Conservation Assessment and Strategy
for the
California Golden Trout
(*Oncorhynchus mykiss aguabonita*)
Tulare County, California

California Department of Fish and Game
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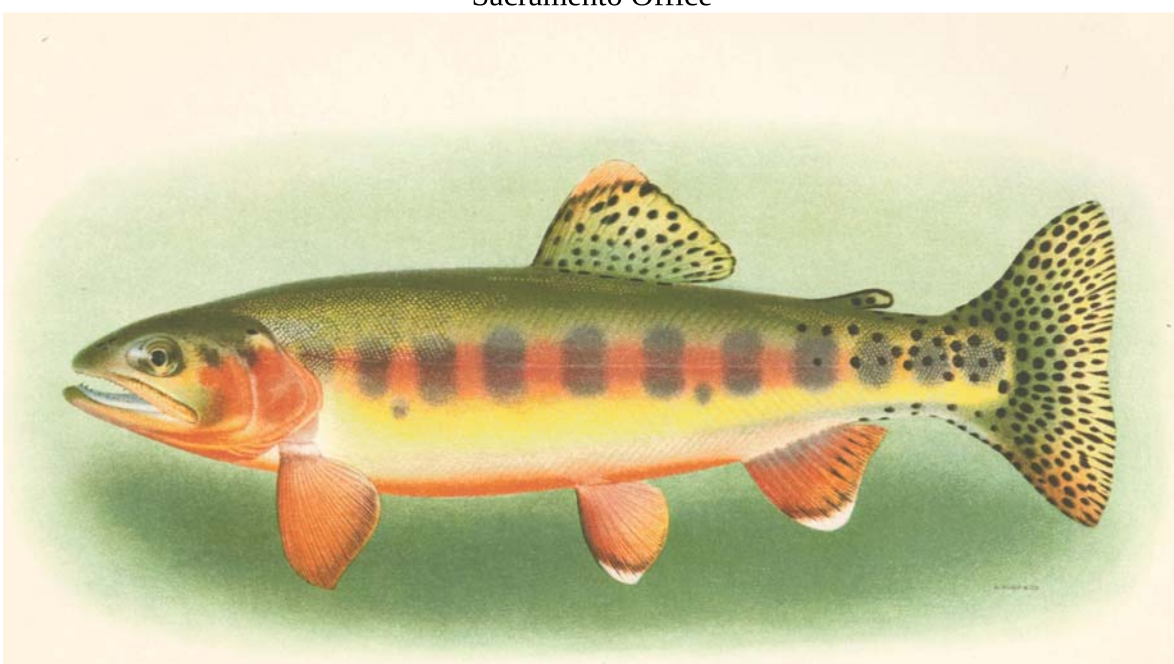

GOLDEN TROUT OF VOLCANO CREEK, SALMO ROOSEVELTI EVERMANN
(DRAWN FROM LIFE BY CHARLES B. HUDSON FROM THE
TYPE, A SPECIMEN 11½ INCHES LONG.)

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Conservation Assessment and Strategy for the California Golden Trout (*Oncorhynchus mykiss aguabonita)* Tulare County, California

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Cover: Drawing of California golden trout from Golden Trout Creek by Charles Bradford Hudson made in 1904 (Evermann 1906).

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1.0 EXECUTIVE SUMMARY

California's State Freshwater Fish, the California golden trout (*Oncorhynchus mykiss aguabonita*), is listed as a species of special concern by the California Department of Fish and Game Moyle et al. 1989). The California golden trout is native to two watersheds in the southern Sierra Nevada of California where it is threatened by a combination of factors. The most insidious threat to the continued existence of the California golden trout is hybridization and introgression with non-native rainbow trout (*O. m.* spp). Introgression is the introduction of genes from one taxon into the population of another taxon. This occurs when first generation hybrids are fertile and cross with the parental types. After a few generations this results in the formation of hybrid swarms: populations in which essentially all individuals are of hybrid origin. The percent of introgression is calculated as the percent of rainbow trout alleles present in a California golden trout population (Cordes et al. 2001). Hybridization is simply the crossing between two genetically unlike individuals (Allendorf et al. 2001). Other threats to the California golden trout include predation by non-native brown trout (*Salmo trutta*) and habitat degradation associated with a long history of livestock grazing, and more recently, off-highway vehicle (OHV) use.

The purpose of this *Conservation Assessment and Strategy* is to: 1) protect and restore California golden trout genetic integrity and distribution in its native range; 2) improve riparian and instream habitat for the restoration of California golden trout populations; and 3) expand educational efforts regarding California golden trout restoration and protection. To meet these goals, this document presents the current status of the California golden trout and identifies the scope of necessary remedial actions and appropriate timetables and estimated costs for their implementation. Furthermore, the implementation of this *Conservation Assessment and Strategy* is intended to recover the California golden trout, thereby precluding its listing as federally threatened or endangered, pursuant to the Endangered Species Act of 1973, as amended. A companion Memorandum of Agreement commits the participating agencies, specifically the California Department of Fish and Game, the U.S. Forest Service, and the U.S. Fish and Wildlife Service, to provide, to the extent possible, necessary financial and logistical support for the identified work.

California golden trout conservation and protection efforts began in 1969 (although general habitat improvement efforts began earlier) and included habitat restoration as well as the conservation of the species' genetic integrity. The later of these efforts was originally based on meristics and for the last 30 years or so, on allozyme studies within California golden trout populations. Allozyme studies indicated rainbow trout and California golden trout hybridization and introgression only within localized populations (Bagley et al. 1998). Beginning in 2000, these populations were evaluated using deoxyribonucleic acid (DNA) analysis, a more sophisticated methodology than what was previously available. Recent DNA sequencing analysis, conducted by the University of California at Davis (UCD), Genomic Variation Laboratory has produced findings with serious implications concerning conservation and potential extinction of the California golden trout. The new genetic findings reveal hybridization with hatchery-raised rainbow trout (*O. m* spp) in most all of the known wild populations of California golden trout analyzed to date in Golden Trout Creek (GTC), the upper South Fork

Kern River (SFKR), and in transplanted populations outside of the California golden trout's native range (Cordes et al. 2001; 2003).

Levels of hybridization in California golden trout populations vary from stream to stream and from reach to reach. A spatial pattern of hybridization levels is especially noticeable in the SFKR where downstream populations show higher levels of hybridization than upstream and headwater populations. Hybridization has spread throughout the vast majority of California golden trout populations within the affected stream reaches, and absent specific conservation actions, it poses a serious threat to the continued existence of the subspecies. Based on genetic markers used for analysis thus far, percentages of introgression levels have been estimated for California golden trout populations. In GTC, rainbow trout alleles in California golden trout populations show introgression levels from 0% to 15%. In the SFKR, rainbow trout introgression in California golden trout populations is estimated at 13% to 88%. Outside of its native range, rainbow trout introgression in California golden trout populations range from 0% to 37% (Cordes et al. 2001, 2003). Although these results are useful in informing management decisions for the California golden trout, we caution that these findings of genetic relationships are only estimates, based on a small number of molecular markers, that field collection locations (both within the native range and elsewhere) are not comprehensive, and that some of the sample sizes of analyzed data are limited. Therefore, the findings presented in Cordes et al. (2001, 2003) should not be considered as comprehensive results on the status of hybridization and introgression of California golden trout with rainbow trout. More site collections, development of additional genetics markers and analyses are needed in order to formulate final interpretations of the extent and status of hybridization.

An important impediment to immediate California golden trout management and recovery actions is that hybridized fish occupy a large geographic extent of habitats within their native range, rendering such habitats unavailable for the natural restoration and repatriation of non-hybridized California golden trout populations. If confined to the few existing localized sites for long periods, the non-hybridized populations of California golden trout are at significant risk of inbreeding depression, the loss of heterozygosity and genetic variance, and are at risk of extinction from catastrophic events due to drought, fire, over-fishing, and unauthorized fish introductions. Failure to take effective and timely action greatly increases the risk of extinction and loss of genetic integrity of this important subspecies.

Hybridized populations where non-native rainbow trout genes occur at very low levels of incidence represent an important genetic resource from the standpoint of preserving an adequately broad California golden trout gene pool. The remaining known non-hybridized populations are so geographically restricted and small in population size that they are unlikely to represent a gene pool that is large enough to assure the long-term genetic viability of California golden trout. In fact these populations are not representative of all of the California golden trout alleles found in the hybridized populations (Cordes et al. 2001). As such, it is important to retain and manage some of the remaining hybridized populations for future gene-pool security and management, even if today we have no way to isolate or otherwise purify those genetic stocks.

To determine appropriate locations for such long-term management, it is important to develop a knowledge base about the genetic composition of California golden trout throughout its native range, and initiate management actions in advance of further encroachment of hybridization and increased levels of introgression. For example, knowledge of the genetics of populations in the upper Kern Basin, especially in relation to fish passage barriers, will help direct management actions to secure the viability of populations of California golden trout that are non-hybridized or hybridized at low levels relative to other populations further downstream. Out-of-basin refuges are also a viable consideration for the conservation of this subspecies. In fact some non-hybrid populations outside of its native range have already been documented (Cordes et al. 2003). Analysis of such sites is one intended objective of this *Assessment and Conservation Strategy*, although populations introduced outside of the native range may be on a different evolutionary trajectory than the native populations and therefore may not be ideal refuge populations (Moyle et al. 1995).

Within the California golden trout's native range, non-hybridized populations appear to be extremely scarce. Ecologists normally consider at least five healthy, reproducing local sub-populations of animals, maintained within stable habitats, to be necessary to assure species viability (Moyle and Sato 1991; Williams 1991). But in the case of California golden trout, there is only one documented remaining non-hybridized population located in a tributary of GTC. Unfortunately, this isolated population is too limited in its number of individuals, distribution, and therefore population stability, to assure its continued viability. Exacerbating the uncertainty of the species' continued existence and stabilization of introgression levels is the potential occurrence of catastrophic events or unauthorized trout movements. As such, additional refuge populations are urgently needed at locations which are sufficiently separated as to remain safe from local catastrophes. However, in order to find and develop new refuges, significant effort will be needed to survey prospective sites, eliminate any pre-existing fishes, and perform genetic analyses to avoid the mistakes of the past in the selection of California golden trout stocks to be used in establishing the refuge populations. It will be necessary to thoroughly evaluate the genetics of all suspected non-hybridized stocks of California golden trout and conduct a thorough search of the upper Kern River, South Fork Kings River and other basins to find all available genetically uncontaminated populations, in order to assure a non-hybridized, yet appropriately broad California golden trout gene pool within the new habitats. Each of these actions is detailed in this *Conservation Assessment and Strategy*.

In general, the necessary California golden trout conservation actions include (in order of priority): 1) elimination of new sources of non-native rainbow trout genetic contamination; 2) population surveys and genetic evaluations; 3) refuge establishment, including locations both within and outside the upper Kern River Basin; 4) management actions to safely isolate non-hybridized and low-level hybridized California golden trout populations in streams, using natural or constructed fish passage barriers in combination with removal of fish with relatively higher levels of hybridization; 5) restoration of riparian and meadow habitats, including the restoration of habitats degraded from permitted livestock grazing and other activities; and 6) adaptively manage and monitor actions using the latest information and technology.

The cost of these necessary actions is significant, averaging about $300,000 per year, except for 2004, when the cost is estimated to be about half that amount (Table 3). This cost would be spread among the State Department of Fish and Game, U.S. Fish and Wildlife Service and U.S. Forest Service.

During and after the initial five years, evaluation of the effectiveness of this *Conservation Assessment and Strategy* is needed in order to adaptively incorporate new monitoring and conservation actions. If new non-hybridized populations are discovered and verified during the initial years of analysis, the extent and associated cost of recovery may be lessened accordingly. Conversely, if only hybridized populations are located, the cost and urgency of needed management actions could escalate. As such, the recovery strategies outlined in this *Conservation Assessment and Strategy* are designed to be adaptive in nature, with regular (i.e., annual) review and reconsideration of each recovery element. Table 3 of this *Conservation Assessment and Strategy* details the needed actions and their estimated costs, distributed among the participants.

Other interested partners are contributing to the financing and implementation of these conservation efforts. For example, California Trout Inc., Trout Unlimited, Federation of Fly Fishers, and The Orvis Company, Inc., a national fly fishing rod and tackle company, are contributing with volunteer work forces and with financial assistance. During the early preparation of the *Conservation Assessment and Strategy*, significant consultation occurred between the three principal agencies. Several interested non-governmental entities provided input and suggestions to the agencies during the planning process. It is intended that ongoing stakeholder coordination and consultation will continue throughout the implementation phase of the conservation program. However, it is the agency representatives that are the decision makers in this process.

2.0 INTRODUCTION

The historic range of California golden trout includes two watersheds draining the Kern Plateau of the southern Sierra Nevada Mountain Range in California: GTC and the SFKR (Figure 1). Other populations of this subspecies (of varying genetic integrity) exist in a few other waters in the western United States due to transplantation. The only other species of fish indigenous to the native range of California golden trout is the Sacramento sucker *(Catostomus occidentalis)*. Within its native range, the California golden trout is at risk due to threats of hybridization, predation, interspecific competition, and habitat degradation.

