APPENDIX B

Alternatives Formulation Report

SILVER KING CREEK
PAIUTE CUTTHROAT TROUT RESTORATION PROJECT

Alternatives Formulation Report

FEBRUARY 2010

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CHAPTER 1

Introduction

The California Department of Fish and Game (CDFG) and U.S. Fish and Wildlife Service (USFWS) (collectively referred to hereafter as the Agencies) are proposing to restore Paiute cutthroat trout (*Oncorhynchus clarkii seleniris*) in Silver King Creek in the Humboldt-Toiyabe National Forest (HTNF). The Agencies propose to apply rotenone to an 11-mile reach of Silver King Creek~~,~~ and its tributaries ~~and Tamarack Lake~~, if necessary, to eradicate non-native trout. The rotenone would be neutralized downstream of Silver King Canyon using potassium permanganate. After two to three years of treatment, the Agencies would restock pure Paiute cutthroat trout. Chapter 3.0, Project Alternatives, presents a more detailed description of the proposed Action.

The Agencies have determined this ~~a~~Action is necessary both to restore Paiute cutthroat trout to its historic range and to isolate Paiute cutthroat trout in the Silver King Creek Watershed, protecting the restored Paiute cutthroat trout population from the introduction of other species of trout (USFWS 2004). The National Environmental Policy Act (NEPA) lead agency for this ~~a~~Action will be the USFWS. In addition, because this ~~a~~Action would constitute a project under the California Environmental Quality Act (CEQA), requiring discretionary action including funding and permit approvals, this ~~a~~Action will also require preparation of an environmental impact report (EIR). CDFG is the lead agency under CEQA. Therefore, the Agencies have determined that a joint environmental impact statement/environmental impact report (EIS/EIR) will be required under ~~f~~Federal and state laws, respectively. The proposed Action would also require permits and approvals for chemical treatment from the Lahontan Regional Water Quality Control Board (Water Board) and for chemical treatment, use of motorized equipment, and import of the required number of workers from the U.S. Forest Service (USFS) - HTNF. The Water Board is a Responsible Agency under CEQA, and the USFS is a Cooperating Agency under NEPA.

This document describes how the Agencies selected the reasonable range of alternatives for detailed evaluation in the EIS/EIR. It discusses the range of options identified through reviews of the literature on fish eradication, the comments on the USFWS Notice of Intent to prepare an EIS (USFWS ~~Federal Register (FR 71 32125 – 32126; June 2,~~ 2006) for the proposed Action (USFWS 2006), and public and agency comments received during the CEQA scoping process. It also considers options outlined in similar environmental documents prepared for other fish restoration projects, including the recently prepared Lake Davis Pike Eradication Project EIS/EIR (CDFG 2007).

The objective of the proposed Action is to establish the Paiute cutthroat trout as the only trout sub-species in Silver King Creek for the purpose of preventing hybridization with other trout species. This is an important and necessary step in preventing Paiute cutthroat trout from going extinct and conserving the species and restoring it to a level that would allow it to be removed from the ~~f~~Federal threatened species list. To accomplish this objective, the Agencies would eradicate all non-native trout from the treatment area prior to restocking with pure Paiute cutthroat trout. ~~The Agencies are also evaluating the necessity of treating Tamarack Lake at the headwaters of Tamarack Lake Creek, a tributary of Silver King Creek. Chapter 3.0, Project Alternatives, presents the surveys the Agencies will complete to determine the presence or absence of fish and the criteria that would be used to determine whether treatment of the lake is necessary.~~

This report identifies and evaluates potential technologies and other strategies to meet the objectives of the proposed Action and selects technologies and combinations of strategies for further development as alternatives for evaluation in the EIS/EIR. The Water Board specifically requested that the Agencies consider combinations of technologies that would reduce the amount of chemical treatment required. The EIS/EIR provides a more detailed evaluation of the potential environmental impacts of the selected alternatives on public health, the local economy, and ecological and recreational values.

1.1 BACKGROUND

Silver King Creek, downstream from Llewellyn Falls to Silver King Canyon in Alpine County is the native range of Paiute cutthroat trout, one of the rarest trout sub-species (USFWS 2004~~1985~~). Indigenous only to Silver King Creek, the USFWS listed Paiute cutthroat trout as threatened under the Endangered Species Act (ESA) on July 16, 1975 (USFWS 1975). The Agencies have established out-of-basin populations of Paiute cutthroat trout in several California streams including the North Fork of Cottonwood Creek and Cabin Creek in the Inyo National Forest (Mono County) and within the Sierra National Forest, in Sharktooth Creek (Fresno County) and Stairway Creek (Madera County).

Hybridization with introduced trout species is a primary threat to the sub-species (USFWS 2004). The fish from Llewellyn Falls downstream to Silver King Canyon are a genetic mixture of introduced rainbow (*O. mykiss*), Lahontan cutthroat (*O. c. henshawi*), golden trout (*O. aquabonita sp.*), and native Paiute cutthroat trout. When associated with Lahontan cutthroat trout or rainbow trout, Paiute cutthroat trout tend to lose their distinctiveness through hybridization (USFWS 1985). Hybridized trout and genetically putative pure Paiute cutthroat trout are currently separated by Llewellyn Falls. Because of their proximity, hybridized fish could easily be transferred above the falls where Paiute cutthroat trout were restored by CDFG in the early 1990s.

The USFWS published a Revised Recovery Plan for Paiute cutthroat trout on August 10, 2004 (USFWS 2004). Criteria for delisting Paiute cutthroat trout and for which the proposed Action addresses include:

- Eradication of all non-native salmonids in Silver King Creek and its tributaries from downstream of Llewellyn Falls to the fish barriers in Silver King Canyon; and
- Restoration of a viable population to all historic habitat in Silver King Creek and its tributaries from downstream of Llewellyn Falls to the fish barriers in Silver King Canyon.

1.2 OPTION EVALUATION AND ALTERNATIVE FORMULATION

The technologies identified included the use of a variety of chemical agents as piscicides (fish-killing agents) with or without motorized equipment, fisheries management actions and fish eradication techniques using non-motorized methods, dewatering, and the introduction of predators. In addition to evaluating these as independent techniques, the Agencies considered combined approaches. All options were evaluated using a two-phase assessment approach. In Phase I, the options were evaluated to determine if they would effectively and, in compliance with current laws and regulations, accomplish the initial step of eradicating all non-native trout from Silver King Creek and its tributaries between Llewellyn Falls and Silver King Canyon. The options that met this criterion were then evaluated in Phase II against a second set of criteria, including protection of public health and safety; timely implementation; use of a proven, effective method; technical feasibility; minimization of environmental impacts; and cost-effectiveness. Technologies that met these criteria were selected as stand-alone measures or combined with other technologies during the formulation of alternatives for evaluation in the EIS/EIR.

