and Martens 1992, pp. 1389-1390).The Service expects that turbidity pulses will generate a plume which may extend for approximately 600 feet downstream of the construction site and should dissipate within 3-4 hours, based on the review of literature (Casselli et al. 2000, pp. 8-9; Jakober 2002, p. 6; Fish and Wildlife Service 2004, p. 30): plumes will likely not last more than four hours, at which point turbidity should recover to near background levels. Re-watering the channel could result in suspended sediment levels triggering effects ranging from minor physiological stress and increased coughing and respiration at level 5, to moderate physiological stress at level 6, to moderate habitat degradation and impaired homing at level 7, and to fish demonstrating major physiological stress at level 8. As a result, bull trout are expected to have only acute sub-lethal behavior and physiological effects due to the short period of elevated suspended solids.

The Service is not aware of any study examining substrate embeddedness following a crossing replacement or removal. But it is likely that a thin layer of sediment may temporarily be deposited on substrate up to 600 feet downstream of the project, and until this sediment is washed out could cause embeddedness effecting spawning substrates, juvenile rearing habitat, prey habitat, and stream function. Bull trout are particularly susceptible to sediment effects and tend to use habitats close to the stream bottom, seeking cover in the interstitial spaces, especially as juveniles. The existing conditions and levels of substrate embeddedness will be site specific. We anticipate that project actions may increase substrate embeddedness within 600 feet downstream of project sites in areas where juvenile bull trout exist and may result in displacement. Any change to substrate embeddedness below project sites is considered a significant temporary disruption in the normal feeding and sheltering behavior of juvenile bull trout, which are typically less mobile than adults. Project features designed to capture sediment at the construction site will minimize sediment substrate embeddedness to an extent. Increased levels of substrate embeddedness are expected to be temporary (less than a year) in nature, as we expect either fall or winter storm events or natural high spring flows to mobilize any sediment that was deposited due to project activities within one year of project implementation. Following flushing flows, the stream simulation technique implemented for this project should result in decreased sediment, and potentially reduced substrate embeddedness over the longer-term because the projects are expected to remove or reduce chronic sources of sediment at poorly designed crossings, and to enhance sediment transport through these structures.

The Service stresses that all impacts associated with increased turbidity and suspended sediment will be temporary to short-term in nature, with most effects occurring within a one to four hour time frame, most likely during bypass construction and stream re-watering. Project design features presented as part of the Program are intended to prevent the majority of sediment from being delivered to stream habitat and to minimize release of sediment in the water during in-channel work. Re-watering the stream slowly is expected to reduce, but not eliminate, the risk to bull trout from elevated suspended sediment concentrations. Prolonged exposure to increased suspended sediment levels will not occur and all potential effects to bull trout are expected to be sublethal: we do not anticipate any mortality associated with increased suspended sediment levels. As described in the Assessment (p. 14), projects will not be completed where there are spawning bull trout or their redds, so the risk to spawning bull trout, eggs, and alevins from sediment deposition is discountable.

Road and Trail Relocation and Decommissioning

Action Agencies may choose to relocate a crossing to an area that provides better access or has less potential for failure. As described under the categories of activities, changing the location of a crossing will include decommissioning and reclamation of approaches on the existing crossing and construction of new approaches at the proposed crossing location, with no net increase in route density within riparian areas. The new crossing must be within ¼ mile of the old crossing and may include no more than ½ mile of new road or trail construction.

During the road, route, or trail decommissioning there is potential for an increased risk of erosion and sediment delivery to streams, depending on site specific characteristics, including proximity of the road to the stream, geology, and slope, etc. Design features will minimize sediment delivery to the stream, but if erosion occurs and sediment enters the stream, it could have the same general effects as described above, but we expect suspended sediment levels and turbidity to be much lower than one would see with excavation or re-watering the channel and the plume would likely not extend the full 600 feet. Effects to bull trout from small amounts of sediment entering live water would not be as severe as the other construction components. Increased turbidity from road construction/decommissioning may affect normal fish behavior, disrupt feeding, etc., but will not result in gill injury or mortality. The Service assumes that bull trout will temporarily move out of the area of increased turbidity if they need to. The timing and sequence of construction as it relates to the crossing replacement is unknown, but it is expected to occur within the same work season. Best management practices and design features will minimize potential effects associated with ground disturbance especially where the road to be decommissioned is near a stream channel.

Effects to habitat conditions and bull trout from road and trail relocation are expected to be insignificant. Limiting the area of disturbance to ½ acre of new construction will limit the amount of disturbance that can occur and this level of disturbance is not expected to change stream shading, large woody debris (including future recruitment), or the temperature watershed condition indicators. If the project biologist or project design team determines that affects to these indicators would be adverse, the project would not fit within the analysis provided in the Assessment or in this Opinion and therefore the project would not adhere to this consultation. The project would have to be redesigned so that affects to the watershed indicators were not significant or separate consultation would have to occur.

Temporary Crossings

Introduction of sediment due to equipment fording of streams at designated temporary crossings not within the dewatered work area will also result in increased suspended sediment/turbidity, with elevated turbidity expected to last for one hour after each ford and for a short distance, less than 100 feet, downstream. The Service estimates that the effects of increased turbidity are less significant than other components of the Program because equipment will move through the channel very quickly and infrequently. Sediment is expected to dissipate much quicker than the other construction activities that increase turbidity. Most temporary crossings will be located within the dewatered work area, or on temporary bridges (Assessment p. 18), but if that is not feasible then a temporary crossing area will be designated by the project design team (Assessment p. 21). Considering application of project design features and conservation measures, the Service expects that fording the channel could result in suspended sediment levels triggering effects ranging from minor to moderate physiological stress and increased rates of coughing and respiration, impaired homing, and moderate habitat degradation. All these effects can be considered harmful to fish exposed to these conditions, and may temporarily degrade habitat.

No mortality is expected to occur as a result of sediment exposure, but if fish are not cleared from the temporary crossing area, there is potential for fish to be crushed (killed) or injured when vehicles ford streams.

Maintenance of Structures

Following initial construction activities, maintenance activities will be necessary to protect the integrity of the crossings and ensure stream simulation objectives are met. Maintenance actions include removal of debris that has been determined to obstruct fish passage or poses threats to the integrity of the crossing, minor armoring around structure inlets, and re-vegetation. The need for maintenance is expected to be minimal and machinery will not enter streams. In occupied habitats, all conservation measures identified for the structure construction phase will also be implemented during maintenance activities. We anticipate that maintenance activities will be much shorter in duration, with necessary activities not expected to exceed two days. The Service expects the nature of effects to bull trout associated with maintenance, primarily sediment effects, to be less than those anticipated for initial project implementation, and no more than what are currently occurring under the existing maintenance. Effects to habitat condition indicators (sediment, substrate embeddedness, water quality) from maintenance activities will be minor and will have an insignificant effect on bull trout feeding and sheltering behavior.