Because these continuing threats have made California golden trout vulnerable to extinction, state and Federal resource agencies have ranked the subspecies within their respective lists of sensitive species. California golden trout was designated by the U. S. Fish and Wildlife Service (USFWS) in 1991 as a Category 2 Candidate Species until deletion of that category in 1996. It is now designated as a Species of Concern. The U.S. Forest Service Region 5 has recently added California golden trout to its Sensitive Species List and the State of California has designated it as a Species of Special Concern. It was petitioned for Federal listing as Endangered by Trout Unlimited in 2000 (Trout Unlimited 2000). After completing the initial review of the listing package, called a 90-day finding, the USFWS determined that substantial evidence exists to support the petitioned action. The USFWS is in the process of a 12-month review to decide whether or not to propose the California golden trout for listing pursuant to the Endangered

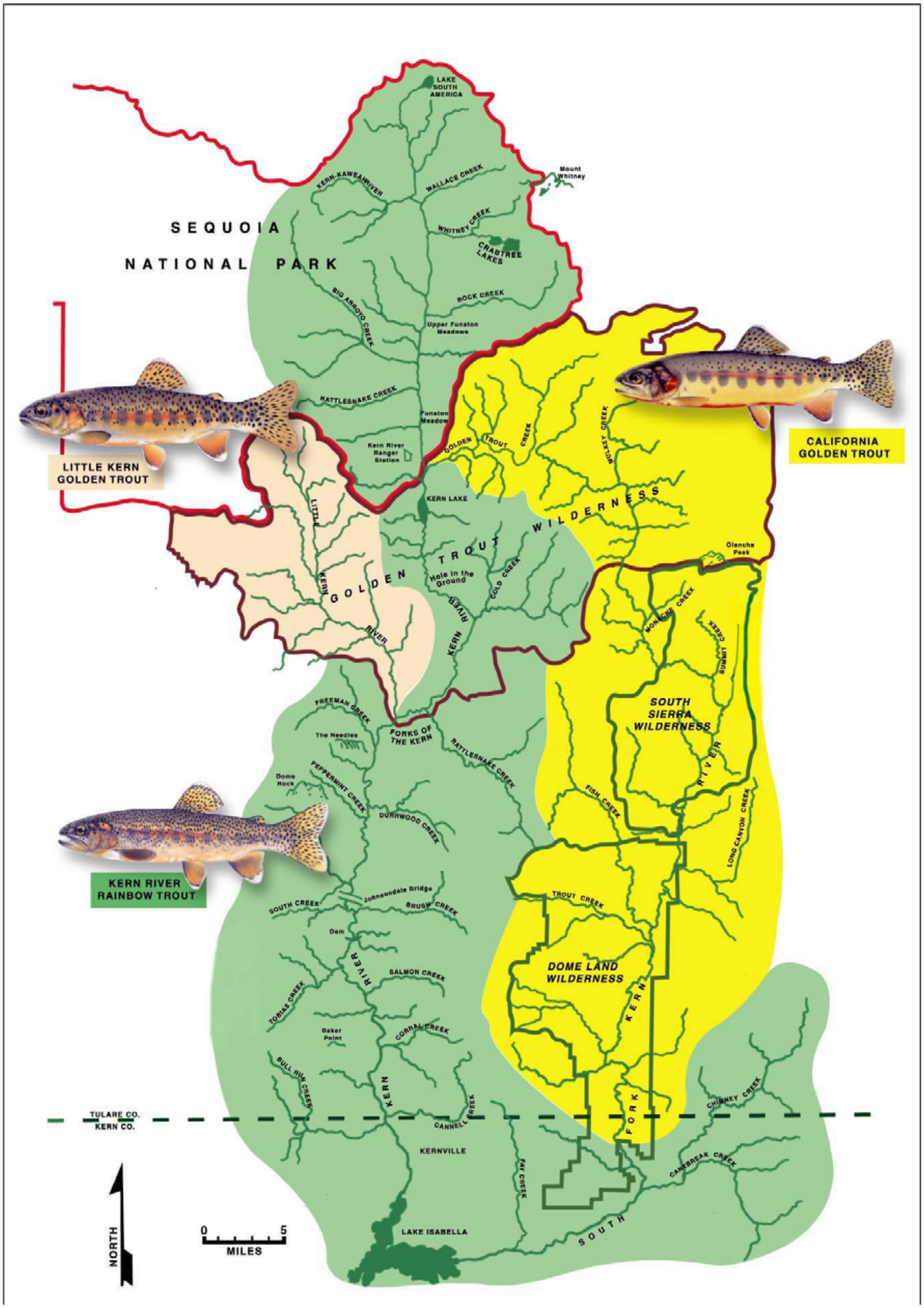

Figure 1 – Historic range of trout native to the Kern River basin (drawing by Joe Tomelleri, used with artist's permission).

Species Act of 1973, as amended (ESA). At the end of this review period, the USFWS will determine whether listing is “not warranted,” “warranted” or “warranted but precluded” due to the precedence of higher priority listing actions.

In 2000, researchers at the UCD began DNA studies to investigate the genetic status of California golden trout (formerly Volcano Creek golden trout) populations. This technique is much more sophisticated than the starch gel electrophoresis method previously used which utilized protein gene products and was hampered by low variability at the subspecies and population level. Based on the initial DNA study, geneticists concluded that all but one of the populations analyzed from the GTC watershed were slightly introgressed with non-native rainbow trout. A single sample analyzed from the upper SFKR was also shown to be slightly introgressed (Cordes et al. 2001). Subsequent analysis of California golden trout populations in the SFKR from Kennedy Meadows to the headwaters shows a decreasing level of introgression, with the lowest level upstream of Ramshaw Barrier (Cordes et al. 2003). The presence of this low level of introgression is a threat to the continued existence of the subspecies and necessitates a revision of the 1999 Conservation Strategy for the Volcano Creek [California] Golden Trout and Agreement, an inter-agency document finalized on April 22, 1999 (CDFG 1999).

The majority (all but one) of remaining California golden trout populations within the native range that have been analyzed with molecular genetic techniques show detectable levels of hybridization and introgression with rainbow trout. However, the use of admixture proportions to define what constitutes a native trout or to create cutoffs of acceptable levels of introgression is problematic, arbitrary, and somewhat discouraged (Allendorf et al. 2001). The conservation value of particular populations may be more appropriately assessed in a relative context, taking into account persisting non-hybridized populations, patterns of introgression, and the geographic extent of hybridization.

The paucity of non-hybridized reference populations that would provide a comprehensive genetic baseline for the species further complicates this issue for the California golden trout. For example, the lack of non-hybridized South Fork Kern California golden trout reference populations makes it difficult to know whether observed unclassified alleles in that drainage are unique South Fork Kern alleles, historic rainbow trout alleles, or unidentified introduced rainbow alleles. It also obscures the historic relationship between South Fork Kern and Golden Trout Creek fish. However, genetic analysis has provided a clear perspective on the patterns and geographic extent of introgression: rainbow trout introgression in the GTC populations is limited to a small percentage of individuals in localized areas, whereas in the SFKR introgression is ubiquitous and increases incrementally downstream (Cordes et al. 2001, 2003).

Levels of hybridization and introgression within a population vary based on the analyzed sample size and method of analysis. Thus far, methods of allelic frequency distribution analysis include investigations of protein coding nuclear loci (allozyme analysis), DNA analysis of nuclear microsatellites, anonymous single copy nuclear (scnDNA) markers, and mitochondrial haplotypes. These different methods have revealed differing levels of hybridization and introgression within the same populations of California golden trout (Bagley et al. 1998, 1999, Cordes et al. 2001, 2003), although it should also be noted that different markers used on the same populations have shown the same patterns of introgression. The relative concordance of introgression levels between the scnDNA marker and the microsatellites is a strong indication that there is some reliability in the percentages of introgression. Current analysis is based on relatively few genetic markers. To better understand hybridization and introgression of California golden trout with rainbow trout, there is a need to continue the development of additional diagnostic markers for screening relatively small sample sizes of individual populations and for identifying relative levels of hybridization and introgression between individual populations, including the identification of non-hybridized populations. The development of these additional markers is presently occurring and should soon be available. Future studies of previously analyzed populations that either use new analysis methodologies or analyze different molecular markers may change our understanding of hybridization and introgression levels within California golden trout populations. Results of such studies will help guide adaptive management of this Strategy in the conservation and management of the California golden trout.

Given these challenges, resource managers face the difficult task of defining California golden trout and prioritizing conservation efforts. For the purposes of this document and for the conservation of this species, all California golden trout populations within the native range, regardless of levels of hybridization and introgression, are considered to be California golden trout. The conservation of hybrid populations of California golden trout is important, as this is the only available option if we are to avoid the complete loss of the (albeit hybridized) species (Allendorf et al. 2001). In this document, California golden trout populations that show the lowest relative levels of hybridization and introgression with rainbow trout are prioritized in terms of conservation efforts. Populations exhibiting low to zero levels of introgression are given highest priority, and management efforts should focus on protecting and potentially expanding these populations, and monitoring the threat that any adjacent hybridized populations pose to their persistence. Populations exhibiting high levels of introgression, though categorized as California golden trout, hold significantly less conservation value. For example, the farthest downstream populations of California golden trout in the SFKR exhibit high levels (88%) of introgression. Thus the downstream populations in the SFKR are of a lower conservation priority than upstream populations, and management actions to remove highly hybridized populations may be an eventual management tool for the conservation of the California golden trout.

This *Conservation Assessment and Strategy* (Strategy) is a cooperative effort between the California Department of Fish and Game (CDFG), Inyo National Forest (INF), Sequoia National Forest (SQF) and the U. S. Fish and Wildlife Service (USFWS). The purpose of this document is to prevent the need to list the California golden trout under the authority of the ESA. The need for a Strategy to protect California golden trout was identified by both the USFWS (Medlin 1994) and the INF (Martin 1995). A conservation status for California golden trout that describes life history requirements with a chronology of past management of this subspecies was drafted by Stephens (Stephens 1998). Available data has been analyzed describing both existing and desired conditions of habitat in streams containing California golden trout on the INF, along with a monitoring plan that identifies appropriate parameters and timelines (Riley 1998). California golden trout are also present on lands managed by SQF.

The overall objective of this Strategy is to conserve the California golden trout. In fulfilling this objective the goals of this Strategy are to:

- Protect and restore California golden trout genetic integrity and distribution in its native range.

- Improve riparian and instream habitat for the restoration of California golden trout populations.

- Expand education efforts regarding California golden trout restoration and protection.

Success in meeting the goals of this Strategy will be evaluated through monitoring outlined in this document (see Section 8.0). Monitoring results will be used as part of an adaptive management process to reduce risks and improve conservation of California golden trout and its habitat.

3.0 CALIFORNIA GOLDEN TROUT BACKGROUND AND ECOLOGY

3.1 Native Range

California golden trout are native to GTC and the SFKR, an area encompassing approximately 593 square miles (1,536 sq. km). They historically occupied GTC from the headwaters, with the possible exception of the upper reaches of some tributary streams and headwater lakes, downstream to a series of waterfalls near the mouth (Evermann 1906). In the SFKR, California golden trout were present from the headwaters downstream at least to the lower end of the present-day Domeland Wilderness (Figure 1). The only known documentation of the lower limits for California golden trout is by longtime Kernville resident Ardis Walker. As a boy fishing the SFKR in 1913, he reported catching California golden trout in the "gorge" just upstream of the Bloomfield Ranch, near the southern boundary of the Domeland Wilderness (Walker NDa). California golden trout most likely extended downstream of Lake Isabella. The lower limits of their range probably moved up or down stream depending on climatic changes and seasonal water temperature (D. Christenson, CDFG retired, pers. comm.).

3.2 Environmental Setting

The Kern Plateau encompasses the SFKR and GTC watersheds, and small portions of several drainages flowing off the east side of the Sierra Nevada Mountain into the Owens Valley and west side into the Kern River (Figure 1).

The SFKR watershed covers 533 square miles (1,380-sq. km). Its headwaters are in the eastern section of the Kern Plateau in the Golden Trout Wilderness, starting at South Fork and Mulkey Meadows (headwaters of Mulkey Creek). The river flows in a general southerly direction and discharges into Lake Isabella near the town of Weldon. Stream elevations range from 10,400 feet (3,172 m) above mean sea level near the headwaters to approximately 2,605 feet (795 m) at Lake Isabella. The river habitat and surrounding vegetation varies from large, high-elevation, low-gradient meadows with sedges (*Carex* spp.), rushes (*Juncus* spp), willows (*Salix* spp), sagebrush (*Artemisia* spp.), and grasses (various genera), to reaches with narrow, rocky, steep-walled canyons and steep gradients. Annual precipitation ranges from 15 to 40 inches (38-102 cm) at higher elevations to 10 to 30 inches (25-76 cm) at low elevations (NOAA 1973).