1.3 ORGANIZATION OF THE ALTERNATIVES FORMULATION REPORT

Chapter 2 identifies and describes a wide-ranging suite of fish eradication technologies and combinations of these technologies and other management strategies. This section attempts to identify all the tools available to the Agencies, including technologies used worldwide, so that no possibilities are overlooked. Chapter 3 presents the Phase I and II screening of technologies, and Chapter 4 presents the alternatives selected to undergo more detailed development and evaluation in the EIS/EIR.

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CHAPTER 2

Identification and Description of Technologies

This section describes all the potential technical and management techniques identified for application in Silver King Creek. These methods were gathered from a variety of sources, including the literature on fish eradication, past environmental documents, public and agency comments on the Notice of Intent for the proposed Action, and public comments received in response to the CEQA Notice of Preparation. Public and agency comments on the recent Lake Davis Pike Eradication EIS/EIR were considered as well (CDFG 2007).

The technologies and management options fall into five categories: chemical treatment, dewatering, fisheries management, habitat management, and combined approaches. These methods are described below and are listed in Table B-1.

2.1 CHEMICAL TREATMENT

This section evaluates seven chemical agents that could be used to eradicate non-native trout in Silver King Creek. However, several piscicides or technologies described in this section are not approved for use in the State of California and others will not be used by CDFG. Nevertheless, the Agencies developed this section to discuss known piscicides currently used in fishery management and restoration projects worldwide.

2.1.1 Powdered Rotenone

The powdered form of the piscicide rotenone (produced from the roots of tropical legumes such as *Derris* spp. and *Lonchocarpus* spp.) is a proven, feasible method for eradicating fish in standing water. In areas where the source plants occur naturally, rotenone has been used as a traditional fishing method. In the United States, it has been used in fishery management since the 1930s.

Powdered rotenone can have limited effectiveness in moving water such as streams and creeks; only standing water application is described on the label. Registered for use as a piscicide with the U.S. Environmental Protection Agency (USEPA) and the California Department of Pesticide Regulation (CDPR), powdered rotenone has been tested extensively in the laboratory and the field. Rotenone biodegrades readily in water via oxidation and during daylight hours via photolysis. If used according to the explicit label instructions, both the USEPA and the CDPR have determined the product to be safe for workers and the public. However, it can be toxic to humans if inhaled. Powdered rotenone is extremely toxic to organisms that obtain oxygen through gills. However, it is not as effective as liquid rotenone formulations (see the descriptions below) in distributing horizontally and vertically in water. Powdered rotenone formulations have been historically used by CDFG; however, because of its inhalation hazards, it is the least preferred piscicide approved for use in California.

Table B-1 Potential Fish Eradication Technologies and Management Options for Silver King Creek

Chemical Treatment	Powdered rotenone Standard formulation of rotenone – non-synergized (Noxfish®) Standard formulation of rotenone – synergized (Nusyn-Noxfish®) Formulated rotenone (CFT Legumine™) Antimycin Copper sulfate Chlorine Chloramine
Dewatering	Damming of Silver King Creek above Llewellyn Falls Bypass water around project area (diversion dam, piping) Divert water to adjacent subwatershed (diversion dam, pumps, piping) Sequential dewatering of stream reaches Pump water out of residual pools with portable pumps
Fisheries Management Techniques	Physical removal (electrofishing, nets, traps or seines) Introduce predatory fish population Fish-out options (public angling, derbies, angler incentives, commercial fishing) Detonation cord, explosives Genetic swamping Sonar
Habitat Management	Use of nitrogen or carbon dioxide to deplete dissolved oxygen and asphyxiate fish Nutrient loading to deplete dissolved oxygen and asphyxiate fish Treatment of a smaller area CEQA requires consideration of a smaller project
Chemical Application Combined with Other Approaches	Dewatering with rotenone application Electrofishing with rotenone application Dewatering with electrofishing and rotenone application
Combined Non-Chemical Options	Combination of physical removal techniques Partial dewatering and physical removal techniques Physical removal techniques and genetic swamping

2.1.2 Standard Formulated Rotenone

Use of standard liquid formulations of rotenone (for example, Noxfish®, Nusyn-Noxfish®) is a proven and feasible method for eradicating fish in both standing and flowing water. Registered for use as a piscicide with the USEPA and the CDPR, Noxfish® has undergone extensive laboratory and field-testing and has explicit application directions. The formulation consists of a rotenone extract dissolved in solvents and emulsifiers, which help it mix into water and disperse both horizontally and vertically, even through thermoclines. Standard formulations of rotenone may contain other ingredients that are proprietary and, therefore, are not listed on the label. All ingredients, however, were disclosed to the USEPA and CDPR and taken into consideration when the product was registered and the label instructions developed.

In addition to containing the active ingredient rotenone, Noxfish® and Nusyn-Noxfish®, contain aromatic hydrocarbons, including naphthalene and methylated benzenes, which serve as solvents. Nusyn-Noxfish® differs from Noxfish® in that it contains a pesticide synergist, piperonyl butoxide, which adds to the rotenone's effectiveness and allows for a lower proportion of rotenone in the formulation.

Aromatic hydrocarbons are considered semi-volatile and do not remain in water for long periods, typically evaporating to concentrations below detection limits within 1 to 3 weeks. These compounds, particularly naphthalene, have a strong odor that the public has noticed following previous treatments (e.g. the 1997 treatment of Lake Davis). When Lake Davis was treated with Nusyn-Noxfish® in October 1997, the piperonyl butoxide did not biodegrade as readily as the other compounds and was detected for about seven months after the treatment at part-per-billion concentrations in the deepest part of the lake. With the exception of piperonyl butoxide, rotenone is the most persistent chemical in the standard liquid formulation. Rotenone itself readily decomposes in water through oxidation and exposure to light (photolysis). CDFG considers Noxfish® and Nusyn-Noxfish® viable options when evaluating piscicide treatments in California.