2.5.1.1.3 Effects from Fish Handling

Prior to dewatering the stream fish salvage (or clearing) operations may occur to remove and relocate fish from the soon to be dewatered work area. A fisheries biologist will conduct, or direct, a survey of the project location during project planning and also prior to implementation in order to determine if ESA listed fish inhabit the project area. The fisheries biologist or designee will also conduct the fish clearing operations prior to construction activities. Methods used to clear fish include passive movement by slow dewatering in steep reaches, electrofishing, and netting or seining. This section describes the various effects that bull trout experience during this process and also the difficulties and assumptions used for estimating fish densities. Adverse effects may occur due to activities such as block net impingement, seining, netting, electrofishing, removal and relocation, and stranding, or a combination of these factors.

Incorporating NMFS electrofishing guidelines (Assessment pp. 98-102) and Idaho Department of Fish and Game collection permit requirements (or state equivalent), will minimize stress, mortality, and competitive effects to bull trout, and will ensure that trained and capable personnel are performing the clearing operations.

Individual fish captured by nets or electroshocking and then handled are subject to many different types of potential injury. These injuries include stress, tissue damage from electrical current, broken vertebrae, bruising, exposure to chemicals, and infection from wounds. The detrimental impacts to individuals from electroshocking are difficult to predict due to complexity and variables associated with the effort such as: type of current; field intensity; exposure duration; fish size and species; stream size; water conductivity; type of electrical current and pulse, frequency, length, waveform; voltage spikes; and repeated exposures. Degree of impacts also depends on the skill of the sampling crew, stream complexity, and visibility. The possible effects include cardiac or respiratory failure, injury, stress, and fatigue. These effects can be immediate or delayed and long-term.

The Service expects the majority of bull trout injuries and death will be due to block nets and electroshocking techniques, while mortality associated with handling stress, seine, and dip nets is unlikely.

Estimating Bull Trout Density

Estimating bull trout density is important for estimating the number of individual bull trout that may be affected by fish clearing operations. The challenge of developing reliable estimates of bull trout densities is complicated by high variability and the use of different metrics in the published literature. For example, bull trout densities have been reported in terms of area, such as per 100 meters^2, as well as linear measurements, per 100 meters or ever per mile. Some of the biological factors influencing bull trout densities are subpopulation demographics, life histories, and spatial and temporal variables related to seasonal availability of forage and high quality habitat. The Service assumes that lower densities of bull trout occur in foraging, migratory and overwintering habitat (FMO), while higher densities of bull trout occur in spawning and rearing habitat. In addition, adults and some subadult bull trout would be using FMO habitat, while younger age class fish would remain in the spawning and rearing areas and would not be utilizing FMO habitat. In bull trout habitat only occupied by resident life history forms, all age classes may be present.

In this Opinion, the Service is following the bull trout density estimates and assumptions provided in the USFWS biological opinion for fish passage restoration activities in eastern Oregon and Washington (USFWS 2004), a very similar effort with similar methods and effects as this Programmatic consultation, which estimated bull trout density to be 10 bull trout per 100 meters for all habitat types. We understand that bull trout densities will vary across subbasins, core areas, and within subpopulations, but providing specific density data for each stream where a project may occur is not feasible within this consultation; therefore we will follow the estimate provided in the USFWS 2004 and use the same assumptions.

Estimates per project from USFWS 2004 rounded up to the nearest whole number:

- 6 fish could be captured and handled during electrofishing activities.
- 2 fish could be injured or killed due to electrofishing.
- 1 fish could be killed due to impingement on block nets.
- 1 fish could be killed due to stream dewatering and stranding in the substrate.

Assumptions by the USFWS 2004 included:

- Density of 10 bull trout/100 meters.
- Average dewatered stream length of 175 feet.
- 3.5 percent block net impingement mortality rate.
- 95 percent capture rate with electroshocking.
- 25 percent electroshocking injury/mortality rate.
- 5 percent stranded fish rate.

Even though the Service understands that projects may be completed in unoccupied bull trout habitat, due to the absence of priority based criteria to govern the selection of culvert sites, it is possible that every project completed under this programmatic could occur within occupied habitat. Therefore, the Service assumes that each project may occur in an occupied stream reach and may affect a bull trout subpopulation. It is also likely that bull trout densities will not conform to the assumed 10 bull trout/100 meters; in some streams these numbers will be much higher, and others it will be lower.

Number of Projects Expected to be Completed under the Program

The Action Agencies propose that a maximum of 156 projects per year in ESA listed fish occupied habitats could be completed under the Program, for an average of 10 projects per year per administrative unit. It is likely, however, given that only about 66 projects were completed in 5 years under the previous programmatic effort, that this number is an overestimate of the number of projects that will be competed. But for estimates of the number of fish that could be injured during a stream crossing replacement project, the maximum number of projects was used in this Opinion.

Block Nets

Prior to dewatering the stream, fish salvage may occur to remove fish from the soon to be dewatered work area. Block nets will be installed upstream and downstream of each site to prevent fish from moving back into the work area. Typically, the Action Agencies will install the block nets, capture and relocate bull trout, divert the streamflow around the project area, then remove the blocks nets all in the same day (Assessment p. 30). Although bull trout will have a general avoidance response to the work area, they may be startled and, in trying to move away from the disturbance, become entangled in the block nets causing injury or death. The Service assumes that personnel will be available while block nets are in place to remove bull trout promptly, thus minimizing effects of impingement.

- Using block net impingement mortality estimates (3.5 percent of population density) derived from Forest Service Region 6 culvert and replacement/removal projects (USFWS 2004, pp. 48-50), and the average estimated density of 10 bull trout/100 meter, it is estimated that one bull trout per project completed under the Program could be killed from being impinged on a block net. Given that 156 site specific projects could be completed each year under the Program, up to 156 bull trout could be injured or killed from block net impingement each year, or up to 1,560 total over the life of the consultation.

Seines and Dip Nets

Seines and dip nets may be used by an action agency to capture and remove any fish trapped between the block nets in the portion of the stream dewatered. The use of seines and dip nets are expected to capture approximately 70 percent of the fish within the section of stream to be dewatered (USFWS 2004, p. 35), but their use is not mandatory and depending on the size of the stream their use may not be feasible.

- If seines and dip nets are used, the Service predicts that it may result in capture and handling of 4 bull trout per project; 624 bull trout a year; 6,240 bull trout over the life of the consultation.

We arrived at these numbers by the following: (10 fish/100 meters)x(.3048 meters/foot)x (175 feet dewatered area per project)x(0.70 bull trout capture rate)x(number of projects per year)x(10 years).

Electroshocking

To estimate the number of bull trout that may be handled by electroshocking, the Service does not assume seining and dip netting occur and the primary method (or only method) of clearing fish from the construction area will be by electrofishing. The capture and handling of bull trout through electroshocking is a short-duration activity occurring intermittently over one day. The Service assumes, based on review of the literature provided in Elle and Schill 2004, that an estimated 96 percent of the fish will be captured. As reported in Elle and Schill 2004, p. 2, 96 percent represents general (3 pass) capture efficiencies in Idaho. The Service also estimates that up to 25 percent of fish exposed to electrical current could be injured, based on literature review conducted by Nielson (1998). Although the risk of electroshocking injuries increase with the size of the fish, we assumed no age/size-based differences in injury rates.