The GTC watershed covers 60 square miles (155-sq. km). The headwaters are in the northern section of the in the Golden Trout Wilderness (Figure 1) and several lakes (Chicken Spring, Johnson, and Rocky Basin Lakes) drain into the basin. The stream flows in a westerly direction to discharge into the Kern River (sometimes referred to as the North Fork Kern River) on the southern border of Sequoia National Park. Elevations range from 10,800 feet (3,294 m) at Rocky Basin Lakes to less than 7,000 feet (2,135 m) at the confluence of GTC and the Kern River. The GTC watershed varies from large, high-elevation meadows with grass/sedge vegetation and low gradients, to narrow, steep canyons and waterfalls. Annual precipitation ranges from 15 to 40 inches (38-102 cm) (NOAA 1973).

Golden Trout Creek was formerly known as Volcano Creek and before that as Whitney Creek. It is wholly encompassed within the Golden Trout Wilderness. Presently, on topographic maps (e.g. USGS Kern Peak 15-minute quad, 1956), the name Volcano Creek refers to a tributary of GTC formed by the confluence of Left and Right Stringer in Volcano Meadows in T18S, R34E, Section 18. Presently, on USGS maps (e.g. Mt. Whitney 15-minute quad, 1956), Whitney Creek refers to a tributary to the Kern River located to the north, in Sequoia National Park (Figure 1).

3.3 Geology and Hydrology

The Kern Plateau was formed in relatively recent geologic times during the second uplift of the Sierra Nevada in the Pliocene epoch approximately one to ten million years ago when the area was tilted up, creating a long, flat plateau. Glaciation of the northern portions and subsequent faulting created basins and lake beds which were gradually filled in by sediment to become meadows. Later, volcanic activity created several prominent cinder cones and the lava flows on GTC. It is presently an area of broad, arid meadows bounded by high granitic peaks and ridges. Highly erosive, soils are primarily decomposed granodiorite and are overlain by sandy loam in the meadows (USDA 1965).

The waters of both GTC and SFKR flow over significant barrier waterfalls before joining the Kern River. Very near the mouth of GTC is the largest of these, Agua Bonita Falls, with a vertical drop of 60 to 80 feet. Several additional falls are located not far upstream of the first, all effective barriers to upstream fish migration (Evermann 1906). A series of large bedrock falls prevent fish migration upstream on the SFKR just inside the present day southern boundary of the Domeland Wilderness (Figure 1).

Past geologic activity has formed the Kern Plateau as well as influenced the genetic diversity of the golden trout. At one time the uppermost portion of the SFKR flowed into GTC (Evermann 1906; USDA 1965; Walker NDa). Through volcanic and alluvial activity these streams were separated and started flowing into separate watersheds (Webb 1946). An alluvial ridge 80 yards (73 m) wide and 30 feet (9 m) in height presently separates the two drainages. Both the genetic diversity and similarity of trout in GTC and in SFKR is evidence of this geologic phenomenon.

A more recent hydrologic connection between the two watersheds was established by human activity beginning in about 1884. During a drought in the 1880s, ranchers from Kern County wanted more water. They devised a plan to divert the waters of GTC into the SFKR, which would carry the water to their fields. A tunnel was constructed through the low alluvial deposit that separated the two watersheds to divert the flow of GTC into the SFKR (Figure 1). The tunnel soon caved in and was replaced by an open ditch. This too caved in and was abandoned and a second ditch was dug beginning about 1.5 miles above the tunnel on GTC in about 1892. The second ditch was observed by George W. Stewart, agent of the U.S. Land Office in Visalia in 1899, and he reported that "about one-half the volume of the stream was flowing into the ditch over a small dam of brush and rock, and there was nothing to prevent the escape of fish" (Evermann 1906). John Broder, who spent considerable time in the area, reported seeing water flowing through the tunnel, the first open ditch and the later ditch. He stated that "fish swimming downstream doubtless found it easier to pass into the ditch or tunnel than to continue down the creek" (Evermann 1906). When the area was visited in 1903 by A. H. Swain of the U.S. Land office in Visalia, he found that water was no longer flowing through either ditch. (Evermann 1906). The two streams have not been hydrologically connected subsequent to that date.

Most precipitation on the Kern Plateau falls in the form of snow during the winter. Peak runoff occurs in May and June. Summers are usually dry with an occasional thundershower. Discharge was gauged for 11 years (1956 to 1967) and from April to September of 1969 on the SFKR, 2 miles downstream of the confluence of Snake Creek. The maximum discharge during this period was 2,360 cubic feet per second (cfs) (66.8 cubic meters/second), measured May 10, 1969 (USGS 1973). Discharge was gaged on GTC, during the same period, 0.5 miles upstream from the Tunnel Ranger Station. Peak annual discharge from 1957 until 1969 ranged from a low of 19 cfs (0.538 cm/s) to a high of 430 cfs (12.2 cm/s) on May 31, 1969 (USGS 1973). Annual discharged averaged 14.1 cfs (0.4 cm/s) in GTC and 45.7 cfs (1.3 cm/s) in the SFKR. Review of Department of Water Resources California Data Exchange Center records indicate that historically there were most likely periods of greater discharge than in 1969, such as in 1938 and 1983. It appears that 1969 represents a 25 year event.

3.4 Taxonomy

Historically there has been a great deal of confusion over the taxonomy of the native trout of the Kern River basin. Four species of trout were originally described: *Salmo agua-bonita* from the SFKR, *S. whitei* from the Little Kern River; and *S. roosevelti* from GTC; and *S. gilberti* from the Kern River (Moyle 2002). However, trout from the SFKR and GTC were later recognized as color variants of the *S. agua-bonita* (Evermann 1906). Today they are recognized as subspecies of rainbow trout (Schreck and Behnke 1971; Behnke 1992b). Rainbow trout taxonomy in general has gone through a great deal of flux since efforts to classify trout began (Behnke 2002). Rainbow trout for years were classified with salmon in the genus Salmo. In 1989 it was realized, based on careful physical examination, that rainbow, cutthroat, and their relatives from the genus *Salmo* were more closely related to Pacific salmon than they are to Atlantic salmon and they were reclassified into the genus *Oncorhynchus* (Smith and Stearley 1989).

There is still debate about the origin of trout native to the Kern Basin and their relationship to the other native trout of California (Schreck and Behnke 1971). The Kern Basin is unique, escaping the most recent glaciations ending some 10,000 years ago that killed trout in most of the Sierra Nevada. Ancestors of golden trout may have been an anadromous coastal rainbow trout (*O. m. irideus*) that invaded the Kern Basin. Others hypothesize that coastal rainbow trout diverged from the "redband" type trout that radiated south into Mexican waters probably in the late-Pleistocene (Behnke 1992b). Trout in GTC and the Little Kern River basins are believed to represent earlier forms, which eventually became isolated from later trout invasions by a series of waterfalls. The Kern River rainbow trout (*O. m. gilberti*) are believed to represent the product of these earlier trout, possibly an ancestral "redband" trout, and later arriving coastal rainbow trout from the ocean and thus are more distantly related to the other trout in the basin (Moyle 2002). While the Kern River rainbow trout is native to the basin, because it is a more distant relative, it is not generally grouped with the golden trout complex (Gall et al. 1981).

3.5 Subspecies Description

The coloration of the California golden trout is spectacularly bright. The belly and cheeks are bright red to bright orange, the lower sides are bright gold, the central lateral band is red orange, and the back is deep olive green. Usually about 10 parr marks are present on each side, even on adults, and are centered on the lateral line and through the caudal peduncle (narrow region immediately anterior to the tail). Body spotting is highly variable but spots are usually scattered across the dorsal surface with a few below the lateral line. The pectoral, pelvic, and anal fins are orange, with the pelvic and anal fins having white to yellow tip preceded by a black band. The dorsal fin also has a white to orange tip (Moyle 2002). The California golden trout found in GTC have particularly bright coloration and many fish in this population display a strong orange-red ventral surface (Pister 1991).

Body spotting pattern has historically been used to differentiate trout into various species and subspecies. Trout classification has varied over time and there is some question as to whether spotting pattern alone is adequate justification for declaring a particular golden trout a separate species. A great deal of variation in coloration and spotting can be found even among golden trout living within a short reach of stream. However, there sometimes is a noticeable difference between the spotting pattern of California golden trout from the SFKR and GTC. Trout from the SFKR often can have small dark spots over most the length of their body above the lateral line. Trout from GTC typically have very few spots on the body and these are concentrated on and near the caudal peduncle. When consistent differences are found in any character between geographically disjunct groups of trout, it can be assumed that these differences have a hereditary basis (Behnke 1992b).

3.6 Life History and Ecology

California golden trout evolved in streams in lush, wet meadows with dense grasses, sedges, and other plants protecting the streambanks from erosion and collapse. Although California golden trout thrive in clear, cold (less than 60°F [15°C]) mountain lakes and streams above 6,890 ft (2,100 m), they can endure temperatures reaching well into the 70s F (21°C) in degraded streams on the Kern Plateau, provided water temperatures cool during the night (Pister 1991; E.

Gerstung, CDFG retired, pers. comm.). However, it is unclear how these stressful temperatures affect trout growth.

Since California golden trout evolved as the only fish species, except for the Sacramento sucker, in their native habitat on the Kern Plateau, they do not coexist well with other salmonids. Being less competitive, they are dominated, preyed upon and sometimes entirely displaced by brown trout. California golden trout lose their genetic integrity through hybridization with other rainbow trout or cutthroat trout (*O. clarki*) subspecies (Pister 1991).

California golden trout mature in their third or fourth year of life and spawn in streams when water temperatures reach 45-50^{o} F (7-10^{o} C), usually in late May or June (Pister 1991). Time of spawning can vary with elevation, severity of the winter, and the onset of warmer weather. In studies of upper Mulkey Creek, Knapp and Vredenburg (1996) found that spawning activity began May 12 and the last redd was constructed June 8. They concluded that spawning did not occur until maximum water temperature consistently exceeded 15^{o}C and average daily water temperature was 8^{o}C. The authors noted that California golden trout were sensitive to daily water temperature and most redds weren't occupied in early morning when water temperatures were at their daily minimum. As water temperature increased, the number of redds occupied also increased, peaking between 1500 and 1630 hours when the daily water temperature reached the daily maximum. Spawning characteristics of the California golden trout are similar to other spring-spawning trout, such as rainbow and cutthroat trout, although, unlike other rainbow trout, they are able to successfully spawn in decomposed granite substrate (Knapp and Vredenburg 1996; Pister 1991).

California golden trout use riffle habitat with gravel or coarse sand substrate for successful spawning. The female excavates a shallow depression, or redd, in the substrate using the water current and an up and down motion of the body while positioned partially on her side. Each female lays 300 to 2,300 eggs, depending on her body size. Once the male fertilizes the eggs, they are covered with substrate material by action similar to redd construction and are left to incubate. Eggs hatch in about 20 days at 57^{o} F (14^{o} C). The fry remain in the substrate as "sac fry" until the nourishment in their yolks is used up. Two to three weeks after hatching, they emerge from the substrate at about one-inch (25 mm) in length and begin feeding (Curtis 1934).

Once out of the gravel, fingerling California golden trout grow quite rapidly for the first summer, doubling their weight each 10 to 15 days (Fisk 1983). Growth rate varies with the type of water, food availability and competition for food and habitat. In their native habitat, adult California golden trout generally grow slowly due to cold water temperatures, low stream productivity, and short growing season (Stefferud 1993). In streams, food and fish density are generally limiting factors affecting growth rates of golden trout (Filbert and Hawkins 1995; Knapp and Dudley 1990). In degraded stream sections on the Kern Plateau, California golden trout populations are highly stunted. In small streams, golden trout grow slowly and rarely exceed 7 or 8 inches (178-293 mm) (Knapp and Dudley 1990). However, larger fish can be found in better habitat, including lakes.

The California golden trout and Little Kern golden trout have a unique adaptation to the harsh environment where they evolved. Egg development for the following year occurs simultaneously with egg maturation for the current year. Along with the fully developed eggs that will be spawned the current year, a small sack containing next year's eggs also develops. It appears this is an adaptation, which allows the trout to be ready to spawn at the earliest opportunity the following spring (Pister 1991; Stephens, CDFG, pers. comm.).

3.7 Transplanting California Golden Trout

Describing the 20th Century attitude toward fish stocking, Ardis Walker, a longtime Kernville resident since the early 1900s, stated that, "many of the pioneer visitors to Golden Trout waters reacted with a desire that was almost compulsive; they shared a common missionary urge to spread the golden beauty and life of this native habitat to the barren waters of more elevated and more easterly and northerly lakes and streams" (Walker NDb).

An understanding of the transplanting history of California golden trout, much of which went unrecorded, is important to the recovery of the subspecies. Thousands of California golden trout, mostly from GTC, were collected and moved to the north, where they were stocked mostly in fishless waters.

3.7.1 Within the Native Range

Early visitors to the area, including anglers and scientists, made a distinction between trout in GTC and those in the SFKR. The fish in GTC were considered to be the "true golden trout" and when described as the "Roosevelt trout", were considered to be a separate species (*Salmo roosevelti*) from the trout in the SFKR (*S. agua-bonita*). Current management of the two watersheds recognizes each as separate unique populations of California golden trout.