2.1.3 Alternative Formulated Rotenone

About 15 years of research and development have produced an alternative rotenone formulation that is currently being used in Europe. Its effectiveness has been demonstrated in the laboratory and in the field. This formulation contains diethylene glycol monoethyl ether (DEGEE), 1-methyl-2-pyrollidone, and a fatty acid ester to improve the rotenone's solubility in water (referred to as inactive ingredients). As with traditional rotenone formulations, the solvents and emulsifiers break down rapidly, giving the product a faint odor. CFT Legumine™ is registered by the USEPA and CDPR (#655-805-AA-75338). This formulation (see Appendix C) was used in the Lake Davis Pike Eradication Project in September 2007 (CDFG 2007).

The CFT Legumine™ formulation contains approximately 5% rotenone, 10% methyl pyrrolidone (MP), 60% DEGEE, 17% Fennodefo 99™ (Fennodefo), and 3% other compounds (CDFG 2007). The two primary inactive ingredients in CFT Legumine™ are MP and DEGEE, which comprise approximately 93% of the formulation by weight as determined by CDFG (see Appendix C, Table C-13). Both of these chemicals are infinitely soluble in water and have an estimated organic carbon partition coefficient (i.e., the "K_{oc}") of 12, indicating their water solubility and tendency not to adsorb to sediment particles (NLM 2006). Based on their low Henry's Law constants, these chemicals do not readily volatilize from surface water and neither chemical would undergo extensive hydrolysis or direct photolysis (NLM 2006).

Aerobic biodegradation is the most important mechanism for the removal of MP and DEGEE from aquatic systems (NLM 2006). The small amount of these chemicals that may volatilize into ambient air would be readily degraded by reaction with photochemically-produced hydroxyl radicals, with an atmospheric half-life of up to 12 hours (NLM 2006). The Fennodefo constituent in CFT Legumine™ facilitates emulsification and dispersion of the otherwise relatively insoluble rotenone. Two classes of constituents, polyethylene glycols (PEGs) and the solvent hexanol (alcohol), are part of the inert additive Fennodefo in CFT Legumine™, which also contains fatty acid esters. As stated in the "Screening Level Risk Analysis of Previously Unidentified Rotenone Formulation Constituents Associated with the Treatment of Lake Davis" (ENVIRON 2007), the fatty acid ester mixture in Fennodefo is likely derived from "tall oil." Tall oil has been independently reported as a mixture of naturally occurring fatty acids, resins and neutrals that are a byproduct of wood pulp, and is a common constituent of soap formulations. The fatty acids in tall oil, principally oleic and linoleic acids, are naturally occurring constituents that are also part of the building blocks that make up fats and oils (triglycerides). Highly unsaturated fatty acids, like linoleic acid, are considered essential dietary constituents in humans, as they cannot be synthesized. Polyethylene glycols (e.g. propylene glycol) are common ingredients in a variety of consumer products, including soft drink syrups (as an antioxidant), in plasticizers, suntan lotions and antifreeze, among other uses (ENVIRON 2007).

Ambient air samples were collected before and during the application of rotenone to Lake Davis in 2007 for pike elimination. The sampling methods were constructed to monitor for rotenone (the active ingredient), MP (water soluble solvent for rotenone), and naphthalene (odiferous, but minor constituent of applied technical material). Background samples were collected prior to application of the rotenone to the lake. Results of the sampling indicated that no rotenone above the detection limit (3 nanograms/meter^3 or 3 ng/m^3) occurred at any of the sample sites. In addition, no MP occurred at above the detection limit (150 ng/m^3) at any of the sites. Low levels of naphthalene were detected at the sample sites. Because naphthalene is a known combustion byproduct, particularly diesel oil combustion and other petroleum based activities, it is a known background constituent in ambient air and measurable amounts would be expected. Although some of the naphthalene levels increased after rotenone application activities began, these slightly elevated levels could be attributed to the increase of motor vehicle and boat traffic in the area. Urban levels of naphthalene, as measured by EPA, can range between 300 ng/m^3 and 700 ng/m^3. All naphthalene levels detected in the samples were below the 300 ng/m^3 level. The VOC results from the sample collected at the fire station site indicate a higher level of combustion products as compared to the other samples. The 1, 2-dichloroethane and dichloromethane concentrations were also elevated at this site in comparison with the other sample sites (Cal/EPA, Air Resources Board 2007). Overall, the monitoring data collected indicate that no appreciable increase in rotenone, MP, naphthalene, and VOC levels were attributable to activities associated with the Lake Davis rotenone project. Because of the low volume of rotenone formulation needed for this application, the small surface to be treated, and the dilution that would be achieved over a short distance, air exposures were not considered a significant exposure pathway and air concentrations of rotenone and its constituents were assumed to be zero.

Based on these data, CFT-Legumine™ is the preferred choice of approved piscicides for this project. The agencies would reserve the option of using Noxfish® ~~or Nusyn-Noxfish®~~ should issues arise with acquisition or approval to use CFT-Legumine™ based upon formulation approvals.

2.1.4 Antimycin

Antimycin (an antibiotic drug) has undergone extensive laboratory testing and field use as a piscicide and is both a feasible and effective method in flowing and standing waters. It has been used primarily in reservoirs up to about 15 to 20 feet deep, but not in water greater than 30 feet deep or in water with pH values of 8.5 or higher.

Antimycin is registered for use as a piscicide by the USEPA and was formerly registered in California. However, because of insufficient human health and safety data, antimycin is not currently registered with the CDPR. Re-registration of antimycin for this action would require the development of health and safety data followed by an approximately one year registration process. Emergency exemptions are possible in some cases; however, because of the expense and time requirements of the application process, antimycin is not expected to be registered for use in California in the near future.

2.1.5 Copper Sulfate

Copper sulfate is toxic to fish and a variety of other aquatic organisms including plants. It has not historically been used as a piscicide and is not registered for this use by the USEPA or CDPR. In aquatic systems, copper sulfate has been used mainly as an algaecide. It has not been tested as a pesticide in the laboratory or in the field. While highly soluble in water, it does not volatilize. Instead, copper tends to bind to sediments and persists in the environment for extended periods. In response to environmental concerns, the European Union has proposed a complete ban on all copper use.