- All bull trout within the electroshocked stream reach will be exposed to electrical current, which is estimated, given the 10 bull trout/100 meters, to be 6 fish per site exposed to electrical current and potentially captured (due to rounding of 95 percent capture rates), with up to 2 bull trout potentially injured or killed from the experience. Given that 156 site specific projects could be completed each year under the Program, up to 936 bull trout could be exposed to electroshocking, or up to 9,360 over the life of the consultation, and 234 could be injured or killed, or up to 2,340 total over the life of the consultation.

The Service understands, however, that more than 6 bull trout could be collected during clearing operations depending on site characteristics, condition of habitat, and subpopulation characteristics, and that, based on the best available information, up to 25 percent of electroshocked bull trout could be harmed during the process.

Removal and Relocation

Bull trout that are collected during electroshocking efforts will be released away from the project site at suitable locations and where they will not likely be in danger of subsequent impingement on nets. Fish that are forced to new habitat may be released into habitat already occupied by bull trout or other resident fish, and may have to compete for available habitat and niches. As a result of being moved, bull trout may suffer from increased competition, loss of cover, stress, and subsequent reduced feeding efficiencies. These behavioral effects may be resolved very quickly if habitat space is readily available, or fish may be forced to seek out appropriate habitat. Overall, the injurious effects of relocation are expected to be temporary (less than a day), sublethal, and bull trout are expected to adjust to their new habitat quickly. However, adverse behavioral effects to bull trout are likely to occur from being relocated to different habitat.

Stranding During Stream Dewatering

During stream dewatering a small percentage (up to 5 percent) of bull trout may avoid being captured and relocated, and thus may die from being stranded in the dewatered work area. The Service estimates that the proposed capture methods will remove approximately 95 percent of the fish prior to stream dewatering.

- The Service estimates that up to one bull trout may be stranded per project, or up to 156 per year, or up to 1,560 over the life of the consultation.

2.5.1.1.4 Chemical Contamination Related Effects

Bull trout could also be affected through impacts to water quality through chemical contamination. Heavy machinery use in stream channels raises concern for the potential of an accidental spill of fuel, lubricants, hydraulic fluid, and similar contaminants into the riparian zone, or directly into the water where they could adversely affect habitat, injure or kill aquatic food organisms, or directly impact bull trout.

Petroleum-based contaminants such as fuel, oil, and some hydraulic fluids, contain poly-cyclic aromatic hydrocarbons, which can cause chronic sublethal effects to aquatic organisms (Neff 1985, p. 420). Fuels and petroleum products are moderately- to highly toxic to salmonids, depending on concentrations and exposure time. Free oil and emulsions can adhere to gills and interfere with respiration, and heavy concentrations of oil can suffocate fish. Evaporation, sedimentation, microbial degradation, and hydrology act to determine the fate of fuels entering fresh water (Saha and Konar 1986, p. 506). Ethylene glycol (the primary ingredient in antifreeze) has been shown to result in sublethal effects to rainbow trout at concentrations of 20,400 mg/L (Staples 2001, p.377). Brake fluid is also a mixture of glycols and glycol ethers, and has about the same toxicity as antifreeze.

During project implementation, heavy machinery will be used adjacent to the stream channel and within the dewatered stream channel. Therefore, there is the potential to introduce petroleum products into the Project area's waterways during work activities. The relevant mechanism of effect is the accidental spill of petroleum-based products during fueling and equipment operations. The likelihood of a fuel spill occurring on travel routes is low due to the limited potential for refueling or maintenance of motorized vehicles. Any adverse effect related to a fuel spill is dependent upon the size of the spill, proximity of the spill to action area streams, and success of containment.

Project design features are incorporated as part of the Program to prevent toxic materials from entering live water. The majority of work is anticipated to occur outside of flowing water, which limits the potential for chemical contamination. The Action Agencies have also proposed the development of spill prevention, containment, and control plan (SPCCP) for all projects to be implemented under this consultation. The SPCCP will be submitted to Level 1 teams which will ensure that they adequately reduce the potential for hazards of chemical contamination to discountable levels. Due to the project's design features, the possibility of petroleum-based products reaching occupied waters is very unlikely. If a spill occurs, amounts will likely be small because they will typically be related to individual vehicles and not associated with larger fuel transport and related transfer operations. In addition, it is unlikely that any machinery or equipment fluids will be spilled in volumes or concentrations large enough to harm bull trout in or downstream of the Project area. In light of these features and the fact that bull trout will be removed from the project area prior to construction activities, effects to bull trout associated with chemical contamination are expected to be discountable.

2.5.1.1.5 Passage Obstruction, Disturbance, Use of Explosives

Passage Obstruction

Where fish passage currently exists, project implementation will temporarily block fish movement at and through the construction site. Resident adult and juvenile bull trout that may be rearing or feeding locally will be temporarily restricted prior to the stream flow being diverted. During fish clearing operations, block nets will be installed at upstream and downstream locations to prevent fish from moving back into the work area. The block nets will typically be in place while the diversion channel is constructed and then will be removed – this normally takes less than one day.

Although there will be a diversion channel that contains flow, it probably will not be designed to provide upstream passage around the project site, but may provide downstream movement. It should be noted that the purpose of most of these projects will be to restore aquatic organism passage, so upstream passage migration blockage may have already been occurring and project activities (stream diversion) will not result in a change of the baseline condition. Although not specified in the Assessment, the Service assumes that most projects may need to divert the channel for a week, but, depending on site specific project complexities, may take longer. If the stream needs to be diverted for longer than two weeks, Level 1 teams should be consulted to ensure there is no additional project effects not already considered in this consultation.

The temporary passage obstruction and diversion around the construction site are not expected to interfere with major life history processes such as spawning, because work will be completed prior to bull trout spawning periods and will not occur where there are redds. Overall, the injurious effects of blocked passage are expected to be temporary, sublethal, and bull trout are expected to recover quickly once the construction is complete and the flow is returned to the stream. The effects associated with passage obstruction are considered insignificant and will not adversely affect bull trout.

Noise and Disturbance Effects

The presence of large machinery in dewatered areas and adjacent to streams where bull trout are present will result in increased noise levels, vibration, and other disturbances associated with increased human presence. The general increase in human activity associated with Program activities is likely to disturb and displace bull trout in the action area. However, these actions are expected to result in only minor disturbances to fish overall, with temporary and insignificant potential avoidance behaviors. Bull trout are typically most active at night, so daytime activities could result in bull trout moving from cover to avoid perceived threats associated with human and equipment presence. The response will be minimal, with fish moving to other available cover in the immediate area. These effects are not considered a significant disruption to normal feeding, holding or sheltering behavior. In most circumstances, the immediate work area during instream construction will be cleared of fish and dewatered so fish will already be moved away from the majority of the disturbance.

Use of Explosives

Site excavation activities may require the removal of large rock or excavation of bedrock to achieve the desired depth for a new crossing structure. If possible, the Action Agencies will use Betonamit, which is a noiseless, shock-free, non-toxic substance that breaks rock through expansive pressure. If it is not possible to use Betonamit for excavation activities, explosive blasting within dewatered areas may be used. The Action Agencies have proposed several measures and design criteria which reduce potential effects of explosive blasting (e.g., fish exposure to chemicals, noise, vibrations, and debris) to insignificant levels. The proposed action also includes buffer distances for explosive use adapted from Wright and Hopky (1998), which we expect will adequately reduce effects to bull trout associated with pressure, toxicity, or vibration. The Service does not anticipate any adverse effects to bull trout associated with potential explosive blasting activities under the proposed action.

