Table 4. Outfall 001 Effluent Limits and Monitoring Requirements (taken from the Assessment)

Parameter	Units	Effluent Limits and Monitoring Requirements [1]			
		Maximum Daily Limit [3]	Average Monthly Limit	Monitoring Frequency	Sample Type
Arsenic [2]	µg/l	100	50	Weekly	Grab
Cadmium [2]	µg/l	0.52	0.26	Weekly	Grab
Cobalt [2]	µg/l	141	70.4	Weekly	Grab
Copper [2]	µg/l	4.80	2.40	Weekly	Grab
Lead [2]	µg/l	0.90	0.45	Weekly	Grab
Mercury [2]	µg/l	0.02	0.01	Weekly	Grab
Nickel	µg/l	26.52	13.22	Weekly	Grab
Thallium	µg/l	0.95	0.47	Weekly	Grab
Zinc	µg/l	37.02	18.45	Weekly	Grab
Ammonia (total as N)	mg/l	4.1	1.6	2/Month	Grab
Nitrate + Nitrite	mg/l	10 [4]	--	2/Month	Grab
Sulfate	mg/l	250	--	2/Month	Grab
Sulfide	µg/l	2	--	2/Month	Grab
TSS	mg/l	30	20	Weekly	Grab
pH	s.u.	Between 6.5 and 9.0 at all times		Weekly	Grab
Dissolved Oxygen	mg/l	Must exceed 6.0 at all times		2/Month	Grab
Temperature	C°	19	--	2/Month	Grab
Iron	µg/l	--	--	Monthly	Grab
Aluminum	µg/l	--	--	Monthly	Grab
Hardness	mg/l	--	--	Monthly	Grab
Chloride	mg/l	--	--	Monthly	Grab
Conductivity	mS/m	--	--	Monthly	Grab
TDS	mg/l	--	--	Monthly	Grab
Whole Effluent Toxicity (WET)	TUC	--	--	1x/6 months	Grab
Expanded Effluent Testing	--	--	--	3x/5 years	Grab

Notes to Table:

1. Metals limits expressed as total recoverable except for mercury which is expressed as total.

2. Expanded effluent testing includes the 126 chemicals listed in 40 CFR § 131.36. This testing shall occur in years 2, 3 and 4 of the permit cycle, and should occur coincident with the September WET testing and other routine monitoring (see Part I.C.1).

3. Reporting is required within 24 hours of a maximum daily limit violation.

4. The maximum daily limit for nitrate was reduced from 100 mg/l to 10 mg/l since the Assessment was released to the Service (Lisa Olsen, EPA, Pers. Comm. May 8, 2008).

Cadmium

Cadmium occurs naturally in the environment. It is bioaccumulated by organisms but is not biomagnified through the food chain (Eisler 1985). Toxicity of cadmium to aquatic organisms varies with water hardness, alkalinity, the type and life stage of organisms, presence of organic matter, presence of other toxicants, and the duration of exposure (EPA 1999). Cadmium is considered one of the most toxic of metals to fish (Sorensen 1991).

EPA (1996) reported mean acute toxicity values of sensitive life stages for rainbow and brown trout at 3.6 and 1.6 µg/l, respectively and chronic values for brown and brook trout at 7.4 and 2.2 µg/l, respectively. Concentrations above the daily and monthly effluent limits proposed in the NPDES permit. However, chromium and zinc are reported to alter toxicity of cadmium when in a mixture, resulting in enhanced uptake of cadmium. Studies with bull trout in water column mixture toxicity tests with Cadmium and zinc indicate that bull trout are sensitive to cadmium at concentrations near the effluent limits. The 120-hour LC_{50} for Cadmium in a mixture was 0.51 µg/l (hardness=30 mg/l), just below the daily effluent limit (0.52 µg/l) but above the monthly limit (0.26 µg/l; Hansen *et al.* 2002).

Cobalt

EPA has not adopted aquatic life criteria for cobalt due to a lack of sufficient toxicology data. However, as part of the CERCLA action at the Blackbird Mine, a site-specific criterion was developed based on site-specific toxicity testing. Summary results indicate the LC_{50} to rainbow trout (using Panther Creek water) ranged from 800 to 860 µg/l for acute exposure, while a chronic exposure of 242 µg/l resulted in a 5% reduction in growth, and no reduction in growth at 101 µg/l (Mebane 2007). Daily and monthly effluent limits are well below concentrations expected to result in adverse effects.