2.1.6 Chlorine

Chlorine (in the form of hypochlorite, the same agent used in laundry bleach) is highly toxic to fish at levels that are safe for humans. It has been used since the 1900s to disinfect drinking water and treat wastewater. When chlorine is added to water with organic content, hazardous byproducts such as trihalomethanes, which are human carcinogens, are produced. Chlorine has been used in fish eradication projects, but not in the State of California. It generally dissipates from water in a few days. Chlorine is also highly toxic to crustaceans, amphibians, reptiles, mollusks, gastropods, algae, plants, and plankton. Chlorine is not registered for use as a piscicide by the USEPA or CDPR.

2.1.7 Chloramine

Chloramine, a compound formed from chlorine and ammonia, has been used for drinking water treatment since the 1930s. Chloramine does not result in the formation of as many trihalomethanes as chlorine, but is persistent in water and must be removed with carbon-activated filters. Chloramine is toxic to fish, crustaceans, amphibians, reptiles, mollusks, gastropods, algae, plants, and plankton. Literature searches completed by CDFG for Lake Davis did not reveal any cases where chloramine was used as a piscicide (CDFG 2004, 2007). Furthermore, chloramine is not registered for use as a piscicide by the USEPA or CDPR.

2.2 DEWATERING

Dewatering would involve full or partial removal of water from the creek to facilitate fish eradication. Dewatering would require construction of a diversion or check dam. Bypassing or diverting water would require pumping the water through pipes either around the proposed treatment area, to an adjacent drainage, or downstream. Dewatering of any residual pools within the treatment area would require pumping. This alternative would eliminate fish from the dewatered portion of the stream if the stream remained dewatered for a long enough period of time and any refugia for fish (i.e., residual pools, hyporheic zone) were eliminated. Because of the remote location, unique wilderness values and environmental quality of the treatment area, the construction of dams and the diversion and storage of large quantities of water on the scale necessary to accomplish fish eradication, was considered unfeasible and is not evaluated further herein.

2.3 FISHERIES MANAGEMENT TECHNIQUES

Six fisheries management techniques are evaluated below: physical removal, introducing a predator, fish-out, explosives, genetic swamping, and sonar.

2.3.1 Physical Removal using Motorized/Non-motorized Methods

2.3.1.1 Electrofishing

Electrofishing introduces an electric current into the water and is commonly used to assess fish populations (e.g. to identify types of fish, counts, aging) and as a fish removal tool. Electrofishing units, which can be gas- or electric-powered, are typically mounted on a backpack. The electricity causes an involuntary muscle contraction, attracting the fish toward the source of the electricity (electrode). Workers with long-handled nets then collect the stunned fish. Voltage, amperage, pulse frequency, and waveform are manipulated to maximize effectiveness which can be influenced by water flow and velocity, temperature, clarity, conductivity (dissolved mineral content), and substrate. Other factors influencing effectiveness include the fish size, species and behavior, presence of aquatic vegetation, time of year, and time of day. It is most effective in shallow water and is therefore most commonly used to sample fish in rivers and streams and occasionally in the shallow water zones of lakes. High elevation Sierra streams often have low conductivities, which can reduce the effectiveness of electrofishing. This can be overcome to some extent by adding salt to the stream. However, this may have other undesirable environmental effects, particularly on amphibians.

To prevent re-colonization from adjacent reaches within the treatment area, the work proposed (11 miles of stream) would have to be conducted in a single season and during the short low-flow season to maximize electrofishing efficacy. To obtain complete fish removal, the treatment area would be divided into segments isolated by nets and shocked multiple times. It may not be possible to effectively remove fish from some areas, such as in deep pools or heavily vegetated sections, beneath undercuts and rootwads, or in the substrates. Battery-powered units are less effective than gasoline-powered units and would need to be recharged frequently, requiring either constant shuttling of batteries in and out of the wilderness area or an on-site charging station. In this instance, a gasoline powered generator would be used to supply electricity to battery rechargers. Gasoline-powered electrofishing units and the use of a generator as a charging station would require authorization from USFS.

A combined physical removal method (electrofishing, seining, gill netting) that strictly uses batteries that are brought in by pack stock was also evaluated. Under this scenario, pack stock would bring in recharged batteries every 2 days over the course of 72 days per season for the projected multiple year timeframe. This method could potentially have more impacts to Wilderness character and could be substantially more costly than using a gas powered generator to recharge electrofishing unit batteries.

Electrofishing with a crew of 11 people is used annually to survey fish populations in Silver King Creek. Electrofishing with the goal of fish eradication would require a much larger number of people. It would also require a lengthy time period for shuttling people, equipment, and removing fish in and out of the treatment area on foot, via horseback or helicopter. To attempt complete removal, the area would likely require treatment for several consecutive years (at least ~~approximately~~ 10 years), each with a similar level of effort.

As described in the EIS/EIR, this method could also be compromised by colonization of the treatment area by Paiute cutthroat trout moving downstream from above Llewellyn Falls or the barriers on Coyote Valley and Corral Valley Creeks during high flows in the intervening period, and would become difficult to determine if the previous year's fish removal effort had been successful.

2.3.1.2 Gill Netting

Gill netting is a passive capture technique used to collect fish by entangling or ensnaring in nets. Both gill nets and trammel nets capture fish when they swim into the net. Nets are typically made of cotton, nylon, or monofilament fiber. Mesh sizes can range from one-quarter inch for small fish to over 5 inches for larger fish species. The method has been used successfully to remove unwanted fish from very small lakes and reservoirs (Knapp and Matthews 1998) through intensive efforts repeated over multiple years. Gillnetting requires less labor than electrofishing or other types of nets. They are light, easy to deploy, and require less maintenance than other types of nets. Gillnets would likely be checked once or twice a day.

Gill nets are more appropriate for use in reservoirs and would likely not work well in a stream where the nets would have to be oriented at an angle to the flow to prevent them from filling with debris. Success with these nets also depends on the movement of fish. Trout are territorial and may move around very little during substantial portions of the year, especially during the low-flow season when the nets would be deployed. Silver King Creek is not accessible year-round and gill net use may not be feasible during high flows, when the nets could be blown out by high flow, clogged with debris or entangled with falling trees. The nets do not effectively capture fry and require use over multiple years to capture these fish as they grow larger but before they are able to reproduce. These factors make it unlikely that this technique would be successful in completely removing fish from Silver King Creek.

The Agencies have used gill netting over the last several years, as a sampling method, to assess fish populations in Tamarack Lake. This monitoring effort, which will also include snorkeling and electrofishing, will continue as part of the proposed Action, in order to determine whether to conduct rotenone treatment of the lake. As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.