2.5.1.2 Effects of Interrelated or Interdependent Actions

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those actions that have no independent utility apart from the action under consideration. Because future maintenance activities are included in the proposed Program they are not considered interrelated or interdependent. The Service did not identify any other potentially interrelated or interdependent actions associated with the proposed action.

2.5.2 Bull Trout Critical Habitat

2.5.2.1 Direct and Indirect Effects of the Proposed Action

The Action Agencies use the watershed condition indicator (WCI) matrix for bull trout to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect bull trout. Using the WCI matrix and the effects analysis included in the

Assessment provides a thorough evaluation of the potential effects of the Program on the primary constituent elements (PCEs) of bull trout critical habitat. How the WCIs relate to the PCEs and the expected effects of the Program on PCEs are summarized in Table 3. Analysis of the affected WCI can provide a thorough evaluation of the existing baseline condition and potential project impacts to the Primary Constituent Elements (PCEs) of bull trout critical habitat (Table 5).

Table 5. Summary Effects to PCEs

#	PCE Description	Watershed Indicators	Indicators Degraded by Program	Anticipated Effect to PCE
1	Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.	Chemical contaminants, physical barriers, substrate embeddedness, channel conditions and dynamics (streambank condition, floodplain connectivity), Flow/hydrology, road density and location, riparian conservation areas.	Channel dynamics and conditions will be impacted during construction. There will be a temporary increase in turbidity and minor bank disturbance.	The increase in turbidity and streambank disturbance will not have significant effects to this PCE. Dewatering and diverting the streams will adversely affect water quantity in short section of dewatered stream. **Significant temporary effect.**
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.	Water quality (temperature, sediment, chemical and nutrient contaminants), physical barriers, change in peak/base flow, width/depth ratio, refugia	There will be a temporary increase in sediment/turbidity and temporary barriers during crossing projects with overall beneficial effects to refugia and migration habitats.	Upstream migration habitat will be blocked during dewatering, although it was likely already blocked, and may be temporarily impacted by increased localized turbidity pulses below the project site. **Significant temporary effect.**
3	An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.	Water quality (temperature, sediment, chemical and nutrient contaminants), physical barriers, substrate embeddedness, pool frequency and quality, floodplain connectivity, riparian conservation areas	Sediment and substrate embeddedness may be sligbtly increased in the temporarily (less than a year). Streambank condition will be negatively impacted by removal of vegetation.	The aquatic food base may be adversely affected by dewatering and deposited sediment downstream of crossings. In the long term, due to restored channel dynamics, this PCE sbould be inproved.

#	PCE Description	Watershed Indicators	Indicators Degraded by Program	Anticipated Effect to PCE
				Significant temporary effect.
4	Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.	Large woody debris, pools frequency and quality, large pools, off-channel habitat, channel conditions and dynamics (width/depth ratio, streambank condition, floodplain connectivity), disturbance history, riparian conservation areas, disturbance regime.	Habitat elements will be temporarily impaired.	This PCE will be adversely affected by dewatering, which effectively eliminates habitat temporarily (expected to take less than 2 weeks). **Significant temporary effect.**
5	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.	Temperature, large pools, refugia, channel conditions and dynamics (width/depth ratio, streambank condition, floodplain connectivity), change in peak/base flows, road density and location, riparian conservation areas.	Temperature will not be affected by the project.	This PCE will be maintained. Stream temperature will not be affected by the Project.
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 minimal amount of fine sediment, generally ranging 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 frem system to system.	Sediment, substrate embeddedness, large woody debris, pool frequency and quality, streambank condition.	See discussion above regarding sediment/turbidity, embeddedness.	Spawning areas within 600 feet downstream of projects may be temporarily adversely affected by fine sediment released during implementation. PDF to capture sediment will be employed, but the potential for increased sediment will not be completely removed. Short- and long-term improvements are expected to this PCE. **Significant temporary effect.**
7	A natural hydrograph, including peak, high, low, and base flows within historic and seasonal	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and	No effects to these habitat features	This PCE will be maintained.

#	PCE Description	Watershed Indicators	Indicators Degraded by Program	Anticipated Effect to PCE
	ranges or, if flows are controlled, they minimize departures from a natural hydrograph.	drainage network increase), watershed conditions (road density and location, disturbance history, riparian conservation areas, disturbance regime).		
8	Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and drainage network increase), water quality (Temperature, sediment/turbidity, Chemical Contaminants and Nutrients), disturbance history, disturbance regime.	Sediment/turbidity may be temporarily increased during project implementation.	Water quantity and quality within the stream crossing areas will be temporarily affected, but the reduction in water quality and quantity is not likely to adversely affect reproduction, growth or survival of bull trout. Effects to this PCE are expected to be insignificant.
9	Sufficiently low levels of occurrence of nonnative predatory (e.g. lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.	Physical barriers, refugia, persistence and genetic integrity.	No effects to persistence and genetic integrity because projects that would facilitate the expansion of brook trout into occupied bull trout habitat are excluded from the Program.	This PCE will be maintained.

As discussed above in Section 2.5, Program activities will have temporary adverse effects to bull trout habitat mainly due to ground disturbing activities associated with increased sediment in streams and dewatering of habitat. PCEs likely to be adversely effected by Program activities are PCE 1, 2, 3, 4, and 6. Project design features, such as diverting the stream, placing sedimats, and re-watering the channel slowly, will be employed to minimize effects.

In-stream work requires block nets, fish salvage, and channel diversion to minimize direct impacts to individuals, and migratory habitats (PCE 2) will be affected during this time. Downstream migration will be blocked for a brief (1 – 2 days) period during fish salvage. Upstream migration will be blocked continually while the stream is dewatered, however, it should be noted that a majority of the crossings removed or replaced under this Program are likely current upstream migration barriers, and dewatering and diverting the stream will not be a change in the baseline at those sites. Bull trout downstream of the culvert may also have migration delayed by turbidity pulses released during project implementation. The adverse effects to PCE 2 will be temporary (during construction) with the ultimate objective to restore passage for bull trout, reduce sediment, and provide access to additional habitat.

Sediment/turbidity is the primary indicator that, as altered, will adversely affect PCEs 3 and 6, by reducing water quality downstream of projects. Road decommissioning and construction activities (for road and trail relocation and decommissioning) may also increase sediment in streams depending on site characteristics, but the end result should be a decrease in sediment from poorly placed or designed crossings and roads. The aquatic food base (PCE 3) may be negatively impacted by deposited sediment for 600 feet downstream of crossings, which may cover aquatic invertebrates and compromise their habitat. Increased sediment and suspended solids downstream of activities have the potential to affect primary production and benthic invertebrate abundance, due to reductions in photosynthesis within murky waters, resulting in decreased food availability for fish (Cordone and Kelley 1961, pp. 189-190; Lloyd et al. 1987, p. 18). Dewatering will also result in the loss of macroinvertebrates in that stream reach. Both dewatering and increased sediment will have temporary adverse effects to PCE 3 for a few months following construction.