Copper

Copper occurs naturally in the environment and is an essential trace element for most organisms. The toxicity of copper to aquatic organisms is dependent on the speciation of the chemical, water hardness, and type and life stage of the exposed organisms. Studies have reported rainbow trout growth was significantly reduced and whole body copper concentrations elevated in fry after 20 days of exposure to copper levels of 4.6 µg/l (hardness=0.027 µg/L; Marr et al. 1996), concentrations below the maximum daily limit proposed for the NPDES permit. Additionally, studies by Hansen et al. (1999) reported avoidance behavior in rainbow trout exposed to concentrations of 1.6 µg/l copper.

Lead

Lead occurs naturally in the environment and has been reported to bioconcentrate; it can be found in rocks, soils, water, plants, animals, and air. It is soluble in water and its bioavailability increases in environments with low pH, low organic content, and low metal salt content (Eisler 1988). Lead is most often precipitated to sediments in aqueous environments. Adsorption of lead by aquatic animals is affected by the age, gender, and diet of the organism, as well as the particle size, chemical species and presence of other compounds in the water (Eisler 1988). Species that are sensitive to lead are affected more strongly by dissolved rather than total lead. Likewise, the toxicity of lead is increased when it forms organolead compounds and when environmental conditions consist of high temperature and low pH. Much of the available data demonstrates adverse effects to salmonids at concentrations above the proposed NPDES effluent limits.

Mercury

Mercury occurs naturally in the environment and accumulates and biomagnifies through the food chain (Eisler 1987). Among metals tested, mercury was the most toxic to aquatic organisms, and organomercury compounds showed the greatest biocidal potential (Eisler 1981). Both organic and inorganic mercury bioaccumulate, but organic mercury (methylmercury) accumulates at greater rates (EPA 1997). In general, toxicity was higher at elevated temperatures and in the presence of other metals such as lead and zinc (Eisler 1987). The Service (2000) previously developed an adverse effect concentration for total mercury in water for larger, piscivorous fish or tertiary consumers (as bull trout are) of 0.005 μg/l using the EPA (1997) default Bioaccumulation Factor and a LOAEL of 2.7 μg/g whole body concentration in brook trout determined by McKim et al. (1976). This concentration is likely to be associated with reproductive impairment.

Nickel

Nickel occurs naturally in the environment and is an essential trace element for many organisms. It is bioaccumulated and bioconcentrated by aquatic organisms (Eisler 1998). Toxicity of nickel to aquatic organisms is dependent on water hardness, pH, ionic composition, chemical form, type and concentration of ligands, presence of mixtures, and availability of solid surfaces for adsorption (Eisler 1998). Nickel interacts with many compounds to produce altered patterns of accumulation, metabolism, and toxicity (Eisler 1998). Birge and Black (1980) reported an LC_{10} for rainbow trout embryos of 11 μg/L while avoidance was observed in adults at water concentrations of 23.9 μg/L (Nebeker et al. 1985), both concentrations fall below the monthly and daily effluent limits, respectively.

Thalium

Thallium is a nonvolatile heavy metal that exists in water primarily as a monovalent ion. Aquatic life criteria have not been developed for thallium due to the lack of toxicity data, therefore the draft NPDES permit incorporated the human health criterion for toxic substances, which is based on human consumption of fish (maximum of 0.47 μg/l). The literature reports for thalium toxicity to aquatic species indicate concentrations at which adverse effects are expected to be well above the daily and monthly effluent limits.

Zinc

Zinc occurs naturally in the environment and is an essential trace element for most organisms. It bioaccumulates but does not biomagnify (EPA 1999). Cadmium, copper, iron, and molybdenum can interact antagonistically with Zn (Hammond and Beliles 1980), whereas calcium and magnesium can reduce toxicity (EPA 1999). However, aqueous solutions of cadmium and zinc have also been additive in toxicity to freshwater fish (Skidmore 1964). Mixtures of Zn and Cu are generally acknowledged to have greater than additive toxicity to a wide variety of aquatic organisms including freshwater fish (Eisler 1993). This becomes particularly important when effluent limits for other constituents (e.g., copper) are at or above concentrations reported to cause adverse effects.