2.3.1.3 Trap Nets

Trap nets are another passive capture technique that relies on fish movement. Fish enter the mouth of the net and then are guided into a trap box from which they cannot escape. The application would require a large number of trap nets placed throughout the Project area and maintained for prolonged periods. To maximize efficiency, nets would be positioned across the channel, a configuration which results in capturing debris as well as fish. A very small net mesh size would be required to capture fry. Small mesh nets capture debris easily and would therefore require continuous monitoring to keep them from clogging. Spacing and numbers of trap nets would depend on habitat characteristics. Because fish movement may be limited, like gill nets, these traps would not likely achieve complete fish removal.

2.3.1.4 Seining

Seining is an active netting technique used to capture fish by dragging a net through the water body. This method is most effective when applied over smooth, uniform bottoms with no obstructions to block the path of the net. Even in these situations, seining generally does not capture all fish. In stream environments, the bottom is typically rough and contains numerous obstructions (e.g. boulders, trees, and logs) and numerous places where fish can seek refuge from the net (e.g. under cobbles or boulders, along banks, or in undercuts). Therefore, this technique is unlikely to catch a substantial proportion of the fish population.

2.3.2 Introducing Predatory Fish

This technique would entail introducing into Silver King Creek and its tributaries a fish predator that would prey on non-native trout. Introduction of a new species into the Silver King Creek ecosystem would be risky, unwise and ineffective for many reasons. First of all, introducing a new predator would only increase the level of threat to native and downstream fish and wildlife resources, rather than protect them. Secondly, if the predator eliminated the non-native trout, it would need to be the target of its own fish removal project. Finally, there are no known documented cases where this technique has completely eradicated a species.

2.3.3 Fish-Out Options

Options in this category include opening the treatment area to public angling, derbies, and creating angler incentives to remove introduced trout species. Successive years of intensive fishing using combinations of the above options could depress the population of non-native trout, however eradication is unlikely (Paul et al. 2003). Case studies have shown that fish populations can be depleted by such methods. It is unlikely that anglers would catch all of the non-native trout in Silver King Creek and its tributaries. Larger trout would be caught while the smaller, more numerous fish would remain. If all larger fish were removed, the smaller fish would grow and reproduce and the population would be reestablished after a few years. If a few adults remained, repopulation would occur even sooner.

The treatment area between Llewellyn Falls and Tamarack Lake has been closed to fishing since June 2006 to help prevent the unauthorized movement of undesirable species to areas above Llewellyn Falls populated by pure Paiute cutthroat trout. Allowing public fishing in this area would increase the threat of unauthorized transport of undesirable non-native trout species above Llewellyn Falls; however, this could be managed to some degree through public education and outreach by CDFG and USFS personnel.

2.3.4 Detonation Cord, Explosives

Underwater pneumatic and percussion explosions create shock waves that can kill fish by rupturing their air bladders and inner-ear structures, causing gill and brain hemorrhages. The method is non-selective and would likely harm or kill many non-target species including invertebrates and amphibians. Similar to electrofishing, complete removal of fish from the treatment area would likely require treatment for several consecutive years, each with a similar level of effort. This method has not been determined effective at achieving complete fish removal from streams (CDFG 2007).

2.3.5 Genetic Swamping

Genetic swamping would attempt to reduce hybridization by stocking large numbers of genetically pure fish on a frequent or annual basis into areas that harbor non-native trout. This approach would gradually dilute the undesirable genetic material to a non-detectable level. This method could be enhanced if coupled with an intensive program of population suppression by removing non-native hybridized trout using the acceptable fisheries management techniques described above. However, this method would not remove the genetic introgression that has occurred in Silver King Creek and would essentially result in the extinction of Paiute cutthroat trout from their native habitat and would not be consistent with the Revised Recovery Plan (USFWS 2004).

2.3.6 Sonar

During the scoping process for the Lake Davis Pike Eradication Project, members of the public suggested using sonar to control or eradicate pike (CDFG 2007). The U.S. Navy uses high intensity sonar to detect submarines. Sonar is also used to locate petroleum resources in the marine environment. Sound waves are emitted at a minimum of 235 decibels and can affect several hundred square miles of ocean. In water, sound travels farther and can have a substantial impact on biological receptors, such as marine mammals. Information compiled by the Natural Resources Defense Council indicates that high-intensity sonar is responsible for numerous deaths of marine mammals, mainly whales, dolphins, and porpoises. It may cause internal auditory and navigational disorders such that they become disoriented and become stranded or succumb to predators. However, the CDFG found no literature describing the direct effects of sonar on fish or its use as a fish eradication method.

2.4 HABITAT MANAGEMENT/ALTERATION

Habitat management techniques involve altering the habitat within the stream to eradicate fish populations. Because fish are dependent on dissolved oxygen, the following 2 techniques focus on depleting the oxygen in the stream to kill fish.

2.4.1 Deoxygenation Using Nitrogen or Carbon Dioxide

This type of deoxygenation includes bubbling nitrogen or carbon dioxide (CO_2) from the bottom of the stream to displace oxygen within the water column, resulting in fish suffocation. Large quantities of compressed nitrogen or CO_2 would be forced through thousands of aeration manifolds or air stones placed along the stream. The precise amount of nitrogen or CO_2 required or how well, if at all, the nitrogen and CO_2 would saturate or replace the oxygenated waters is not known.

While this methodology might work in a limited area, such as small pools, it is unlikely to be successful over a large area of moving water such as Silver King Creek. Additionally, this methodology has no record of laboratory or field application, would not necessarily kill all unwanted species, and could affect non-target species, such as invertebrates and amphibians.

2.4.2 Deoxygenation through Nutrient Loading

This deoxygenation technique would increase the nutrient load in the stream by adding highly decomposable materials to the water such as corn syrup, molasses, fertilizer, or methanol. The biological oxygen demand resulting from the bacteriological breakdown of the nutrients depletes the available oxygen to lethal levels. The method has not been laboratory- or field-tested for use as a technique to eradicate fish, and thus, questions remain regarding its efficacy. These materials are not approved for use as a piscicide in California and may violate the Clean Water Act and/or Water Board regulations. In addition, the associated aesthetic, ecological, and water quality impacts would be significant.