Spawning areas (PCE 6) within 600 feet of each stream crossing may be temporarily adversely affected by fine sediment released during the project as there is potential for fine sediment to settle on spawning gravels during construction and re-watering of the stream channel. PDFs to capture sediment will be employed, but the potential increase of fine sediments will not be removed completely.

Dewatering the stream during stream crossing replacements will adversely affect PCEs 1, 3, and 4 for approximately 175 feet at each site for one to two weeks (or longer if agreed upon by the Level 1 team). Small projects would likely be completed in a much shorter time frame. Springs, groundwater sources, and groundwater flows will not be impacted in the action area, but water quantity as it relates to PCE 1 will be eliminated during de-watering. Stream complexity, PCE 4, will be adversely affected in the immediate area of the stream crossings, because the habitat will be unavailable while the stream is dewatered during construction. In the long term, this PCE 4 will be improved as stream function through the crossing, including large woody debris movement, would be restored.

The slight increase in deposited sediment in streams from all activities associated with the Program will not significantly affect PCE 1 or 8. The reduction in the aquatic food base and the temporary alteration of water quality are not expected to have measurable effects to normal reproduction, growth, and survival of bull trout (PCE 8). The lack of water flowing in the construction sites will not have significant effects to PCE 8 as bull trout would be removed from the action area: the Service assumes bull trout will be able to resume normal growth and survival upstream of the project after relocation.

PCEs 5 and 7 relating to stream temperatures and the natural stream hydrograph will not be affected by the Program. PCE 9, relating to invasive species, will also be maintained because projects that would facilitate the expansion of brook trout into occupied bull trout habitat are excluded from the Program.

2.5.2.2 Effects of Interrelated or Interdependent Actions

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those actions that have no independent utility apart from the action under consideration. Because future maintenance activities are included in the proposed Program they are not considered interrelated or interdependent. The Service did not identify any other potentially interrelated or interdependent actions associated with the proposed action.

2.6 Cumulative Effects to Bull Trout and Bull Trout Critical Habitat

The implementing regulations for section 7 define cumulative effects to include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

To a large extent bull trout in the action area are distributed on federally managed lands. However, private and state activities and management programs may affect bull trout or their habitat in some parts of the action area. These may be continuation of effects associated with ongoing activities that include timber harvest, grazing and management of domestic livestock, road construction, agriculture, water diversions, and residential development. Population growth and associated demands for agricultural, commercial, or residential development are expected to affect available habitat quality and quantity for bull trout in the future. Similarly, landowners may take steps to curtail or avoid land management practices that would harm or harass bull trout. However, there is no certainty that this will occur. Therefore, the Service assumes future non-federal actions in Idaho are likely to continue over the next 10 years at similar intensities as in recent years and these actions will cumulatively affect bull trout. The Service anticipates that majority of cumulative effects related to State and private activities will occur within bull trout forage, migratory, and overwintering habitats where the greatest concentration of non-federal lands occur.

Illegal and inadvertent harvest of bull trout is considered a cumulative effect. Harvest can occur through both misidentification and deliberate catch. Schmetterling and Long (1999, p. 1) found that only 44 percent of the anglers they interviewed in Montana could successfully identify bull trout. Being aggressive piscivores, bull trout readily take lures or bait (Ratliff and Howell 1992, pp. 15-16). Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Hooking mortality rates range from 4 percent for non-anadromous salmonids with the use of artificial lures and flies (Schill and Scarpella 1997, p. 1) to a 60 percent worst-case scenario for bull trout taken with bait (Cochnauer et. al. 2001, p. 21). Thus, even in cases where bull trout are released after being caught, some mortality can be expected.

An additional cumulative effect to bull trout is global climate change. Warming of the global climate seems quite certain. Changes have already been observed in many species' ranges consistent with changes in climate (Independent Scientific Advisory Board 2007, p. iii; Hansen et al. 2001, p. 767). Global climate change threatens bull trout throughout its range in the coterminous United States. Downscaled regional climate models for the Columbia River basin predict a general air temperature warming of 1.0 to 2.5 °C (1.8 to 4.5 °F) or more by 2050 (Rieman et al. 2007, p. 1552). This predicted temperature trend may have important effects on the regional distribution and local extent of habitats available to salmonids (Rieman et al. 2007, p. 1552), although the relationship between changes in air temperature and water temperature are not well understood. Bull trout spawning and early rearing areas are currently largely constrained by low fall and winter water temperatures that define the spatial structuring of local populations or habitat patches across larger river basins; habitat patches represent networks of thermally suitable habitat that may lie in adjacent watersheds and are disconnected (or fragmented) by intervening stream segments of seasonally unsuitable habitat or by actual physical barriers (Rieman et al. 2007, p. 1553).

With a warming climate, thermally suitable bull trout spawning and rearing areas are predicted to shrink during warm seasons, in some cases very dramatically, becoming even more isolated from one another under moderate climate change scenarios (Rieman et al. 2007, pp. 1558–1562; Porter and Nelitz 2009, pp. 5–7). Climate change will likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007, pp. 1558–1560; Porter and Nelitz 2009, p. 3); invasions of nonnative fish (Rahel et al. 2008, pp. 552–553); diseases and parasites (McCullough et al. 2009, p. 104); predators and competitors (McMahon et al. 2007, pp. 1313–1323; Rahel et al. 2008, pp. 552–553); and flow alteration (McCullough et al. 2009, pp. 106–108), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PCEs 1, 2, 3, 5, 7, 8 and 9.

2.7 Conclusion

2.7.1 Bull Trout

The Service has reviewed the current status of the bull trout, the environmental baseline in the action area, effects of the proposed Program, and cumulative effects, and it is our conclusion that the Program is not likely to jeopardize the continued existence of the species. The Service concludes that direct effects to adult, subadult, and juvenile bull trout will occur at project sites across Idaho and Nevada (and those portions of surrounding states including in this Program). Effects will be limited to short-term disturbance, feeding rate reduction, increased predation risk, and physiological distress resulting in adverse effects from increased levels of suspended sediment/turbidity and deposited sediment. Anticipated effects should be minimized (but not precluded) by the design features incorporated into the Program. In addition, adult, subadult, and juvenile bull trout may be harmed by impingement on block-nets and all bull trout within the area cleared for fish would be exposed to capture and handling effects from electroshocking. In-stream activities will be completed prior to the on-set of spawning; therefore, spawning bull trout, eggs, or alevins are not expected to be affected by the Project.

Up to 156 individual projects may be implemented across the Idaho bull trout core areas and 38 subbasins per year, with an average maximum of 10 projects per year per administrative unit in occupied habitat. The Service considers this number to be flexible, however, and if an administrative unit has the opportunity to complete more than 10 projects in a single year it is up to the Level 1 team to determine if potential effects are within those described in this Opinion, and consistent with the overall totals anticipated across the action area over the term of the action. The limit to the number of projects is meant to reduce the potential for aggregate effects to a single bull trout subpopulation.