Mixtures

Fish and other aquatic organisms will be exposed to the whole effluent with unknown combined effects of the metals. Antagonistic metal reactions, which reduce the toxicity of metals primarily through precipitation, result in solutions that are less toxic than simple metal solutions. For example, calcium markedly counteracts the toxic effects of copper, lead, potassium, sodium and zinc (Dourdoroff and Katz 1995: in Nelson et al. 1991). Conversely, combinations of metals can be synergistic; their joint effect being greater than the sum of the separate effects. Copper, cobalt, zinc and cadmium, which occur in the effluent, are known to act synergistically. Of the metals in the effluent, the metals of primary concern with potential synergistic effects are cobalt and copper, since copper loading is an issue in the watershed from past mining activities. Additionally, avoidance responses have been demonstrated to occur at very low concentrations both in the laboratory and in field studies (Sprague 1985) and the avoidance response varies depending on the mixture of metals encountered, the species of salmonid studied, and water chemistry conditions.

Ammonia

Discharge of ammonia may impact receiving waters in three ways: 1) by causing acute or chronic toxicity, 2) by causing DO depression due to nitrogenous biological oxygen demand (BOD), and 3) by adding nitrogen, which may act as a nutrient, to the receiving water. Studies have reported acute toxicity of un-ionized ammonia to freshwater organisms in a wide range of concentrations. Acute effects include loss of equilibrium, hyperexcitability, increased breathing, cardiac output, and oxygen uptake, convulsions, coma, and death. Chronic effects of ammonia on freshwater organisms include reduced hatching success, growth rate, and morphological development, and pathological changes in tissues of gills, livers, and kidneys (EPA 1999).

Nitrates

Nitrate is a pollutant present in mine drainage water at the ICP as a residual from explosives used in underground blasting operations. EPA applies the permit limit to the combined form of nitrogen as "nitrate plus nitrite" because nitrite nitrogen is relatively unstable and is easily oxidized to the nitrate form. As discussed in the NPDES permit fact sheet materials, nitrite is not expected to be present in the Mine Project wastewaters. Elevated nitrate concentrations are a concern from both the standpoint of toxicity, which may occur at very high concentrations, and from the standpoint of eutrophication (stimulating excessive algal growth) and resulting in negative effects on dissolved oxygen and pH regimes. Based on concentrations reported in the literature that cause adverse effects, and the concentrations predicted to be discharged from the Mine Project, it is not likely concentrations of nitrates will rise to toxic levels (McGurk et al. 2006). Additionally, based on discussion between National Marine Fisheries Service and EPA, and the concern for adverse affects to salmonids, it was determined that the NPDES effluent limit would be lowered from 100 mg/l nitrate (which is the effluent limit set in the draft NPDES permit) to 10 mg/l nitrate (Lisa Olsen, EPA, Pers. Comm. May 8, 2008).

Total Suspended Solids

Total suspended solids (TSS) measures both settleable and suspended sediment and organic matter in a discharge. Although concentration and duration of exposure are the primary drivers of TSS effects on fish, other factors influence the degree of effects. Using available past study results, Newcombe and Jenson (1996) developed matrices of TSS dose and response. For juvenile and adult salmonids, their results suggest behavioral effects are likely at 20 mg/l TSS over short durations (< 144 hours). Over longer durations, the severity of ill effects increases, but does not exceed a sublethal level of effects at this exposure concentration. For larval salmonids, effects of 20 mg/l are sublethal when maintained for 1 to 144 hours. Sublethal effects include: reduction in feeding rate and success and physiological stress. For the egg stage, effects of 20 mg/l are sublethal (physiological stress) when maintained for 1 to 144 hours. The lethal effects occur at longer durations of exposure. A secondary effect of TSS is degradation or loss of habitat due to fine sediment deposition at areas with diminished flow. Also, populations of macroinvertebrates, a primary food source for salmonids, can be reduced due to habitat reduction from fine sediment deposition. Based on typical flows in Big Deer Creek, dilution of the effluent water should minimize any potential adverse effects from TSS.

pH

The pH of natural waters is a measure of the acid-base equilibrium achieved by the various dissolved compounds, salts, and gases in the water and is an important factor in the chemical and biological systems of natural waters. The IDEQ and EPA freshwater criteria indicate that water quality standards for pH lie between values of 6.5 and 9.0. The primary concern with changes in pH is the interaction and effect of pH on toxicity of metals. pH activity has a significant impact on the availability and toxicity of metals. Metal-hydroxide complexes tend to precipitate (i.e., reduced ability to remain suspended) and are quite insoluble under natural water pH conditions, thus, the metal is not able to exert a toxic effect. However, the solubility of these complexes increases sharply as pH decreases. The pH activity also affects the sensitivity of organisms to a given amount of metal.