2.5 TREATMENT OF A SMALLER AREA

Treating a smaller area is not a fish removal technology but rather a potential action alternative that could be considered in the EIS/EIR to comply with the CEQA guidelines. The concept of a smaller action could involve two approaches: 1) breaking the treatment area up into smaller treatment areas, or 2) establishing a smaller treatment area.

2.5.1 Smaller Treatment Areas

This approach would involve treating smaller portions of the proposed treatment area, with the ultimate goal of treating the entire area. Treatment of smaller areas would increase the potential effectiveness of methods such as electrofishing. Alternative 3 (Combined Physical Removal) utilizes this approach by dividing the treatment area into subreaches, which would be electrofished separately. Some benefit may be achieved by adopting this approach for Alternative 3, with the caveat that all reaches would need to be electrofished in one season, and barriers would be removed annually.

Chemical treatment of a smaller area would require a smaller amount of chemicals for the separate reaches, but would require the same amount, or more, by the time the entire treatment area was treated. No benefit would be realized by breaking up the treatment area for the purposes of chemical application. Unless all segments were treated within one season, barriers would need to be constructed to last over winter, with the consequent logistical and environmental issues discussed above and in the gill-netting section. Since no benefits would accrue using this approach, it is not evaluated in detail in the EIS/EIR.

2.5.2 Establish a Smaller Project Area

This would restore Paiute cutthroat trout to a smaller area of their historic range, between ~~Tamarack~~ Llewellyn Falls and Silver King Canyon, such as a segment of Silver King Creek or some or parts of the tributaries. Such an action would not meet one of the primary objectives of the Revised Recovery Plan to restore Paiute cutthroat trout to its entire historic range. Moreover, because fish can now move freely between these 2 natural barriers (~~Tamarack~~ Llewellyn Falls and Silver King Canyon), a smaller treatment area would require the construction and maintenance of artificial barriers above Silver King Canyon to prevent the upstream movement of undesirable trout. Barriers that could withstand high spring and winter flows would require use of heavy equipment and construction of a large dam. The option would require a large workforce with the consequent logistical issues and large amounts of heavy equipment. Construction would disturb the streambed and bank areas and could result in permanent geomorphologic changes to Silver King Creek. The option is essentially infeasible and does not meet the objectives of the proposed Action and is not evaluated further in the EIS/EIR.

2.6 CHEMICAL APPLICATION COMBINED WITH OTHER APPROACHES

This section addresses potential combinations of chemical treatment with other technologies and chemical treatment with non-motorized equipment to facilitate fish removal in Silver King Creek. Several combined approaches have been considered in the past, including electrofishing combined with rotenone application. Evaluating combined approaches responds to comments received from the Water Board on the NEPA Notice of Intent. The Water Board encouraged the consideration of combinations of technologies that would limit the amount of chemical applied.

2.6.1 Dewatering with Rotenone Application

This option would entail dewatering Silver King Creek and applying rotenone. Dewatering would involve damming Silver King Creek and diverting or bypassing its flows or sequentially dewatering individual stream reaches (see Dewatering section above). Water remaining in residual stream pools would be treated with rotenone. Because upstream flows would be diminished or eliminated, treatment would require less rotenone. Rotenone would be applied to selected reaches along stream banks in Lower Fish Valley and Long Valley due to the complexity of stream habitat ~~riparian vegetation and springs~~.

While reducing the amount of chemical applied to the environment, this combination of treatments would present significant technical and logistical challenges and would result in considerable adverse environmental effects from dam and pipeline construction as well as the rotenone treatment. It would require placing a diversion or check dam just upstream of Llewellyn Falls, as well as at other locations, depending on the selected approach.

One option would involve constructing a dam near Llewellyn Falls to treat the entire 11-mile treatment area. The check dam would prevent water from spilling over Llewellyn Falls and the water would cause flooding of Upper Fish Valley. Pumps and piping would be used to pump out residual pools. The dam could be constructed with a spillway to allow a slower rate of flow but enough to disperse the rotenone as the dispensed chemical flows downstream.

This alternative would present significant technical and logistical challenges. It would require transporting a large quantity of sandbags, pumps, and piping into the project area as well as a substantial work force to build the dam, string the piping, and operate the pumps. The large stream flows would make construction of the dam very challenging.

A potential variation could involve sequentially dewatering and treating shorter stream reaches. Individual reaches would be blocked off from upstream flows, pumped out to the extent feasible, and treated with rotenone. The dams would be removed sequentially and moved downstream in a "leapfrog" fashion, ensuring that no fish move upstream. This option would present the same technical and logistical challenges as described above and would result in significant environmental impacts; thus, it is not evaluated further in the EIS/EIR.

2.6.2 Physical Removal / Fisheries Management Followed by Rotenone Application

Under this option, physical removal and fisheries management just prior to rotenone application would remove part of the fish population. Because rotenone alone is likely to achieve complete removal of fish, using physical removal methods such as electrofishing, netting and angling prior to treatment would not appreciably improve the effectiveness of the action. Physical removal programs may be useful in garnering public support and attention for the action. For example, recreational fishing organizations could hold a fishing derby. Allowing the public to gather fish for consumption could be an effective option, although current fish stocking restrictions would prohibit the transport of live fish for restocking elsewhere. Partnering with knowledgeable organizations, such as Trout Unlimited, could reduce the chance of an accidental introduction upstream of Llewellyn Falls. For the strict purpose of removing undesirable fish, physical removal followed by rotenone treatment would not be a cost-effective combination of methods for eradicating fish from Silver King Creek.

2.6.3 Dewatering Followed by Physical Removal/Fisheries Management and Rotenone Application

This option would use dewatering to increase the effectiveness of subsequent physical removal (e.g. electrofishing, fishing derbies) and rotenone treatment. Dewatering would involve damming Silver King Creek and diverting or bypassing its flows or using sequential dewatering of stream reaches (see Dewatering section above). Dewatering would reduce stream flows, would increase the effectiveness of methods such as electrofishing, and would allow remaining water in residual stream pools to be effectively treated with a reduced quantity of rotenone. While reducing the amount of chemical applied to the environment, this combination of treatments would present significant technical and logistical challenges and would result in environmental effects from diversion dam construction, pipeline construction, pumping, electrofishing, and rotenone treatment. It would have the added public relations benefit of using fishing to remove part of the population. There would not, however, be a significant difference in fish removal effectiveness between rotenone application alone and rotenone application preceded by dewatering, electrofishing, and angling.