The Service expects that the numbers and distribution of bull trout in the Columbia Basin and Jarbidge population segments will not be significantly changed as a result of this Program; Program impacts will not reduce appreciably the likelihood of both the survival and recovery of bull trout, and may increase the likelihood of both survival and recovery by restoring local connectivity and potential refugia. Therefore, although the proposed action may have some adverse effects to small numbers of bull trout, these effects are not likely to cause a measurable response to bull trout at the local population, core area, management unit, or coterminous U.S. scales. It is the Service's biological opinion that the proposed Program will not jeopardize the coterminous population of bull trout.

2.7.2 Bull Trout Critical Habitat

The Service has reviewed the current status of bull trout critical habitat, the environmental baseline in the action area, effects of the proposed Program, and cumulative effects, and it is our conclusion that the proposed Program is not likely to destroy or adversely modify designated critical habitat for bull trout. Projects completed under the Program will result in temporary adverse effects to 5 of the 9 PCEs (1, 2, 3, 4, and 6), but should improve the condition of critical habitat once the project is complete. Particularly, migratory habitats (PCE 2) will be restored in some streams, and additional spawning and rearing habitat (PCE 6) will be made available. We expect that project design features should reduce the magnitude of adverse effects, but not eliminate them.

There are over 8,770 miles of critical habitat in Idaho, made up of spawning and rearing habitat, and foraging, migratory and overwintering habitat. Individual projects completed under the Program will have temporary significant effects to critical habitat primarily during stream de-watering and construction, which will likely take from one or two days to approximately two weeks. Each project would affect approximately 600 feet of critical habitat; with 156 projects allowed to be completed under the Program this equates to approximately 18 miles, or 0.20%, of critical habitat that could be affected each year. The Service expects, however, that this number is an overestimate; 66 projects were completed over 5 years under the previous programmatic.

Impacts to critical habitat will not affect the functioning or the conservation value of the Kootenai River, Clark Fork River, Coeur d'Alene River, Clearwater River, Salmon River, Hells Canyon Complex, Little Lost River, Southwest Idaho River Basins, or Jarbidge River Critical Habitat Units or any of the subunits within those units. Therefore, we conclude that the project will not destroy or adversely modify designated critical habitat.

2.8 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without specific exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of take in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The Forest Service, Bureau of Land Management and the Corps of Engineers have a continuing duty to regulate the activity covered by this incidental take statement. If the action agency fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the action agency must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

2.8.1 Form and Amount or Extent of Take Anticipated

Take Related to Increased Turbidity and Suspended Sediment from Dewatering, Construction Activities, and Reintroduction of Flow

Because it is difficult to anticipate the number of individual bull trout that will be taken as a result of implementing the Program, we will use both the amount of habitat affected and an estimate of the number of bull trout that may be handled. To address take associated with sediment and turbidity, we will use the amount of habitat affected as a surrogate. We anticipate that all adult, subadult, and juvenile bull trout present within 600 feet downstream of a stream crossing improvement project (replacement or removal), will be subject to take in the form of harassment and harm from direct exposure to the increased levels of suspended sediment, turbidity, and deposited sediment. Elevated suspended sediment may result in direct injury (gill irritation, physiological stress, reduced feeding efficiency), and may also result in harassment and an increased likelihood of injury by causing bull trout to move out of areas of elevated suspended sediment. Effects are not expected to rise to the level of mortality. Moving out of the areas (harassment) may cause loss of territories, increase competition and stress, and reduce feeding efficiency. Incidental take of bull trout associated with sediment effects from stream crossing projects is only anticipated to occur during the in-stream work window (generally May 1 – August 15th) when spawning bull trout, redds or alevins are not present at each stream crossing project. Project design features incorporated into the project are expected to reduce the level of anticipated take. Harassment of juvenile bull trout below project sites may occur as well due to a significant temporary disruption in the normal feeding and sheltering behavior of juvenile bull trout due to increased substrate embeddedness. This take is expected to last until a precipitation event (resulting in a flushing flow) or spring high stream flow flush sediment out of the area (up to one year).

Take associated with increased turbidity and suspended sediment is expected to occur during the construction phases, de-watering and re-watering the stream, but is not expected to occur during the entire project implementation. Take is expected to be periodic during that time, following any turbidity pulses that may occur usually following significant events such as construction of the bypass, and re-watering of the stream channel. Pulses are only expected to last 3 to 4 hours and turbidity levels should drop down significantly by that point.

Sediment and turbidity will not affect spawning bull trout, redds, eggs, alevins because project will not occur where there are spawning bull trout or their redds. No take is provided for spawning adults, eggs or alevins.

Take Related to Temporary Crossings

Considering application of project design features and conservation measures, the Service expects that fording the channel when temporary crossings are needed could result in suspended sediment levels triggering effects ranging from minor to moderate physiological stress and increased rates of coughing and respiration, impaired homing, and moderate habitat degradation, resulting in harassment and harm of adult, subadult and juvenile bull trout in the fording area and immediately downstream for 100 feet for approximately one hour. If fish are not cleared from the temporary crossing area, there is potential for bull trout to be crushed (killed) or injured when vehicles ford streams. This take is expected only when vehicles ford a stream at temporary crossings that are considered necessary and have been designated by the project design teams.

Because each crossing site and bull trout densities within those will be different, and because the need for temporary crossings will be rare, it is difficult for the Service to predict the number of bull trout that could be taken as part of this component. Therefore, we will use habitat as a surrogate. For each temporary crossing that is needed, all bull trout within the crossing area and downstream 100 feet will be subject to take in the form of harm and harassment. The Service assumes that crossings will be approximately 14 feet wide, the average road width of Forest Service roads.

Take Associated with Fish Handling

Prior to dewatering the stream, fish salvage may occur to remove fish from the soon to be dewatered work area. Block nets will be installed upstream and downstream of each site and fish will be removed from the construction site by dip netting and seining, by electroshocking, or by both. Slow dewatering in steep topography may serve to move some of the fish out of the area prior to fish clearing operations.

Take in the form of harm and harassment is expected due to impingement on block nets. Although we do not have bull trout density estimates for every potential site, using block net impingement mortality estimates (3.5 percent of population density) derived from Forest Service Region 6 culvert and replacement/removal projects (USFWS 2004, pp. 48-50), we estimate that one bull trout at each site could be harmed or killed from impingement on the block net. Given that 156 site specific projects could be completed each year under the Program, up to 156 bull trout could be injured or killed from block net impingement each year, or up to 1,560 total over the life of the consultation. Incidental take of bull trout associated with the use of block-nets is only anticipated to occur while the block nets are in place during construction.

If seines and dip nets are used, the Service predicts that it may result in capture and handling of 4 bull trout per project; 624 bull trout a year; 6,240 bull trout over the life of the consultation. No mortality is expected from using seines and dip nets.

If fish are present within a project site, it is most likely that electroshocking will occur to remove fish. All bull trout within the electroshocked stream reach will be exposed to electrical current, which is estimated, given the 10 bull trout/100 meters density we assume in this Opinion, to be 6 fish per site exposed to electrical current and potentially captured (due to rounding of 95 percent capture rates), with up to 2 bull trout potentially injured or killed from the experience. If 156 projects are completed each year then up to 936 bull trout a year, or 9,360 bull trout over the life of the consultation, could be exposed to electroshocking and 234 bull trout a year, or 2,340 over bull trout over the life of the consultation, could be injured or killed. This take is expected to occur only during and immediately following fish clearing operations.