Dissolved Oxygen

The dissolved oxygen concentration limit in the draft NPDES permit is set at the State water quality criteria minimum of 6 mg/L for cold water aquatic life. Dissolved oxygen concentrations can be expected to remain at or near saturation with air in high gradient mountain streams unless they are impacted by organic sources of pollution. As with other constituents, the early life stages of fish (egg, embryo, alevin) are the most sensitive life stage to alterations of dissolved oxygen. The general recommendation is that dissolved oxygen should be at or near saturation for successful incubation of salmonid fish. Juvenile salmonids may be able to survive when dissolved oxygen concentrations are relatively low (< 5 mg/L), but growth, food conversion efficiency, and swimming performance will be adversely affected. High water temperature, which reduces oxygen solubility, can compound the stress on fish caused by marginal dissolved oxygen (Bjornn and Reiser 1991). Mining and milling operations are expected to have little effect on dissolved oxygen concentration as predicted by the low biological and chemical oxygen demand concentrations as outlined in EPA's fact sheet for the NPDES permit.

Temperature

Studies on the growth and survival of bull trout indicate that as temperature increases, growth and survival of bull trout decreases (Selong et al. 2001). At temperatures above 22°C, survival of larval bull trout was 0 %. At temperatures greater than 16°C, food consumption declined significantly, and completely ceased when temperatures reached 22°C. Saffel and Scarnecchia (1995) also found that stream reaches with the highest densities of bull trout had maximum summer temperatures ranging from 7.8 -13.9°C, whereas most reaches with low densities had higher maximum summer temperatures (18.3 - 23.3°C). Additionally, temperature change may increase, decrease, or cause no change in toxicity depending on many factors including the toxicant or species (Sprague 1985). As outlined in Appendix C of the Assessment, the effluent discharge from the Mine Project is expected to be in the range of 11°C in the winter and 14°C in the summer.

Sulfate

Sulfur is one of the critical elements in living matter, as it participates in several structural, metabolic and catalytic activities; it is a critical component of photosynthesis. Sulfur compounds are naturally occurring within the ore body at the Mine Project in the form of metallic sulfide minerals. In contact with aerated water the sulfides are oxidized to sulfate ions. Once liberated, both sulfates and sulfides would be present in wastewater from the mill and in the discharge at Outfall 001.

EPA has not established toxics criteria for sulfates or sulfides in 40 CFR § 131.36, and Idaho has not adopted any numeric criteria for these pollutants to protect aquatic life or human health in their Water Quality Standards and therefore effects to aquatic biota are based on the best available science. EPA set the sulfate maximum daily limit in the draft NPDES permit at 250 mg/l based on the secondary drinking water standard (EPA 2004), and not on toxicity to aquatic life. The maximum daily limit for sulfide was set at 2 μg/l, based on the chronic criteria for protection of freshwater aquatic life (EPA 1986).

A review of the literature indicated that the potential toxicity of sulfates to salmonid species and invertebrates is 2 to 3 times higher (BC Research 1998, Davies and Hall 2007, Soucek 2004, Soucek 2007) than the draft permit effluent limit of 250 mg/l. For impact evaluation purposes, the No Observed Effect Concentration for an early life stage of a salmonid species of 1060 mg/l is considered protective of listed species (BC Research 1998) and will be used to evaluate the potential effluent toxicity to fish that may occur in Big Deer Creek.

Treated water that is discharged to Big Deer Creek is predicted to have sulfate concentrations ranging from approximately 400 to 840 mg/l, depending on flow. As part of the Plan of Operations for the Mine Project, a mixing zone for sulfate has been requested. Within the mixing zone, the Mine Project discharge would be diluted to meet the water quality standard of 250 mg/l established in the draft NPDES permit.

At the point of discharge, sulfate concentrations immediately adjacent to the diffuser ports would be similar to the discharge, 400 to 840 mg/l. At the edge of the assumed regulatory mixing zone (25% mixing; the mixing zone should be limited to 25% of the width and volume of the stream to allow a zone of passage for aquatic life), sulfate concentrations would range from approximately 34 to 166 mg/l during average conditions and low flow (7Q10) conditions, respectively. Outside of the regulatory mixing zone after mixing with the entire volume of Big Deer Creek is achieved, sulfate concentrations in Big Deer Creek are predicted to increase from approximately 7 mg/l to 54 mg/l, depending on flow in Big Deer Creek. The worst case scenario of low stream flow and 25% mixing area results in a predicted maximum sulfate concentration of 166.1 mg/l, much lower than the estimated protective value of 1,060 mg/l.