2.6.4 Chemical Treatment with Non-motorized Equipment

Under this option rotenone at Tamarack Lake would be administered by hand pump and the potassium permanganate at the neutralization station would be administered via drip system. This option could result in increased human exposure to rotenone and potassium permanganate and increased potential for water quality degradation. The treatment of Tamarack Lake would also be logistically infeasible (time consuming and costly) using a non-motorized raft and equipment.

2.7 COMBINED NON-CHEMICAL OPTIONS

This section addresses potential combinations of technologies for fish removal other than chemical application. Considering combined non-chemical approaches responds to comments received on the prior USFS Environmental Assessment (2003) and on the June 2006 NEPA Notice of Intent published by the USFWS (2006).

2.7.1 Electrofishing and Gill Netting

A combination of electrofishing and gill netting could be used to remove the undesirable species. Gill nets would be used in deep pools and in Tamarack Lake where electrofishing would not be feasible. Environmental impacts would result from shuttling workers and supplies and transplanting fish (if implemented). The feasibility of removing fish in a single season is highly unlikely. As described above, removals over several successive years (at least ~~approximately~~ 10 years) would be required and could still be compromised or confounded by fish movements.

2.7.2 Dewatering and Physical Removal Techniques

This option would entail complete or partial dewatering of Silver King Creek to enhance subsequent physical removal using electrofishing and other seining and netting methods. A combination of electrofishing and gill netting would be used to remove undesirable species, using gill nets in deep pools where electrofishing would not be feasible. Reducing or eliminating upstream flows would reduce the area and depths to be electrofished, making that technique easier to implement and more effective, and might allow the effort to be completed within 1 to 3 years. However, as described above, complete removal of fish from the treatment area would likely require treatment for several consecutive years, each with a similar level of effort. Impacts associated with check dam and pipeline construction and stream dewatering by pumping would occur as described above (see Dewatering and Pumping Out Residual Water sections above), as would those associated with the constant shuttling of workers and equipment into the treatment area.

2.7.3 Genetic Swamping and Physical Removal Techniques

Under this scenario, a combination of electrofishing and gill netting would be used to remove as large a portion of undesirable fish as possible from Silver King Creek and its tributaries, followed by stocking large quantities of genetically pure fish in the area. By reducing the number of undesirable fish, the "swamping" effect of restocked Paiute cutthroat trout would be greater. Some hybridization would still occur, however, since the electrofishing and gill netting would not remove all of the undesirable fish. The degree of this hybridization would depend on the number of undesirable fish remaining and the number of pure Paiute cutthroat trout stocked. Because this option would not completely remove the genetic introgression, it would not be consistent with the Revised Recovery Plan and would not accomplish the objective of the proposed Action.

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CHAPTER 3

Screening and Selection of Technologies

This section describes the evaluation and screening process and describes which technologies were eliminated and which technologies or combinations of strategies were retained for potential inclusion in the alternatives in the EIS/EIR.

3.1 SCREENING PROCESS AND CRITERIA

The technologies and management options identified were evaluated using a two-phased assessment and screening approach. First, the options were reviewed to determine if they would likely be effective in accomplishing the objective of eradicating introduced fish species from the treatment area while complying with current laws and regulations. For example, any chemical agent, such as a piscicide, must be legally permitted for use in California and registered with the USEPA and the CDPR. These agencies evaluate the effectiveness of chemical agents and examine human health and safety issues. If the technology did not meet these criteria, the Agencies eliminated the option from further consideration.

If a potential technology met the objective of successful fish removal and complied with current laws and regulations, the Agencies advanced the technology to the next phase and evaluated with a second set of criteria. These criteria included protection of public health and safety; timely implementation; use of a proven, effective method; technical feasibility; minimization of environmental impacts, compatibility with rules governing designated wilderness areas; and cost-effectiveness. Using these criteria, the remaining options were ranked and used to select the proposed ~~a~~Action as well as a reasonable range of alternatives to the proposed ~~a~~Action for consideration in the EIS/EIR. If a technology warranted further consideration as the potential basis for a comparative alternative in the EIS/EIR, potentially in combination with other strategies, it was retained.

3.1.1 Public Health and Safety

The public heath and safety criterion addresses the safety of the public and the workers implementing the project. Protection of public health includes consideration of potential impacts to air quality, drinking water, and other exposure pathways through which people could be exposed to hazards. Any proposal to use a chemical agent would require approval of the intended use and measures to protect public health. Options that posed substantial risks to public health and safety were eliminated from further consideration.

3.1.2 Speed of Implementation

Because stochastic events or rogue introduction of non-native trout could threaten pure populations of Paiute cutthroat trout, USFWS and CDFG believe time is of the essence. ~~and has identified a 3-year schedule to remove non-native trout from Paiute cutthroat trout native habitat.~~

3.1.3 Proven Effective in the Laboratory and Field

The method must be proven by laboratory and field tests and be a known effective method of removing non-native salmonids in a stream environment. Because the survival of a species is at stake, any new or experimental methods were screened out. Using a method with demonstrated effectiveness dramatically increases the chance of success.

3.1.4 Technically Feasible to Implement

The technology must be technically and logistically feasible to implement. For example, it must not require a prohibitive amount of equipment or number of workers such that it would be possible to implement in a remote area.

To make accurate determinations regarding technical feasibility, site-specific data and reports regarding the habitat types present, stream dimensions, water temperature, and fish densities. Reports included cross-section surveys (~~CDFG~~ Flint 2004), unpublished data collected during fish surveys in August of 2000, and habitat assessments completed for Upper Fish Valley, Coyote Valley Creek, and Corral Valley Creek (O'Brien 1998, 1999, 2002).

3.1.5 Allowed in a Designated Wilderness

Silver King Creek lies within a designated wilderness. There are numerous restrictions on activities and equipment that can be used in wilderness areas. For example, wilderness areas restrict motor vehicles, mechanical transport, and motorized equipment. These activities would require a special use permit.

3.1.6 Potential for Environmental Impacts

The method should minimize significant adverse environmental impacts that cannot be mitigated to reduce their significance. Such impacts may include damage to archaeological resources, biological resources, or water resources, or significant noise or air quality impacts inconsistent with adjacent land uses (i.e., wilderness). This objective was not used by itself to eliminate potential technologies or management options. The EIS/EIR would analyze potential environmental impacts to determine their significance, compare the environmental consequences of the alternatives, and identify mitigation measures.