The Service understands, however, that more than 6 bull trout could be collected during clearing operations depending on site characteristics, condition of habitat, and subpopulation characteristics, and that, based on the best available information, up to 25 percent of electroshocked bull trout could be harmed during the process. Therefore, take in the form of harassment is provided for all bull trout that could potentially be electroshocked and harm is provided for up to 25 percent of collected fish.

Bull trout that are collected during electroshocking efforts will be released away from the project site at suitable locations and where they will not likely be in danger of subsequent impingement on nets. Additional take for these fish is not provided for relocation because these are the same fish captured by dip nets, seines and electrofishing efforts and take is provided for them under those categories.

Stranding from Stream Dewatering

During stream dewatering a small percentage (up to 5 percent) of bull trout may avoid being captured and relocated, and thus may die from being stranded in the dewatered work area. The Service estimates that the proposed capture methods will remove approximately 95 percent of the fish prior to stream dewatering. The Service estimates that up to one bull trout may be harmed by being stranded per project, or up to 156 per year, or 1,560 over the life of the consultation.

Summary

If incidental take anticipated by this document is exceeded, all project activities will cease and the action agency will immediately contact the Service to determine if consultation should be reinitiated. Authorized take will be exceeded under the following conditions.

1. Suspended sediment levels within the project site and for 600 feet downstream exceed those described in this Opinion and as reported by Yenko (2007), Foltz et al. (2012), Casselli et al. (2000), Jakober (2002); or

2. Suspended sediment levels that cause adverse effects to fish (on the severity scale described in Section 2.5.1.1.2) are observed further than 600 feet downstream from project activities; or

3. Temporary crossings are wider than 14 feet and increased turbidity extends beyond 100 feet downstream; or

4. More than one bull trout per project is harmed or killed by impingement on blocknets; or

5. More than 25 percent of all bull trout collected by electroshocking are injured or killed. The Service expects that all bull trout within a project site will be subject to take in the form of harassment from electroshocking (average of 6 bull trout per 100 meters of habitat); or

6. More than 4 bull trout are captured by seines or dip nets per project; or

7. More than one bull trout are harmed or killed by stranding during stream dewatering; or

8. More than 156 projects are implemented in any single year, or more than 10 projects implemented on an administrative unit without prior approval from the Level 1 Team.

2.8.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the bull trout across its range. This Program will occur in two population segments, the Jarbidge River and the Columbia River, and is not expected to reduce the reproduction, status, and distribution of bull trout in the action area, and will not appreciably reduce the likelihood of survival and recovery of either population segments.

The Jarbidge population segment currently contains a single core area with six local populations: East Fork Jarbidge River, West Fork Jarbidge River, Dave Creek, Jack Creek, Pine Creek and Slide Creek. Recent information provided in Allen *et al.* (2010) indicates population is much healthier (up to four times the numbers) than the recovery plan estimate of 500, and bull trout exhibit more migratory behavior than previously thought. No stream crossing projects were implemented in this population segment through the previous programmatic (Hoefer 2012. *in litt.*) and the Bureau expects that there is only approximately 15 to 20 stream crossings total in occupied bull trout habitat that may be replaced under the Program (Hoefer 2012, *in litt.*). Given the conditions in the Jarbidge and the low number of potential projects, the Program will not appreciably reduce the population.

The Columbia River population segment comprises 22 management units. This population segment currently contains 97 core areas and 527 local populations. The action area for this Programmatic includes Forest Service and Bureau managed lands in Idaho, which spans nine management units: Clark Fork River; Kootenai River; Imnaha-Snake River; Hells Canyon Complex; Coeur d'Alene Lake Basin; Clearwater River; Salmon River; Southwest Idaho (Boise, Payette and Weiser river basins); Little Lost River. The number of local populations puts this population segment at a low risk for extirpation.

We do not anticipate appreciable changes in the numbers, distribution, or reproduction of bull trout in any of the core areas or local populations that occur in the action area. Over the long term, the projects implemented under this programmatic consultation are expected to contribute to the conservation and recovery of bull trout throughout the action area, and the Columbia River and Jarbidge River distinct population segments.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize the take of bull trout caused by the proposed action.

1. Minimize incidental take and site disturbance by appropriate consideration of alternative project designs and implementation methods during the streamlining process.
2. Minimize incidental take that occurs as a result of programmatic project implementation.
3. Establish a monitoring program on each Forest or Bureau District to confirm that projects implemented under this Program are meeting objectives of the programmatic consultation and are also not exceeding the amount and/or extent of take from permitted activities.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest Service and Bureau of Land Management must comply with the following terms and conditions, which implement the reasonable and prudent measures described above:

1. To implement RPM #1 the Forest Service, Bureau, and Corps shall ensure the Project Design Team (PDT) seeks input and agreement from Level 1 Teams during design process and during pre-project reviews. The PDT shall remain flexible in the design process in order to adapt to various and unique site conditions and ensure the likelihood that completed projects meet programmatic objectives.

2. To implement RPM #2 the Forest Service, Bureau, and Corps shall ensure the following.
   a. Implement the following best management practices in addition to implementing all programmatic activities consistent with the project design criteria, activity types, and mitigation measures presented in the proposed action.
      1. Determine, based on site characteristics, whether or not reducing stream flow in order to passively move fish out of the construction site prior to electroshocking would reduce the potential for take of bull trout associated with electroshocking. Prioritize this passive movement of fish as appropriate.
      2. Electroshocking (where utilized) will be conducted with a three pass method to ensure the greatest level of fish salvage unless previously approved by the appropriate Level 1 Team to perform more or fewer passes.

3. Ensure that holding conditions for any transported fish provide the lowest level of stress to captured individuals by ensuring the availability of cold, well oxygenated water in holding vessels, minimizing holding time, and avoiding any predation in holding vessels. To avoid predation consider separate holding vessels for different age classes.
4. While block nets are set, inspect them regularly for fish and remove any living to an area far enough away from the crossing to avoid additional impingement risk.
5. Stream dewatering is not expected to last more than two weeks. If site specific conditions require dewatering and diverting the stream channel for longer than two weeks, Level 1 Teams shall be consulted to determine if additional measures are necessary to ensure that project effects are within those described in this Opinion.
6. For projects in bull trout spawning and rearing habitat, if in-stream work is required, in-stream work shall be completed by August 15th and in-stream work may not commence in the spring until May 1, to avoid potential effects to spawning bull trout, eggs, alevins, and fry. If site specific information and rationale (attached to the pre-project checklist) shows that these time frames can be adjusted without additional harm to bull trout, the Level 1 Team has the discretion to do so. Rationale for work in spawning areas in the spring prior to May 1 should also include site specific survey data that indicates bull trout did not spawn there the previous year.

b. The guidelines found at http://swr.nmfs.noaa.gov/pdf/Treated%20Wood%20Guidelines-FINALClean_2010.pdf (NOAA 2010) shall be used for any installation of treated wood if copper or creosote-based treatments are used. For other treated wood products, adhere to guidelines and BMPs in "Preservative-Treated Wood and Alternative Products in the Forest Service" (USFS 2006) and the Western Wood Preservers Institute "Best Management Practices for the Use of Treated Wood in Aquatic Environments" (1996).

c. Survey all proposed ford sites prior to design and implementation to evaluate the stream for potential bull trout spawning habitat and to ensure project design does not promote spawning at or immediately downstream of the proposed ford site.

d. Provide Level 1 Teams with a written rationale statement (attached to pre-project checklist) supporting any determination that overall impacts to stream channels will be reduced at crossing sites proposed for conversion to a ford.

e. If a temporary crossing is needed, the PDT will ensure that the designated temporary crossing area minimizes effects to fish and critical habitat.