South Fork Kern River Basin

The first recorded California golden trout transplant was made in the SFKR Basin. At an unknown date prior to 1876, Samuel Mulkey took trout from either GTC (Ober 1935; Vore 1928) or the SFKR (Evermann 1906; Anonymous 1913; Curtis 1934) and planted them in fishless upper Mulkey Creek. This original transplant probably occurred in 1872 from GTC (Behnke 1992a). Upper Mulkey Creek appears to have been effectively separated from the SFKR by a major rockslide that preceded the invasion of the upper watershed by fish (Vore 1928), thus isolating this population from other populations in the SFKR.

Golden Trout Creek Basin

There are few records of California golden trout being moved around within the GTC watershed. This may be due to the fact that most waters within the drainage contained trout. Only the headwater lakes were fishless. On July 7, 1908, one of the Rocky Basin Lakes was planted with approximately 110 California golden trout taken from GTC (Colby 1909). Between 1929 and 1943, around 300 adult California golden trout were collected annually from GTC in the vicinity of Big Whitney Meadows and transported to Rocky Basin Lakes (and possibly Johnson Lake) where they were stocked by Mt. Whitney District Ranger Everest Shellenberger (Shellenberger

1943). In 1952, USDA personnel, and volunteers, captured 581 California golden trout from GTC and stocked them in Rocky Basin Lake (CDFG, fishery management files, Bishop, CA).

3.7.2 Outside the Native Range

Historically, California golden trout were transplanted into many fishless lakes and streams throughout the Sierra Nevada. Most of these waters were subsequently planted with brook, brown and rainbow trout. Beginning in about 1896, and continuing into the early 1900s, California golden trout were captured in GTC and transplanted mostly to the north (Ellis and Bryant 1920; Schreck and Behnke 1971). California golden trout were collected from GTC either by hook-and-line or by diverting the flow into a side channel and collecting the floundering trout from the main channel. Captured trout were placed in pack cans on mules and transported northward out of the California golden trout's native range. During a season, thousands of California golden trout would be collected for transplantation. Sometimes as many as twenty mules would be used for this purpose, with trout being transported for up to 6 hours per day for up to six days. At the end of each day, a small impoundment would be constructed in a stream where the fish would be kept overnight before being collected the following morning, placed back in the cans on the mules and moved north. Trout were sometimes distributed in waters as the mule train moved north (Ellis 1910). Many of these transplants were into waters managed today by Sequoia-Kings Canyon National Park. By the summer of 1914, all of the eastside tributaries to the Kern River from Rock Creek north, had been planted with California golden trout (Ferguson 1915).

Probably the most significant California golden trout transplant was made by Colonel Sherman V. Stevens, A. C. Stevens and Thomas George in July 1876. They successfully transplanted 12 California golden trout, caught from upper Mulkey Creek and carried in a coffee pot over the Hockett Trail, and releasing them into fishless Cottonwood Creek, an Owens River tributary (Evermann 1906; Walker NDb). In 1891 about 50 offspring of this first transplant were collected from Cottonwood Creek and transported 3 miles (4.8 km) upstream past barrier water falls and stocked in Cottonwood Lakes at the head of the drainage (Evermann 1906; Koch 1912). Ardis Walker reported 21 "battered trout" were planted in Cottonwood Lake, so not all fish may have survived (Walker NDb). The small number of fish in the original transplants resulted in a reduction (bottlenecking) of the golden trout genetic material in the Cottonwood drainage.

Since 1917, the CDFG has intermittently used the California golden trout in Cottonwood Lakes as a source of eggs for its fingerling trout stocking program (Pister 1964). This broodstock continues to be used today as a source of fingerling trout for high mountain lake management in the Sierra Nevada range. Adult golden trout are trapped and artificially spawned at Cottonwood Lakes. The eggs are packed to Hot Creek Hatchery where they are hatched and reared to fingerling size. Fingerling golden trout are extensively used in CDFG's aerial trout stocking program with the majority of the fingerling California golden trout being stocked in lakes in Fresno and Madera counties. Fish produced in this program prior to the early 1930s were most likely non-hybridized California golden trout. It's believed that hybridization of the brood stock occurred at some point after that time (P. Pister, CDFG retired, pers. comm.; Calhoun 1961). Golden trout populations that were established by these plants outside the native range prior to the early-1930s, with no subsequent stocking, may never have been hybridized, although they may now be on a different evolutionary trajectory than the populations within the native range (Moyle et al. 1995). However, beginning soon after the egg taking operation began, CDFG hatchery personnel adopted the practice of returning some of the California golden trout produced in the hatchery to the Cottonwood Lakes, so hybridization could have occurred at a much earlier date. (CDFG, unpublished reports, Bishop). Due to their limited genetic diversity (as predicted by the founder effect), these populations are of diminished restoration value.

There were several transplants to adjacent waters on the Kern Plateau outside of the GTC and SFKR watersheds. On the west side of the Kern Plateau these included Ninemile Creek, Cold Creek, Salmon creeks, as well as many of the lakes and streams to the north in Sequoia National Park, all tributaries to the Kern River. In the early 1960s, Roy Hunter (a cattle permitte on the Mulkey grazing allotment) planted the upper reaches of Diaz and Ash creeks, tributaries to the Owens River, with fish he transplanted from upper Mulkey Creek (R. Hunter, pers. comm.). DNA analysis revealed that the Diaz Creek population is introgressed with rainbow trout, but the Ash Creek population, although bottlenecked, remains non-introgressed (Cordes et al. 2003).

In 1897, Ninemile Creek was stocked with Kern River rainbow trout (Evermann 1906; Ellis 1915). The headwaters of Ninemile Creek in Casa Vieja Meadow were originally stocked by direct transplanting from the SFKR. Between 1932 and 1950, Ninemile Creek was planted with California golden trout from Cottonwood Lakes (CDFG, unpublished records, Bishop). The drainage was subsequently stocked with rainbow trout and steelhead trout (Schreck and Behnke 1971). Trout collected in the various tributaries and the main stem of Ninemile Creek, including Cold Creek and Redrock Creek, have been genetically analyzed and found to be hybridized (Gall 1995, Cordes et al. 2003). However, because allozyme analysis of trout from the headwaters of Ninemile Creek in Casa Vieja Meadow showed them to be pure, these fish will be re-examined using DNA analysis.

A population of California golden trout is present in Salmon Creek (Figure 1), a tributary to the Kern River. There is documentation that in about 1889, trout from Trout Creek, a tributary to the SFKR, were transplanted into Salmon Creek (Boyd 1973). Allozyme analysis revealed that the trout in Salmon Creek are most likely California golden trout. However, they are "highly differentiated from SFKR and GTC samples (Bagley et al. 1998). The authors hypothesize that this differentiation may have been due to the small number of trout used to start the population (founder effect) or due to genetic differences in the source population. There are records of rainbow trout being planted in Salmon Creek as early as 1873 (Ellis 1915) and almost annually between 1932 and 1947, with the last plant occurring in 1951 (CDFG unpublished records, Kernville). Trout from the headwaters of Salmon Creek will be analyzed using DNA technology in a future study. These fish are important because they are the only known population of California golden trout from lower down in the drainage.

In addition, many of the waters in the headwaters of the South Fork Kings River and several tributary streams and lakes were also planted with California golden trout from GTC between 1909 and 1914. Sam Ellis, one of the CDFG employees responsible for many trout transplants from GTC, kept a map of 1870 to 1915 trout transplants from GTC to waters elsewhere in the southern Sierra Nevada. Information on the map shows locations, dates and species of trout planted in the southern Sierra Nevada. Based on this map, information from other sources (Ellis

1915; Ellis and Bryant 1920), and all known stocking records (such as unpublished CDFG hatchery records) a list of more than seventy-five waters has been developed where no additional trout stocking is known to have occurred. It is possible these waters contain non-hybridized California golden trout that were transplanted from GTC (Stephens, CDFG, pers. comm.).

In more distant California waters, planting records and historical documents show that California golden trout have been stocked in Alpine, El Dorado, Nevada, Placer, Sierra, Fresno, Inyo, Madera, Mono, Siskiyou, Trinity, Tulare, and Tuolumne counties (Fisk 1983). Outside of California, between 1928 and 1937, golden trout were sent to England, Colorado, Utah, Montana, New York, and Wyoming (McCloud 1943). The source for most of these trout transplants were eggs from Cottonwood Lakes. Eggs were shipped to the Bozeman Nation Fish Hatchery from Cottonwood Lakes as early as 1907, before the establishment of an egg taking station (Marcuson 1984).

4.0 LAND MANAGEMENT DIRECTION

Management of the habitat for the California Golden trout falls under the direction of two National Forests. The SQF manages lands on lower SFKR, including Trout and Fish creeks (Figure 2). The majority of the habitat is the responsibility of the INF and includes upper SFKR and GTC (Figure 3). Each Forest is guided by their own Forest Land and Resource Management Plan, as directed by the Federal Land Policy and Management Act (FLPMA 1976). In 2004, the Final Supplemental Environmental Impact Statement and Record of Decision for the Sierra Nevada Forest Plan Amendment (SNFPA) was incorporated into all Sierra Nevada Forest Plans, and supercedes direction given by the most current Forest Plans if the guidelines are more stringent than those already in place. (The SNFPA is colloquially referred to as the Framework.) Therefore, the direction given for riparian and aquatic resources for both Forests in the specific Forest Plans is supported or superceded by direction given in the Framework.

4.1 Sequoia National Forest Land and Resource Management Plan

The Forest Land and Resource Management Plan (FLRMP) for the SQF (USDA 1988b) provides direction for fisheries management, along with other aquatic/riparian species and their habitats. Management direction for fisheries, including the golden trout, incorporates elements identified in the SQF FLRMP, supplemental direction from the Mediated Settlement Agreement (MSA) (USDA 1990), and the SNFPA (USDA 2004). Specific management direction that would affect the California golden trout, as taken from the SQF FLRMP, can be found in Appendix A of this document.

General aquatic and riparian species are those species that are not listed as Federal or State Threatened or Endangered, Proposed for Listing, R5 USFS Sensitive Species, or California Species of Special Concern. The direction in the SQF FLRMP for managing general aquatic and riparian species is to increase the diversity of the animal communities and also provide well-distributed habitat diversity on each Ranger District for all indigenous aquatic species (USDA, 1988b). To do this, habitat is to be maintained or increased to ensure that aquatic species will have adequate population levels and distribution to provide for their continued existence