Affects of NPDES Permit

No bull trout have been surveyed in Big Deer Creek (Kuzis 2004, Stantec 2004, Ecometrix 2006, Forest Service 2006, Keeley, pers. comm. 2008). Based on the multiple sample attempts, the Service does not consider Big Deer Creek to be occupied by bull trout, and they are blocked from access to Big Deer Creek at the cascades/falls located 2.3 miles below the outfall location.

Stream flow characteristics of Big Deer and Panther Creek were derived using US Geological Survey StreamStats and Q-80 flow duration statistics (Q-80 is the 80% exceedence flow, an estimate of the natural flow stream flows for an average year that characterizes dry year flows). Low flow stream characteristics are estimated at 6.9 cfs (at the lowest flow in the summer) for Big Deer Creek (at the proposed outfall) and 51.1 for Panther Creek and the confluence of Big Deer Creek. The estimated mean and maximum volume for the discharge is 112 gpm (0.25 cfs) and 150 gpm (0.33 cfs), respectively. When discharged into Big Deer Creek and Panther Creek the dilution of the effluent ranges from a factor of 21 – 28 in Big Deer Creek to 155 – 204 in Panther Creek, based on flows. As such, at Outfall 001, contaminants are mixed by a dilution factor of 21-28 at expected low flows (based on September Q-80 estimates); further dilution occurs after mixing with Panther Creek increasing the dilution factor to a range of 155 – 204.

As such, while concentrations of constituents discharged through Outfall 001 may by elevated enough to cause acute and chronic effects at the discharge point (as straight effluent prior to any dilution, which would occur immediately), and/or mixtures of metals may act synergistically with each other, increasing toxicity, the dilution factors (the lowest being a dilution of 21 times once the discharge water mixes with Big Deer Creek) results in concentrations of constituents that would be insignificant to any bull trout exposed to it in Big Deer Creek below the impassable cascade (2.3 miles downstream from the outfall) and below concentrations at which adverse effects have been reported. Concentrations of constituents discharged from Outfall 001 would be well below Idaho water quality criteria by the time they reach the impassable cascade at the bottom of Big Deer Creek (where they may come in contact with bull trout). As such, adverse affects to bull trout are not anticipated and would not be measurable as a result of the NPDES permit.

Riparian Disturbance and Sedimentation

Disturbance to riparian vegetation would include short-term impacts during installation of a cable car across Panther Creek near Big Flat Creek and construction of the NPDES outfall on Big Deer Creek. The cable car would result in localized vegetation removal and streambank disturbance on each bank, and localized, transient disturbance of the steambed from crossing of a backhoe or excavator (a total of two trips – to one side of the Creek and back) to access the far-bank deadman site. However, per discussions with Bob Rose, Forest Fisheries Biologist (Pers. comm.., April 2008), the instream work windows as recommended in the June 2004 Upper Salmon River Recommended Instream Work Windows and Fish Periodicity report would be adhered to, along with the associated Best Management Practices (BMPs). This includes a work window of the 3rd week of July to the 2nd week of August for Panther Creek, as well as appropriate BMPs including, but not limited to, use of silt fences, straw bales, coir logs, timing of disturbance, or other methods to minimize negative effects of the project. This also assumes that the entire channel will not be completely obstructed during construction (i.e., there would still be fish passage). The portion of Panther Creek where the stream crossing will occur is not suitable spawning habitat, and given the time of year when the activity would occur, due to higher stream temperatures, it's likely the bull trout would have moved out of Panther Creek to higher elevation (cooler) tributary streams (B. Rose, Pers. Comm., April 2008). While there may be minor sedimentation into Panther Creek from the stream crossing, the adherence to the work windows and implementation of the BMPs are expected to minimize sedimentation to the point it is insignificant and would not rise to the level of 'take'.

Construction and placement of the in-stream diffuser for the NPDES outfall is not expected to impact bull trout, as bull trout do not occur in Big Deer Creek (above the impassable cascade) and disturbance (sedimentation) associated with the diffuser are not expected to impact bull trout below the cascade (more than 2 miles downstream). Sediment would be diluted by the time it reached the cascade to the point it would be negligible.

Sediment input into streams occupied by bull trout may occur as a result of road improvement projects as part of the Mine Project. Disturbance to 40 miles of road is anticipated as a result of the Mine Project, including from activities such as regarding, total reconstruction of new road segments, regraveling portions of the haul route, and construction of new turnouts. Short term impacts due to construction activities will result in increased sediment deposition into streams where the road construction activities are adjacent. Long term benefits will include decreased sedimentation (due to improved road surfaces), along with increased safety and decreased risk of spills (resulting in reduced risk for chemicals getting into the streams).