   1. Provide Level 1 Teams with a written rationale statement (attached to the pre-project checklist) as to why the temporary crossing is necessary and what steps are being taken to ensure effects are minimized.

2. The area shall be cleared of fish prior to equipment crossing, and the block nets will removed immediately after equipment crosses.
3. Minimize the frequency of crossings by equipment: Only allow equipment and vehicles to cross that are absolutely necessary.
4. Width of temporary crossings will be approximately 14 feet wide, the average road width of Forest Service roads.

3. To implement RPM #3 the Forest Service, Bureau, and Corps shall ensure the following.
   a. All captured, handled and killed ESA-listed fish shall be identified, counted, and reported on the 'post-project checklist' (Appendix A).
   b. The Action Agencies will implement a suspended sediment/turbidity monitoring program. Under the monitoring plan a reasonable sample of projects implemented under this consultation will be assessed to assure that the incidental take associated with suspended sediment and exempted in this Opinion has not been exceeded. At a minimum, 25 percent of projects completed under this Program will have monitoring completed that assesses the duration and intensity of turbidity. Monitoring can be adjusted as needed, but should consider the following recommendations.
      1. Monitoring should occur above the site once for reference conditions before the project begins and prior to stream re-watering.
      2. Monitoring should occur below the construction site where the bypass or stream diversion enters the stream and 600 feet below the site. Alternative sites may be chosen if 600 feet is excessive for a particular site.
      3. Measurements shall be recorded at the following times: (a) Prior to re-watering the stream, and (b) every 30 minutes after re-watering for 4 hours or until turbidity decreases to background.

2.8.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [(50 CFR 402.14 (i)(3)].

1. The action agency shall provide a Post Project Checklist for each project to the Level 1 Team within one year of completion detailing project implementation, including monitoring information and fish capture results. Bull trout surveys conducted for a project must adhere to the State Collection Permit and agencies must comply with the reporting requirements within the Permit.
2. Upon locating dead, injured, or sick bull trout not anticipated by this Opinion, as a result of Project activities, such activities shall cease. Please notify the Service within 24 hours. Circumstances leading to this unanticipated take will be discussed between the action agencies and the Service to determine whether and how the individual project and the Program as a whole, can move forward.

3. During project implementation promptly notify the Service of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.

2.9 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop new information on listed species.

- Prioritize culvert replacement projects to better allocate scarce funds and replace crossings that provide the most benefits to listed fish.
- Minimize the use of riprap on new structures to the smallest extent reasonable to limit the amount of streambank alteration and to ensure fish habitat is maintained while providing structural stability.
- Removal and disturbance of riparian vegetation will be minimized as much as possible when designing projects, siting relocated trails, roads and crossings, and designating temporary crossings. Disturbance to riparian vegetation will not degrade stream shading, large woody debris recruitment, or temperature to a significant level.
- If fords are proposed, relocated, or culvert crossing are proposed to be converted to a ford, and surveys indicate that it is within spawning habitat, seek alternative locations outside of spawning habitat.
- As feasible, incorporate bioengineering techniques as a substitute for or with hard armoring techniques (riprap).

2.10 Reinitiation Notice

This concludes formal consultation on programmatic Restoration Activities at Stream Crossings on National Forests and Bureau of Land Management lands in Idaho. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion.
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion.
4. A new species is listed or critical habitat designated that may be affected by the action.

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3.2 *In Litteris* References

Hoefer, S. 2012, *in litt.* Email from Scott Hoefer, Fish Biologist (U.S. Bureau of Land Management, Idaho State Office, Boise, Idaho) to Pam Druliner, Biologist (U.S. Fish and Wildlife Service, Boise, Idaho). Subject: Re: How many potential projects would occur in Jarbidge. May 10, 2012.

4. APPENDICES

4.1 Appendix A: Project Checklists

PRE-Project Checklist

Complete checklist prior to implementation and submit to NMFS and FWS at Level 1 meetings and if requesting Section 404 permit coverage, to USACOE. Use one checklist/crossing. Provide the following attachments: NEPA documentation, map, and photos of existing crossing, and document if any are not applicable.

Administrative unit	
Subbasin Name and Number (Table 4)	
Project Name:	
Stream Name:	
Activity category (Section II.A)	
Width and slope of existing structure	
Bankfull width and slope of channel	
width and slope of proposed structure	
Anticipated date of implementation	
Pre-project fish passage (red/green/gray)	
Bull trout spawning and rearing (Yes/No)	
Bull Trout Recovery Unit and Core Area (Apdx. A)	
Chinook, steelhead population (Appendix A)	
Anticipated adverse effects to listed species (Y/N)	
If 'Yes,' provide brief explanation:	
Design Team members	**Additional Team members, if necessary**
Fisheries Biologist:	
Wildlife Biologist:	
Hydrologist:	
Engineer:	

ESA-listed Species within Project Area (check those that apply):

Species	**√**	**Species/Critical Habitat**	**√**
Grizzly Bear		Bull trout	
Canada lynx		Critical habitat	
Northern Idaho ground squirrel		Steelhead	
Yellow-billed cuckoo		Critical habitat	
Columbia spotted frog		Sockeye salmon	
McFarlane's four-o'clock		Critical habitat	
Spalding's catchfly		Spring/summer Chinook salmon	
Water howellia		Critical habitat	
Slickspot peppergrass		Fall Chinook salmon	
		Critical habitat	

NMFS Tracking # ____________________ **USFWS Tracking #** ____________________

POST-Project Checklist

Complete checklist within one year of project implementation and submit to NMFS and FWS at Level 1 Meeting. Use one checklist/crossing. Provide the following attachments: photos of new crossing and pre-project checklist.

Administrative unit	
Subbasin Name and Number (Table 4)	
Project Name	
Stream Name	
Width and slope of new structure	
Length of upstream habitat opened for passage	
Date of implementation	
Post-project fish passage (red/green/gray)	
Turbidity monitored during implementation (Yes/No)	
Excessive erosion observed as a result of project (Yes/No)	
If 'Yes,' provide brief explanation	
Headcutting observed above new crossing (Yes/No)	
If 'Yes,' provide brief explanation	
Is there effective substrate retention or recruitment (Y/N)	
If 'No,' provide brief explanation	
Method of fish collection during dewatering operations	
Area dewatered during implementation	
Number, species, and life stage of ESA-listed fish *handled*	
Number, species, and life stage of ESA-listed fish *injured*	
Number, species, and life stage of ESA-listed fish *killed*	

NMFS Tracking # ____________________ **USFWS Tracking #** ____________________