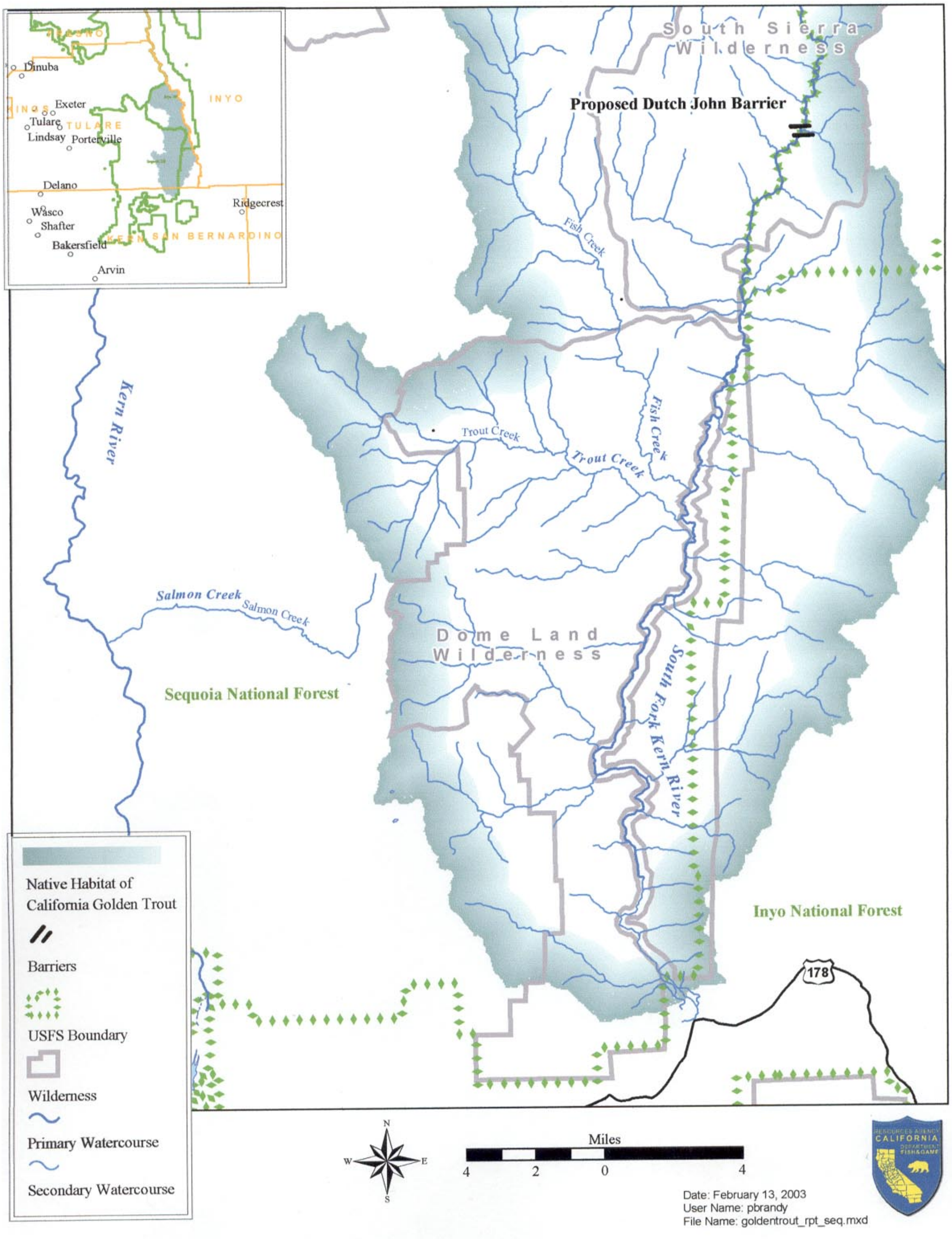

Figure 2 – Sequoia National Forest part of Kern Plateau

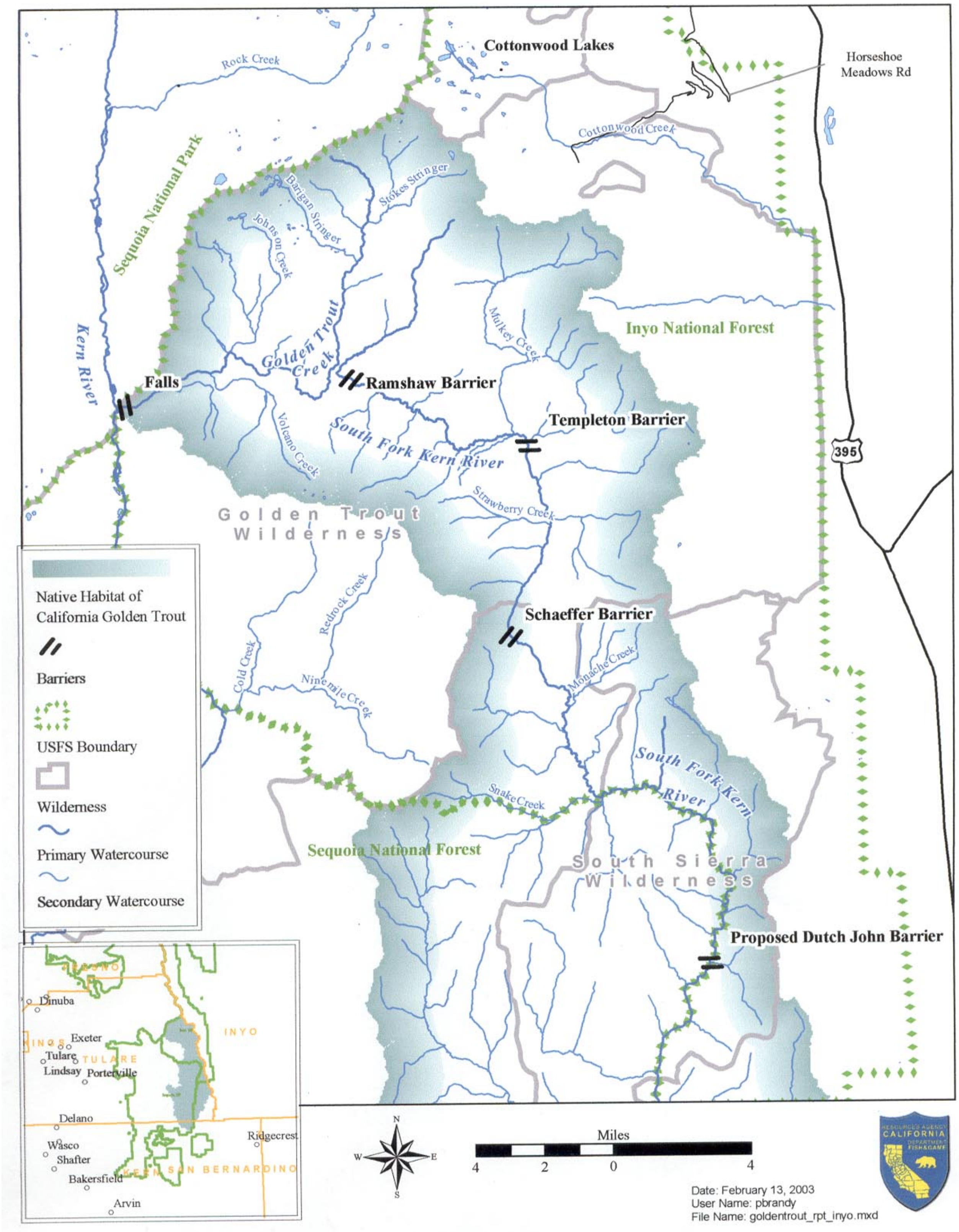

Figure 3 – Inyo National Forest part of Kern Plateau

throughout their current range (*ibid.*). Habitat management will be emphasized for species that utilize riparian areas and down-log habitats (*ibid.*).

The majority of the historic habitat for golden trout on the SQF is located within the South Sierra and Domeland Wildernesses (Figure 2). Specific management direction for these two wildernesses was established with Management Plans by the USDA Forest Service in 1978 (USDA 1978) (Domeland) and 1991 (South Sierra) (USDA 1991a). Neither Plan provides specific direction for California golden trout. General direction is to maintain and perpetuate the enduring resource of wilderness as one of the multiple uses of National Forest system land. Additionally, river segments along the SFKR are managed as Wild and Scenic. Access to the area is limited to a series of trails, with the exception of Forest Road 22S05 that provides a travel corridor to Kennedy Meadows and beyond. The headwater areas of most tributary streams are roaded and these areas have had timber management activities in the past. Current primary uses on this portion of the Forest are recreation (including OHV use, equestrian use, and camping) and domestic livestock grazing.

There are three cattle grazing allotments (Figure 4) on the SQF that drain to the SFKR: 1) A. Brown (up to 200 head from June 15 to September 30); 2) Burnt Country (approx. 30 head in upper Trout Creek from July 1 through September 30); and 3) Fish Creek (up to 700 head from July 1 through September 30) (Table 1).

Table 1 – Summary of cattle Grazing Allotments on the Sequoia National Forest part of the Kern Plateau.

SQF Allotment	Grazing Period	Livestock permitted in SFKR drainage	2001	2002	2003	2004
A. Brown	6/15-9/30	200	Non use	Non use	Non Use	Non use
Burnt Country	7/1-9/30	30	Non use	Non use	Non Use	30
Fish Creek	7/1-9/30	700	450	450	425	425

The southern Sierra fisher conservation area encompasses the known occupied range of the Pacific fisher (*Martes pennanti pacifica*) (fisher) in the Sierra Nevada. The fisher is a State designated species of special concern, and is on the Federal candidate species list. The fisher's range overlaps with that of the California golden trout and its habitat, which puts the California golden trout waters under fisher management direction for this area. This overlap consists of an elevational band from 3,500 feet to 8,000 feet (1,067 to 2,438 meters) on the SQF. Management direction for overlapping riparian conservation areas, meadows, and critical aquatic refuges (CARs) complements southern Sierra fisher conservation area management direction; in these overlaps, the Forest standards and guidelines of both allocations apply.

There are currently no proposed vegetation manipulation projects (such as timber or fuel reduction projects) on the SQF within the drainage of the SFKR. The Manter Fire burned through portions of the drainage in 2000. Subsequent to the fire there have been some activities to remove hazard trees adjacent to travel corridors and some additional site preparation and

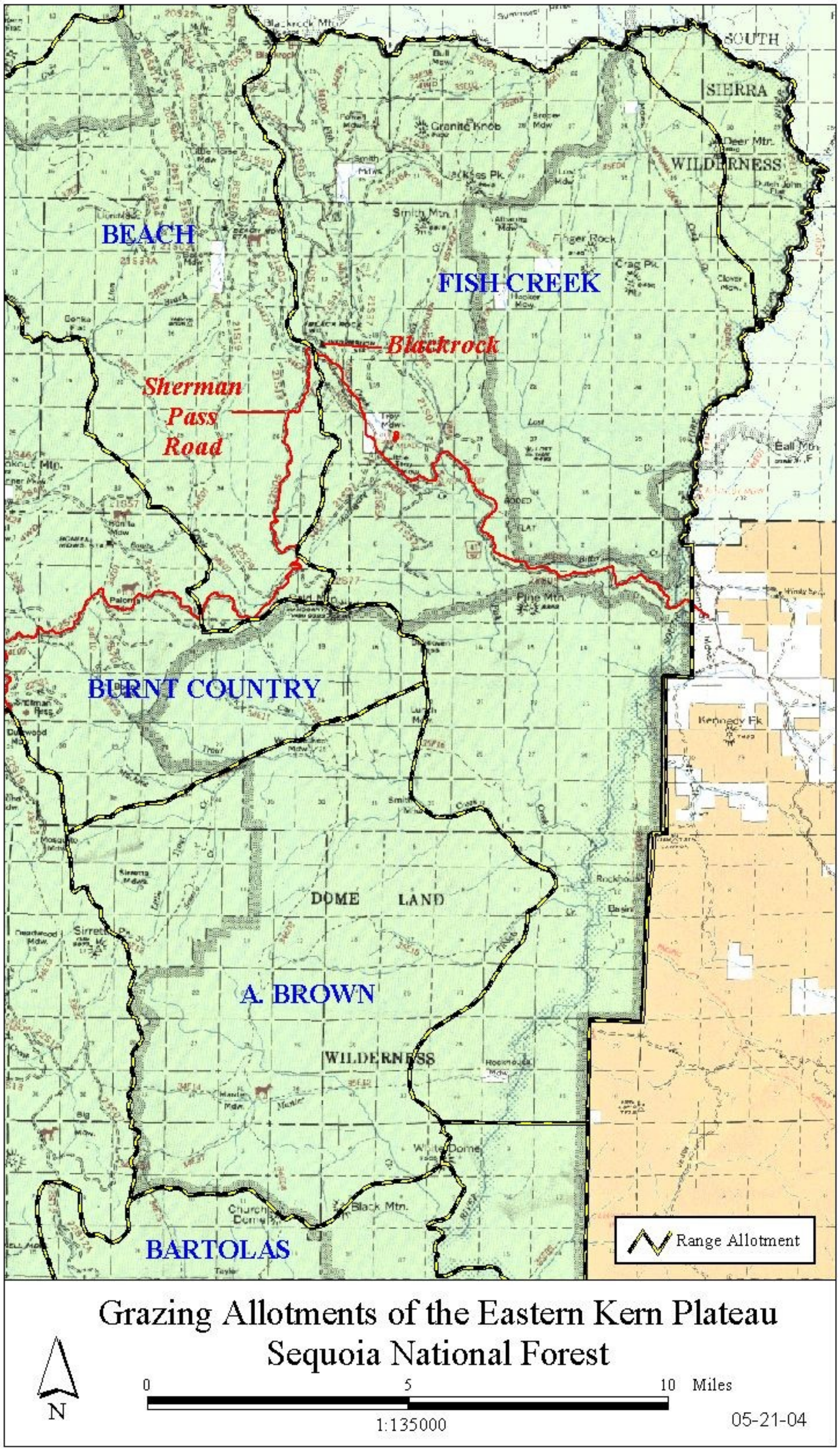

Figure 4 – Cattle grazing allotments on the Sequoia National Forest part of the Kern Plateau.

planting may occur within the fire. There are two Wildland Urban Intermix Zones on the SQF along this portion of the SFKR, which are near Black Rock Station and Troy Meadow.

4.2 Inyo National Forest Land and Resource Management Plan

Standards and guidelines applicable to fish and their habitat, including the California golden trout, are given in the INF's FLRMP (USDA 1988b), as amended (1995). Other direction aimed at providing protection for California golden trout habitat include the Golden Trout Wilderness, Wild and Scenic River designation for the SFKR, special management area for the South Fork Kern Watershed, and the Conservation Strategy for the Volcano Creek [California] Golden Trout. Specific management direction that would affect the California golden trout, as taken from the INF FLRMP, can be found in Appendix A of this document.

The current occupied habitat for the California golden trout on the INF is mostly contained within the Golden Trout and South Sierra Wilderness Areas, except for the SFKR through Monache Meadows (Figure 5). Direction for managing the wilderness areas is to protect the integrity of natural ecological processes by restoring those processes that have been altered by human activities. Management within the area is directed towards recovery and maintenance of golden trout habitat, as long as activities are within the constraints of wilderness values and regulations. The regulatory process for using mechanized equipment for recovery activities can add additional time to obtain necessary permits and authorizations, and can extend the timeline expected for similar activities in non-wilderness areas. Therefore when planning conservation actions in wilderness areas, it is important to account for regulatory requirements and any additional time needed to be in compliance with existing regulations.

Recreation outside of the wilderness, primarily in the Monache Meadows area, caters to the rugged, outdoor OHV experience. Access is restricted to a single, four-wheel-drive-mandatory road that enters to the south of the meadow. Camping, fishing and hunting are the primary uses, as well as providing access for horse packers.