Sediment delivery to streams along the haul route and within the Mine Project area is expected to decrease overall based on modeling completed for the Assessment. However, during actual construction activities, sediment delivery to Big Flat and Bucktail Creek is expected to increase by 1% and 31%, respectively. Neither stream is occupied by bull trout. A 1% increase in sediment to Big Flat Creek, tributary to Panther Creek (approximately three miles downstream and occupied by bull trout), is expected to be diluted by the time it reaches Panther Creek and as such would be insignificant and discountable, and not rise to the level of harm/harassment. A 31% increase in sediment to Bucktail Creek which flows approximately 1 mile to Southfork Big Deer Creek, then another ¾ mile to Big Deer Creek, and eventually another 3 ¾ miles to Panther Creek (which is the only occupied bull trout stream in that section), is not likely to adversely affect bull trout in Panther Creek. A 31% increase in sediment is significant for Bucktail Creek; however, the closest occupied stream reach from where the sediment input occurs is over five miles away and as such, sediment is expected to settle back into the system prior to reaching Panther Creek. Therefore, sediment delivery to Bucktail Creek is insignificant and discountable to bull trout present in Panther Creek, and is not expected to rise to the level of harm/harassment.

Activities associated with the Williams Creek road reconstruction does have the potential to impact listed fish both from sediment and salvage activities. Currently Williams Creek road runs immediately alongside Williams Creek in some locations, with several tight switch-back turns. As part of the road reconstruction, Williams Creek road would be reconstructed away from the Creek (by a couple hundred yards), and the old road would be obliterated (using heavy equipment) and returned to natural conditions (recontouring and re-establishment of riparian vegetation). Additionally, as part of the obliteration of the old road, two, approximately 50 foot long culverts on the North Fork of Williams Creek, would be completely removed and the associated channel rehabilitated. Specific details on the road reconstruction and associated culvert removal are not available, as the Forest has requested an engineering design from FCC for those activities. The Service intends to review those plans and provide comment in order to minimize the potential for adverse affects.

The culvert removal associated with this Mine Project can not be covered under the Programmatic Biological Opinion for Stream Crossing Structure Replacement and Removal Program (Programmatic; Service 2006), as any culvert project that is part of a larger project and has other components with potential adverse effects on listed fish are exempted from the Programmatic and require separate consultation that considers project impacts from all action components. Though not covered under the Programmatic, it is assumed the Forest would adhere to the guidelines/ recommendations outlined in the Programmatic for the Mine Project culvert removal. Similarly, the effects of the action (the culvert removal on North Fork Williams Creek) would have similar affects to bull trout as those analyzed in the Programmatic. The effects of the action related to the Williams Creek road reconstruction will be analyzed in this Opinion; however, detailed information on culvert removal and affects of such actions can be found in the Programmatic as well, which is incorporated by reference (Service 2006).

As stated previously, though this activity is not covered under the Programmatic, the Service assumes the Forest will be following the guidelines/recommendations in the Programmatic. That being said, the Service assumes that FCC's engineering plan for the road construction work will involve damming North Fork Williams Creek and diverting the water around the project area. As the project area dewaters (due to the upstream dam/diversion) any bull trout present will need to be removed from the project area. Williams Creek is a relatively small stream (mean annual flow of 10 cfs with a range of mean monthly flows of 40 cfs to 3 cfs); and the project would be implemented in the late summer and early fall when the stream flow is at its lowest (approximately 3 cfs). As such, the Service anticipates electroshocking will not be necessary to salvage fish and remove them from the project area, but that any bull trout present can be 'encouraged' to leave the area by physically walking in the stream and 'hazing' them downstream. Upon project completion, the upstream dam/diversion would be removed and water would be slowly turned back into the Creek. It is anticipated that no more than approximately 100 meters of North Fork Williams Creek, including the existing culvert reach, will be dewatered for project operations.

The road reconstruction/culvert project has the potential to impact bull trout in two ways: 1) sediment/turbidty and 2) physical barriers. Potential adverse affects associated with those impacts may include: 1) sediment-related affects from increased turbidity/sediment movement during reintroduction of streamflow back into the stream; and 2) harassment-related affects associated with installing the diversion and 'hazing' the fish out of the project area. Adverse affects of the above described impacts will likely include disruption of normal behavioral