3.1.7 Cost-Effectiveness

While cost alone was not used to screen out any technology or strategy, overall cost and effectiveness was used as a balancing criterion in comparing options that were approximately equal in effectiveness or environmental impact.

3.2 TECHNOLOGY SCREENING

The following information describes the screening of the technologies and management options. The results of this evaluation are described below.

The following technologies were eliminated in Phase I because the agencies determined they would not be effective in eradicating fish from Silver King Creek or did not comply with current laws and regulations:

- Powdered rotenone was removed from further consideration based on its limited effectiveness in moving water and worker safety considerations.
- Chlorine, chloramines, copper sulfate, and antimycin were removed because they are not registered pesticides, and their use would not comply with current laws and regulations.
- Most fisheries management techniques (introduction of predatory fish, explosives, and sonar) were removed because they were not expected to achieve complete removal of introduced fish in a stream environment. Introducing a highly predatory fish to Silver King Creek was not seriously considered because it would only worsen the existing situation with non-native species. Sonar is not sufficiently developed as a fish removal technique.
- The habitat alteration options (nitrogen, CO_2, oxygen depletion) were eliminated because they are unproven and considered unlikely to be effective, particularly in moving water.
- Because of physical and logistical limitations, treatment of a smaller treatment area was removed from consideration and will not be evaluated in detail in the EIS/EIR. However, dividing the proposed treatment area into smaller treatment areas (with the goal of treating the entire area) was retained for Alternative 3 (Combined Physical Removal).
- The non-chemical combinations of strategies of dewatering followed by physical removal, and physical removal followed by genetic swamping were eliminated because they would not achieve complete removal of undesirable fish and were not consistent with the Paiute cutthroat trout Revised Recovery Plan.
- Chemical application combined with other approaches involving dewatering (e.g., diverting stream flows to an adjacent watershed), physical removal, or fisheries management (fish-out) and chemical treatment involving the use of non-motorized equipment (i.e., a hand pump) were removed from consideration because of the major technical and logistical challenges involved as well as environmental impacts. Because rotenone application would likely achieve complete removal of undesirable fish in 1 or 2 years, the options of combining rotenone treatment with dewatering, physical removal, and/or a fish-out approach would not increase removal effectiveness and thus were not included for detailed evaluation in the EIS/EIR.

The Agencies retained the following technologies and combinations of strategies as potentially effective in eradicating fish from Silver King Creek and allowed under current laws and regulations:

- Rotenone application (standard or new formulation).
- Combination of physical removal techniques, including electrofishing, gill netting, seining, and trapping.

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CHAPTER 4

Alternatives Formulation

Based on the screening-level assessment presented above, three options were selected for further evaluation as potential alternatives in the EIS/EIR. This section uses those retained options to outline the proposed Action and alternatives. The following paragraphs describe the alternatives that the Agencies will evaluate in detail in the EIS/EIR.

4.1 PROPOSED ALTERNATIVES FOR THE EIS/EIR

4.1.1 No Action Alternative

Both NEPA and CEQA require consideration of the No Action alternative. This option includes continuing the current stream and fishery management practices into the foreseeable future. Under the No Action alternative, the USFWS would not implement its Paiute cutthroat trout Revised Recovery Plan. No eradication of non-native, hybridized trout or reintroduction of Paiute cutthroat trout, below Llewellyn Falls would be implemented. Paiute cutthroat trout would not be reintroduced to its historic habitat and its ESA status of threatened would likely remain unchanged. Therefore, this alternative would include continued protection of pure Paiute cutthroat trout, populations in the Silver King Creek Watershed as well as out-of-basin populations.

4.1.2 Proposed Action ~~(Rotenone Treatment)~~

The proposed Action ~~Project~~ includes varied methods of chemical application, such as the use of CFT Legumine™ and/or~~,~~ Noxfish® ~~and/or Nusyn-Noxfish®.~~ Mini-drips and gel or sand matrices may be used on small seeps that may provide a refugia source of fresh water from treated waters. To eliminate the toxic effects of rotenone downstream of the treatment area, potassium permanganate would be administered using generator-powered volumetric augers at a downstream neutralization ~~detoxification~~ station. Potassium permanganate is a powerful oxidizing chemical that quickly renders rotenone harmless to aquatic organisms. The in-stream application of potassium permanganate below Silver King Canyon would ensure that no adverse effects of rotenone are experienced downstream of the treatment area. After 2~~o~~ to 3 years of treatment, Paiute cutthroat trout restocking and repopulation would begin.

4.1.3 Combined Physical Removal Alternative

This report identified individual physical removal techniques as well as combinations of methods as appropriate. Because none of the techniques described would be likely to achieve complete removal as stand-alone methods, the EIS/EIR will include, as a non-chemical alternative, a combination of electrofishing, gill netting, seining, and other physical methods to address Silver

King Creek and its tributaries, springs, and Tamarack Lake. The Combined Physical Removal Alternative would not employ chemical treatment or dewatering. Because this method could have low efficiency in a rocky stream environment, it would be implemented over multiple years until fish are no longer found (at least ~~approximately~~ 10 years).

An intensive multiyear removal effort may eradicate undesirable species but not within the scheduled 3-year period anticipated under the proposed Action. Manual removal efforts, however, are not effective in capturing small fish and could be confounded by trout moving into the treatment area from untreated upstream areas.

4.2 SUMMARY

In addition to the proposed Action of rotenone application, the alternatives proposed for the EIS/EIR include No Action and Combined Physical Removal, an alternative that would be strictly limited to physical removal techniques (i.e., non-chemical alternative).

Although considered in detail as a second non-chemical option, dewatering was not selected as an alternative for detailed evaluation in the EIS/EIR, either as a stand-alone alternative or in combination with other technologies. Constructing check dams, stringing pipeline, and pumping out residual pools may be technically feasible if sufficient resources were mobilized; however, this approach would present significant technical, institutional, regulatory and economic challenges and would result in great damage to the wilderness area.

Also, at the discretion of the California Fish and Game Commission, any of the action alternatives listed above could be followed by re-opening Silver King Creek to recreational fishing following the fish eradication and restocking with pure Paiute cutthroat trout. Because Paiute cutthroat trout are a threatened sub-species, this would be a catch-and-release fishery. The Agencies would couple any return to the previous policy of recreational fishing in the area with public education regarding protected status of Paiute cutthroat trout and the threat to the survival of the sub-species that could result from illicit fish transfer.

CHAPTER 5

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