There are four grazing allotments within the Inyo portion of the Kern Plateau: the Mulkey, Monache, Templeton and Whitney Allotments (Figure 5). Grazing has been suspended for ten years beginning in 2001 for the Templeton and Whitney Allotments, as described in the Conservation Measures section. Grazing still occurs within the Mulkey and Monache Allotments, with 235 permitted head of cattle from July 10 to October 10 on the Mulkey Allotment, and 885 head of cattle permitted from July 1 to September 30 on the Monache Allotment. Exact on/off dates for the allotments are determined by factors including plant phenology, soil condition, forage utilization and climatic variables.

There are no timber or fuel reduction projects planned, or identified, within the Monache Meadows or adjacent areas. Vegetation improvement projects, such as riparian vegetation enhancement and streambed repairs have been implemented within the California golden trout's habitat and range.

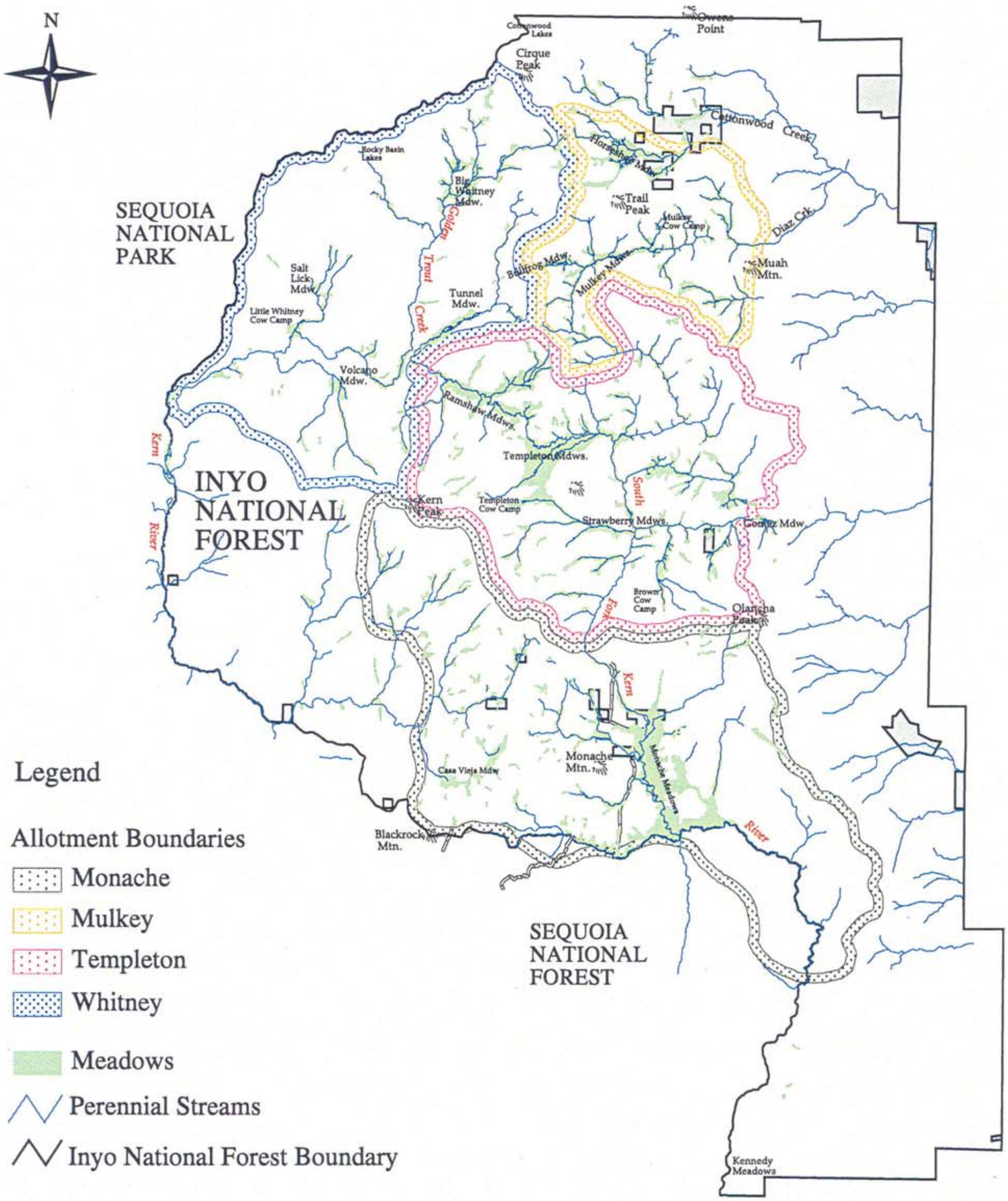

Figure 5 – Cattle grazing allotments on the Inyo National Forest (prepared by INF)

4.3 Final Supplement to the Sierra Nevada Forest Plan Amendment (SNFPA)

With the adoption of the SNFPA in 2004, new standards for management of riparian areas replaced previous existing FLRMP standards for national forests in the Sierra Nevada and Modoc Plateau (USDA 2004). Two different designations for riparian areas were created, the Riparian Conservation Areas (RCA) and the CARs. These designations are included in the SNFPA (2004). CARs are subwatersheds, generally ranging between 10,000 to 40,000 acres, with some as small as 500 acres, which contain either: known locations of threatened, endangered or sensitive species; 2) highly vulnerable populations of native plant or animal species; or 3) localized populations of rare native aquatic or riparian dependent plant or animal species. CAR areas overlap with other land allocations. Under the Framework, standards and guidelines for RCAs apply in CARs except in cases where the standards and guidelines of the overlapping land allocation place even greater restrictions on management activities. For example, some of the INF's grazing standards (see Amendment #6 of the INF FLRMP) are stricter than the RCA grazing guidelines, in which case, the standards in Amendment #6 of the INF FLRMP apply.

Several CARs occur within the habitat for the California golden trout. The Fish Creek and Trout Creek CARs occur on the SQF. On the INF, a CAR is designated in the watershed that encompasses GTC and its tributaries, including all the land within that watershed to the confluence with the Kern River. Standards and guidelines for CARs are identical to those for RCAs, but apply to the entire mapped area.

The width of the RCA is defined as being 300 feet on each side of the stream, measured from bankfull edge of the stream for perennial streams. For ephemeral streams with defined stream channel or evidence of scour, the effective area is 150 feet on each side of the stream, measured from the bankfull edge of the stream. All streams and stringers within the California golden trout habitat fall within the management standards and guidelines, which are identified as Riparian Conservation Objectives (RCO's). The RCO's that apply to the management area of the California Golden Trout and associated Standards and Guidelines are detailed in Appendix A of this document and in the SNFPA (USDA 2004).

4.4 Other Management Direction

On April 20, 2000, forest-wide direction was given to all National Forests in regard to fire retardant use during wildland fire suppression activities. The guideline is to avoid aerial application of retardant or foam within 300 feet of waterways. Further details concerning delivery from different types of aircraft, interactions with Threatened and Endangered species and exceptions are given in the document. A copy of the guidelines is included in Appendix A of this document.

5.0 THREATS TO THE SUBSPECIES

Threats to the conservation of California golden trout within its historic range can be grouped into two categories: 1) non-native trout introductions; and 2) habitat degradation. Of the two threats, the greatest risk is from the effects of non-native trout introductions, which are primarily hybridization and introgression, and secondarily predation, and interspecific competition for food and space.

5.1 Non-Native Trout Introductions

Early restoration efforts to protect California golden trout were begun in the 1970's by addressing the threats posed by brown trout introductions. The extent of the more insidious problem of hybridization with rainbow trout was largely unknown at that time due to the lack of the availability of genetic testing. Biologists relied on meristics (things you can count) and outward appearance to separate species of fish. When the first allozyme analysis in 1995 revealed that hybridization had occurred in the Cottonwood Lakes broodstock, the problem was recognized, but its full extent was still not realized (Leary 1995). Only with further allozyme analysis, and finally the use of molecular DNA methodology, are the effects of non-native trout introductions in GTC and the upper SFKR beginning to be fully understood.

5.1.1 Hybridization and introgression with Non-native Rainbow Trout

It is recognized now, by far the greatest threat to the continued existence of California golden trout is from hybridization and introgression with non-native rainbow trout. California golden trout readily hybridize with other subspecies of rainbow and cutthroat trout (*O. clarki* spp.) (Behnke 1992a). Hybridization with close relatives such as rainbow trout dilutes the fundamental genetic character of California golden trout, resulting in a significant loss to the native gene pool over time. Genetic contamination is difficult to detect because it is impossible to visually determine, with any degree of certainty, which fish are hybridized. Hybridization between California golden trout and non-native rainbow trout is sometimes displayed by an increased number and location of body spots, especially below the lateral line, and a more rainbow trout-like body coloration and iridescence. However, not all hybrid trout display rainbow trout characteristics. The only way to determine, with certainty, if a population has hybridized is through genetic analysis using DNA methodology.

There is no known degree of certainty about the long-term consequences of the current level of genetic contamination by non-native rainbow trout on California golden trout populations (see 7.1.2 Consequences of Low Level Hybridization). What the rainbow trout alleles in the hybrid individuals code for is unknown, thus it is difficult if not impossible to attribute differences in morphology, behavior, ecology, and life history to the introduction of non-native alleles into the gene pool. If the non-native alleles are selected against, they should decrease in abundance from within the population. If they are selected for, they should increase in abundance within the population. If neutral, they are likely to persist at low levels throughout the population. Any or all of these scenarios may be in effect, but their impact on California golden trout populations is unknown.

One of the researchers actively participating in California golden trout conservation efforts offered the following advice: "It seems that monitoring of hybridization should be emphasized as a first course of action as an attempt to assess the spread or decline of hybridization; establishment of refuges should be offered as an option or alternative security measure that has its own problems and caveats (i.e., choosing source population(s) and maintaining genetic diversity)" (B. May, UCD, pers. comm.). Even though there are problems associated with choosing source populations relative to maintaining genetic diversity, it seems only prudent to assume that under the existing conditions, without some immediate and deliberate management actions, non-hybridized native trout genotypes may not be preserved (Leary and Booke 1990).

5.1.2 Strawberry Connection

Strawberry Creek, a western tributary to the SFKR, enters the river just downstream of the Templeton Barrier (Figure 6). During a 1996 survey by CDFG biologists, heavily spotted trout, suggestive of California golden trout and rainbow trout hybrids, were observed in the north branch of upper Strawberry Creek (C. McGuire, CDFG, pers. comm.). Allozyme analysis on a sample of these trout by geneticists at the University of Montana and the UCD revealed that they were indeed introgressed with rainbow trout (Leary 1997; Gall and May 1997; Bagley et al. 1998). Bagley et al. (1998) concluded that the trout in Strawberry Creek were more similar to rainbow trout in tributary streams to the Kern River than to California golden trout, and that the introgression there had occurred recently. It appears likely that hybrid trout from nearby Redrock Creek, a tributary to the Kern River, were illegally transplanted into Strawberry Creek following the last series of chemical treatments of the area by CDFG personnel in the 1980s.

Strawberry Creek and an unnamed tributary of the SFKR further up the watershed in Templeton Meadows originate in close proximity to each other above a low-lying ridge west of Templeton Mountain (Figure 6). Templeton Barrier prevents upstream movement of trout between these two drainages via the SFKR. However, in their headwaters there is a meadow area where during high flows, they are hydrologically connected. Exacerbating the problem, at some time in the past 50 years, the cattle permittee at the Templeton Cow Camp constructed a small wood and metal dam that diverted part of the stream flow from upper Strawberry Creek to the northeast into the unnamed tributary so it enters the river upstream of Templeton Barrier. This diversion facilitated a possible hydrologic route for trout to travel around Templeton Barrier and is referred to as the Strawberry Connection.

Evidence that trout had bridged the Strawberry Connection was discovered during the high water year of 1997. During an electrofishing survey by CDFG biologists, three trout were found in isolated pools in the uppermost reach of the unnamed channel flowing into the SFKR in Templeton Meadow upstream of Templeton Barrier. All three fish were collected for genetic (allozyme) analysis, and no other fish were observed within that reach. One of the three trout appeared to be a golden x rainbow trout hybrid, as it had heavy spotting below the lateral line. Allozyme analysis of these fish revealed that they were all California golden trout and rainbow trout hybrids and were similar to the hybrid fish in the north branch of Strawberry Creek (Bagley et al. 1998). Leary's 1997 allozyme analysis of the California golden trout from the SFKR at the mouth of the unnamed tributary upstream of Templeton Barrier indicated that the trout there were non-hybrid California golden trout and that they were dissimilar from the hybrid trout in the headwaters of both the unnamed tributary and Strawberry Creek. The allozyme analysis suggests that fish movements between these two drainages were directly facilitated by high stream flow conditions at the Strawberry Connection. In 1997 when these drainages were surveyed, there was no surface flow from the headwaters of the unnamed tributary to the SFKR. At that time the water disappeared subsurface, beneath the sandy meadow, so it is likely that the

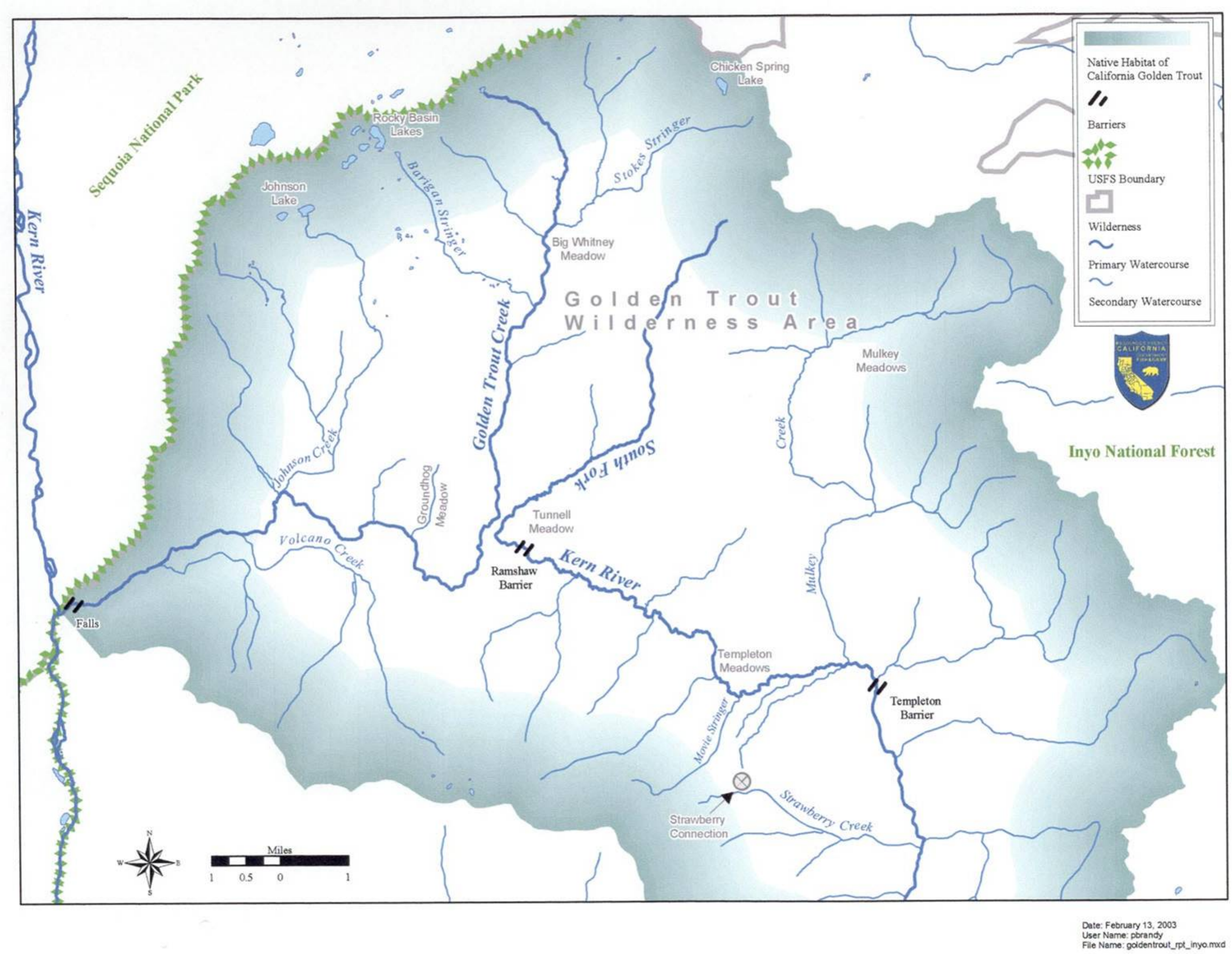

Figure 6 – Upper South Fork Kern River and Golden Trout Creek

three fish found in the headwaters of the unnamed tributary above the Templeton Barrier moved there from Strawberry Creek via the Strawberry Connection.

Because the diversion structure posed a significant threat to the California golden trout population upstream of Templeton Barrier, it was removed in 1999. An effort was made to return the flow back into the historic channel of Strawberry Creek. Native willow slips were planted at the diversion site to help restore and stabilize the banks.

Examination by CDFG and INF biologists in 2002 revealed that, while the willow plantings had been successful at rooting and growing at the old diversion site, there are still several other places in the area that may allow fish passage during high flows. Solutions to preventing hydrologic connectivity at the Strawberry Connection need to be evaluated by qualified hydrologists. Some structure or other channel modification may be necessary to better separate the two watersheds under high stream flow conditions. It is also possible that there may be no reasonable option to preventing the mixing of these two watersheds under high flow conditions.

Electrofishing surveys by CDFG with the aid of volunteers in October 2003 revealed that adult brown trout had ascended Strawberry Creek to the junction of the two forks of Strawberry Creek. Drought conditions over the past several years have prevented brown trout from ascending further upstream. In 2003, to temporarily check the upstream movement of brown trout, an effort was begun to remove brown trout from Strawberry Creek by electrofishing. However, rainbow trout may be a greater threat due to their spring migration under higher flows than the fall spawning brown trout that would move under low flow conditions.

The existence of the Strawberry Connection exposes 83 miles (134 km) of California golden trout habitat between Templeton and Ramshaw barriers to invasion by brown trout and golden trout with high levels of rainbow trout introgression. This 83 mile reach is in the heart of the native California golden trout range and its protection is crucial to effective conservation and long-term security of the subspecies.

5.1.3 Catchable Trout Stocking Program at Kennedy Meadows

The CDFG has stocked non-native brown and rainbow trout in the lower SFKR at Kennedy Meadows since 1930. The current trout allotment (beginning in 2004) is for 2,400 triploid (sterile) catchable-size rainbow trout (1,200 pounds [544 kg]) planted twice per season. The State Fish and Game Commission's Golden Trout Policy, adopted in 1952, prohibits the stocking of non-native trout in designated California golden trout waters. This catchable trout stocking program is extremely popular with some members of the angling public and CDFG management wishes to continue this program in some form that no longer threatens the California golden trout populations upstream.

Recent electrofishing surveys found the wild trout population in this reach of the SFKR is depleted due to intense recreational angling. Compounding the problem, the instream habitat in this reach of river has been degraded and is detrimental to most aquatic resources, including trout. The river bottom is filled with sand, eliminating the deep pools and aquatic insect production beneficial to both stocked and wild fish (Reeves et al. 1991) (see section 5.2 Habitat Degradation).

While the catchable-size rainbow and brown trout are not well adapted for survival in the wild, a few have survived and reproduced. A self-sustaining population of brown, rainbow and golden x rainbow trout hybrids exists in the SFKR downstream of Templeton Barrier. The reproduction of stocked rainbow trout with California golden trout exacerbates the problem of hybridization and is the likely cause of the high levels of introgression (88%) that have been documented in the lower reaches of occupied California golden trout habitat in the SFKR (Cordes et al. 2003). The switch by CDFG in 2004 from the use of fertile to sterile (about 99% sterile) catchable sized rainbow trout should effectively eliminate the infusion of non-native genetic material into the trout population.

Whether or not the current catchable trout stocking continues or is eventually eliminated, evaluation of a new barrier at the Dutch John site seven miles upstream of Kennedy Meadows is desirable (Figure 3). The additional barrier would allow the extension of the California golden trout population downstream into about 62 more additional miles of their historic range (Schaeffer to proposed Dutch John barrier) and decrease the risk of trout being illegally moved upstream over one of the upper three fish barriers. Unfortunately it would not be difficult for an individual to illegally move non-native trout upstream of existing fish barriers. One advantage of this site is that it is remote and thus the risk of illegal trout movements upstream of this barrier may be reduced. The Dutch John Barrier has been proposed to be located in the Domelands Wilderness.

5.1.4 Brown Trout Predation and Competition

Predation by non-native brown trout can devastate California golden trout populations and therefore is a conservation issue. Brown trout are present in over 300 miles (778 km) of historic California golden trout habitat on the SFKR. They occupy habitat in the river, and many tributary streams downstream of Templeton Barrier. Brown trout prey on all life stages of golden trout. They compete with California golden trout for resources, which may be limited, such as food and space, particularly in the few deep pool habitats. Before the restoration program began in 1969, brown trout outnumbered California golden trout by 50 to 1 in the headwaters of the SFKR (Pister 1998). Brown trout are not present in the GTC watershed.

Predation by birds and mammals has not been documented to have a significant negative impact on California golden trout populations in either of its native watersheds. Angler harvest is light in most areas and is considered to have no significant negative effect except at Monache Meadows, Kennedy Meadows, and a few other easily accessible areas (C. McGuire, CDFG, pers. comm.).

5.1.5 Illegal Trout Transplants

Illegal transplanting of trout is a real and continuing threat to the continued existence of California golden trout. As such, greater public education and enforcement efforts are necessary and a part of this strategy. Citizens have been known to illegally move trout of unknown origin into the California golden trout's range, thus jeopardizing the success of basin-wide efforts to protect California golden trout. Illegal transplants may be motivated by various factors.

In 2003 the Schaeffer Barrier was reconstructed to prevent the upstream movement of trout. Removing all trout between Schaeffer and Templeton barriers is one goals of this Strategy (although the target area could change based on current and future genetic information). However the illegal movement of brown trout upstream of the Schaffer Barrier will continue to remain a threat, especially with the presence of existing roads and trails that provide public access upstream of existing barriers. The construction of an additional fish migration barrier downstream of Monache Meadows combined with a California golden trout management program with an education and outreach component is likely to reduce the threat of brown or rainbow trout being illegally moved upstream of Schaeffer Barrier or elsewhere within the species' range.

5.1.6 Founder Effect

Founder Effect is defined as random genetic changes caused when a population is established from another, using only a few organisms. This usually results in a loss of genetic variation and is referred to as a genetic bottleneck. Species conservation depends on protection of genetic diversity (Rieman et al. 1993). The consequences of reduction in genetic diversity are the loss of a species adaptation to its environment and ability to respond to environmental change. There is no way of knowing the minimum amount of genetic diversity that must be maintained to ensure the continued existence of a particular species (Rieman et al. 1993). However, it is critically important to make every effort possible to optimize genetic variability.

A naturally occurring population typically contains a wide range of genetic diversity, giving the species the ability to adapt to most changes in their environment. The genetic composition of each individual organism in a population, however, may not contain the full range of genetic diversity present in the entire population. When only a few organisms are used to establish a new population, the new population may not contain the full complement of genetic material present in the original population, and the resulting population may become bottlenecked. According to Leary and Allendorf (1993), "genetic variation is essential in order for populations to make adaptive responses to changing environmental conditions through the process of natural selection."

Based on records of the source(s) and small number of California golden trout transplanted into the Cottonwood Creek watershed (i.e., small founding population), and the electrophoretic evaluation of 62 protein-coding loci of various California golden trout samples, Leary and Allendorf (1993) offered an important conclusion. They identified a loss of genetic variation in association with the small founding populations. Moreover, they concluded that the more generations away from the donor population the new population was, the greater the reduction of genetic diversity.

Because only a few trout were likely used to establish most of the out-of-basin populations of California golden trout, there has probably been a successive reduction of genetic diversity in each newly established population. Therefore, when considering specific populations as a source for restoration purposes, not all California golden trout populations may be of equal value, especially those established using relatively few adult trout. Because in most cases there are no records of the number of fish or the exact origin and genetic make up, all populations established by historic transplanting of California golden trout to new waters will be evaluated using current genetic analysis techniques before proceeding with further fish movement or management activities. These populations will also have to undergo evaluation by fish pathologists to ensure no undesirable diseases would be transferred to new waters.

Serious consideration must be given to the preservation of genetic diversity when considering the management of this subspecies, especially when considering the establishment of new California golden trout populations or refuges. Only an adequate number of California golden trout should be used, from a genetic conservation viewpoint, to establish a new population. These donor fish must come from a population with as much genetic diversity as possible. Preserving phenotypic and genetic diversity also requires maintaining populations through a wide geographic range in a variety of habitats (Rieman et al. 1993; Allendorf and Leary 1988; Leary et al. 1991; Moyle and Sato 1991; Reeves and Sedell 1992).

5.2 Habitat Degradation

The existence of quality habitat within the native range is a critical component to the overall well-being of California golden trout. Optimum habitat is necessary to allow the subspecies the opportunity to fully express and preserve its population characteristics over time. Since much of the land within the native range of the California golden trout is owned and managed by the Forest Service, it is important that the Forest Service manage land use in a manner that does not degrade riparian and instream habitat of watersheds within the native range.

Due to the remoteness of most of the Kern Plateau, the diversity of land uses is limited. The use with the highest impact and that which has caused most of the habitat degradation is grazing of domestic livestock. The impacts of grazing to California golden trout habitats include the loss of pool habitat, sedimentation, reduced instream cover, riparian cover loss, loss of undercut streambanks, stream channels becoming wider and shallower, the resultant inability of the system to buffer temperature extremes (increased summer water temperatures and threat of icing in colder months), loss of quality spawning habitat and reduction of instream and riparian area food production. Riparian and meadow habitat degradation is common to both the SFKR and GTC watersheds in many areas where cattle-grazing is permitted. Recreational use can have a similar negative impact on streambanks, but the damage is limited to a few sections of the SFKR. While these impacts may not lead to the extinction of the California golden trout, habitat degradation is having an impact on the size, numbers, physical condition, and structure of California golden trout populations (Knapp and Matthews 1996; Knapp and Dudley 1990).

Decreases in habitat quantity and quality have cumulative impacts on individual fish and populations. Loss of cover such as undercut banks increases the vulnerability of California golden trout to predation, while shallower pools reduce the quality of over wintering habitat (Reeves et al. 1991) and growth potential, again raising mortality. Increased rates of streambank erosion and fine sediment deposition do not appear to have strongly affected the ability of California golden trout to spawn and reproduce, as evidenced by their relatively high population numbers per length of stream. Because many stream reaches are unnaturally wide and shallow, there is an overabundance of spawning areas. The California golden trout are adapted to spawning in coarse sand substrate. Unlike a properly function channel with pools and pool tail-outs (where spawning would typically occur), California golden trout are able to use most of the sandy bottom substrate to successfully spawn (Knapp and Vredenburg 1996).

However, the deposition of fine sediments in the interstitial spaces between larger substrate likely has had an impact on the diversity of aquatic invertebrates, particularly their seasonal availability as trout food, further reducing the potential for growth and survival of California golden trout. This situation is exacerbated by the generally poor riparian habitat along many reaches of the SFKR and GTC. Cadwallader et al. (1980) found that overhanging riparian vegetation was important for terrestrial insect input in some streams and that terrestrial insects were more common in the stomachs of fish from sites with overhanging vegetation. During the summer months of peak feeding, in areas with riparian vegetation, terrestrial insects that drop into the water can comprise as much as 50% of a trout's diet (Behnke 1992a; Wipfli 1979). The loss of food and habitat are at least partial explanations for the relatively low growth rates of California golden trout (Knapp and Dudley 1990).

5.2.1 Historical Perspective of Grazing

Almost all (95 percent) of the California golden trout historical habitat on the INF and SQF has been subjected to varying intensities of grazing by domesticated livestock for more than 130 years. Grazing by domestic livestock in the Sierras Nevada dates back to European settlement of California (Menke et al. 1996; USDA 1997b; Burcham 1981; Ratliff 1985). It is estimated that thousands of sheep and cattle grazed the Kern Plateau each season from the 1860s until the 1920s (USDA 1961). Following the gold rush of the mid-1800s, grazing rose to a level that exceeded the carrying capacity of the available range and caused significant impacts to meadow and riparian ecosystems throughout the Sierra Nevada (Meehan and Platts 1978; Menke et al. 1996). In 1852, stockmen from Bakersfield are reported to have summered 10,000 head of cattle in Monache Meadow (USDA 1965). Local anecdotes compiled by the Forest Service personnel suggest that much of the erosion on the Kern Plateau occurred between the 1870s and 1940s (Sarr 1995). Moreover, "excessive number of animals and grazing too early in the season appear to be the causes of accelerated erosion in many meadows" (USDA 1982a). With the establishment of national forests, the amount of livestock grazing in the range of the California golden trout was gradually reduced and better documented, and the types of animals shifted, with reductions in sheep and increases in cattle and packstock (Menke et al. 1996; University of California 1996). In 1921, the Inyo National Forest started range inspections and reported 42 permittees using Monache Meadow from June 16 to October 15 (USDA 1965).

There are few references to the historical condition of the Kern Plateau prior to abusive grazing practices. Clarence King (1902) observed in 1871:

> The Kern Plateau, so green and lovely in my former visit in 1864, was now a gray sea of rolling granite ridges, darkened at intervals by forest, but no longer velveted with meadows and upland grasses. The indefatigible shepherds have camped every-where, leaving hardly a spear of grass behind them.

Historical grazing adversely modified stream channels, degraded fish habitat, and caused accelerated erosion and gully formation in many meadows (USDA 1965, USDA 1982b). Extensive gully erosion and altered riparian habitat caused by livestock grazing have been documented throughout the Sierra Nevada and has lead to the present degraded conditions of many meadows and riparian areas on the forest (Hagberg 1995; Wood 1975). Although grazing has been significantly reduced from historic numbers, the effects caused by past grazing practices are evident today.

5.2.2 Effects of Grazing on Stream Ecosystems

Grazing of livestock in riparian areas impacts vegetation in multiple ways, including: soil compaction, which increases runoff and decreases infiltration and water availability to plants; herbage removal, which promotes increased soil temperatures and evaporation rates at the soil surface; and direct physical damage to the vegetation (Kauffman and Krueger 1984; Cole and Landres 1996; Knapp and Matthews 1996). Streamside vegetation protects and stabilizes stream banks by binding soils to resist erosion and to trap sediment (Chaney et al. 1990). A study by Kauffman et al. (1983) indicated that livestock grazing may have weakened the streambank structure through trampling and removal of vegetation, thereby promoting conditions for erosion. Grazing may result in changes to vegetation composition, resulting in an increased density of forested stands and the expansion of trees into areas that were formerly treeless (Cole and Landres 1996).

According to Chapman and McLeod (1987), insect abundance and diversity generally declines in stream systems with high sediment bed-loads. They found that some of the more common mayflies (*Emphemerella* spp.), stoneflies (*Pteronarcys* spp.) and caddisflies (*Trichoptera* spp.) were “moderately sensitive to small and medium amounts of sediment, and highly sensitive to large amount.” Many streams of the Kern Plateau, especially the larger-order streams, consist of a stream bottom composed of a shifting sand substrate. The vast majority of aquatic insects do not do well in the shifting sand substrate (Nuttall 1972), which results in reduced aquatic prey for fish and other predators (Allexander and Hansen 1986; Wipfli 1979). Reiser and Bjornn (1979) found the highest production of aquatic macroinvertebrates occurred in streams with gravel or rubble-sized substrate. Pennak and Van Gerpen (1947) found that the number of benthic invertebrates decreased in the progression from a rubble to a sand stream bottom.

Livestock grazing can cause a nutrient loading problem due to urination and defecation in or near the water, and can elevate bacteria levels in areas where cattle are concentrated near water (Meehan and Platts 1978; Stephenson and Street 1978; Kauffman and Krueger 1984). The nutrient status of streams can markedly influence the growth of microflora and microfauna and directly and indirectly affect many other characteristics of the stream biota (Lemly 1998). Growth of filamentous bacteria on the bodies and gills of aquatic insects has been documented in association with nutrient loading in livestock use pastures, along with significantly lower densities of insects at downstream sites. In laboratory and field studies, aquatic insects with this bacterial growth experienced extensive mortality. This indicates that elevated bacteria levels associated with livestock use can negatively influence stream insect populations (Lemly 1998).

Stream ecosystems are closely linked to, and dependent on, the riparian zones for nutrient input. Energy becomes available to the stream from two main sources: photosynthesis and input of organic matter from outside the stream. Photosynthesis by aquatic plants in the stream forms the basis which other aquatic organisms depend on for food. The aquatic plants are eaten by aquatic insects, which are a basic food source for trout and other aquatic animals. The second source of energy for the stream comes from organic matter imported from outside the stream (Murphy and Meehan 1991; Wipfli 1997). Leaf litter from the riparian vegetation enters the stream system and affects associated microbial and benthic macroinvertebrate communities that consume and process this organic material into food. A healthy and viable riparian plant community as a source of energy is vital to the well being of the aquatic ecosystem. Land management activities that reduce or remove riparian vegetation may reduce food resources that could contribute to stream energy dynamics (Wipfli 1997).

Competition also occurs within California golden trout populations. Sites with higher fish density contained fish with significantly slower growth rates (Knapp and Dudley 1990). Although growth rates in high-density areas were slower than those with lower fish densities, low growth rates were found throughout the study area. The authors concluded that low stream productivity and the short growing season were probably responsible for low growth rates. The large amount of sand substrate found in much of the SFKR may be contributing to reduced growth rates due to reduced aquatic insect diversity and numbers (Knapp and Dudley 1990). California golden trout are well adapted for spawning in coarse sand. The lack of well-defined runs and riffles in many areas results in an excessive number of redds (nests) and an overabundance of young-of-the-year California golden trout (Sedell 1988). The extent to which this phenomenon affects the SFKR and the GTC is not known at this time.

5.2.3 Beaver

Beaver (*Castor canadensis*) are considered by many as non-native to the Kern Plateau and potentially harmful to trout habitat. There are unconfirmed reports in the literature (Townsend 1979) that beaver existed on the Kern Plateau at the turn of the century and possibly earlier which would indicate they are native to the Kern basin. However, beaver were introduced to the plateau by CDFG wildlife biologists back in the 1940s and 1950s as a potential tool to restore habitat and meadows degraded by livestock grazing (CDFG Bishop, unpublished records).

Both positive and negative effects of beaver on trout habitat have been documented since the 1940s (Tappe 1942, Retzer et al. 1956). Currently, large beaver populations exist in upper and lower Ramshaw Meadow where their dams are trapping sediment, forming extensive pools, and accelerating meadow restoration (C. Riley, INF, personal observation). Beaver have thrived in upper Ramshaw for decades as it is a low gradient channel with an adequate supply of willow. In lower Ramshaw the current willow population is moderate but appears to be increasing as water tables are being raised by dams. No evidence of negative impacts by beaver has been observed to date in Ramshaw Meadow. There are additional, smaller populations of beaver in other locations on the Kern Plateau, but their extent has not yet been surveyed. These populations appear to be expanding to new areas. This expansion in beaver numbers and distribution is a concern and a determination needs to be made about possible management actions. Where negative impacts occur, beaver populations should be actively managed.

5.3 Existing Land Uses, Inyo National Forest

5.3.1 Livestock Grazing

Use of the mountain meadows of the Kern Plateau by livestock has occurred for over 130 years, initially by cattle and sheep in the late 1800s and then exclusively by cattle by the early 1900s

(USFS, INF files). By the early 1930s the Forest Service recognized degradation in watershed conditions and began taking action, including reducing the season of use and numbers of cattle, and implementing active watershed restoration projects. These actions have continued through the years, with current seasons of use and livestock numbers being controlled by implementation of the FLRMP grazing standards and completion and implementation of environmental analysis documents (Golden Trout Habitat Restoration Environmental Analysis, 1983 [USDA 1983]; Templeton Allotment Environmental Analysis 1991 [USDA 1991b]; Templeton and Whitney Allotments Environmental Assessment 2000 [USDA 2000]). Current grazing use is substantially less than historical levels. During the past decade especially, actual grazing use has been less than permits allow. For example, in 2002 the actual use on the Monache allotment was 940 head months, though 2,814 head months were permitted annually over the last decade; on the Mulkey allotment, actual use was 407 head months, though 705 permitted annually over the last decade. Between 1995 and 2000 the number of cattle on the Templeton and Whitney allotments was 1,650 and 1,050 head of cattle, respectively.

In February 2001, Ms. Luci McKee, District Ranger, Mt. Whitney and White Mt. Ranger Districts, signed a Decision Notice that implemented a period of rest on the Templeton and Whitney grazing allotments to allow for the most rapid recovery toward the desired watershed and aquatic habitat conditions. That Decision Notice included the provision that in approximately 10 years, an analysis will be initiated to determine if a proposal should be considered to resume grazing, continue the rest, or permanently eliminate the grazing allotments. The period of rest on these allotments was implemented beginning with the summer of 2001. Interested members of the public and other agencies will be reviewing monitoring results during the rest period, and consulted prior to any proposed action to continue the rest, resume grazing, or retire the allotments (USDA 2002).

The INF LRMP (USDA 1988a) was amended in 1995 to include Forest-wide grazing utilization standards (USDA 2001). These standards were implemented beginning in 1996 on the Monache and Mulkey allotments and resulted in reduced use, especially in riparian areas. The monitoring plan to determine the validity of the decision to rest the Whitney and Templeton allotments includes monitoring the Mulkey and Monache Allotments to determine the effectiveness of the Amendment #6 grazing standards (USDA 1997a). It is anticipated that this information will be used in the analysis for permit renewal for the Mulkey and Monache Allotments in 2007-2008.

5.3.2 Habitat Restoration

Erosion control efforts were implemented by the USFS beginning in 1932 (Laituri et al 1987). These efforts included log, rock and brush control structures in numerous watersheds. In 1980, a watershed inventory was initiated on the Kern Plateau that included surveys to determine the extent of the erosion along each stream and in each meadow. That document, Watershed Improvement Needs Inventory, 1982, was the basis for the Golden Trout Habitat and Watershed Restoration on the Kern Plateau, 1982, document. This document is still used as a guide to determine where much needed restoration activities will take place within the habitat of the California golden trout. More recent efforts (Peterson 1982) have focused on structural control of headcuts and bank trampling to reduce erosion and loss of meadow habitat, particularly within the Golden Trout Wilderness (Smith 1982). Monitoring efforts for the Whitney and Templeton

Allotment decision includes continued efforts to monitor structures and use the information to best determine appropriate locations and situations to use headcut and erosion control methods.

However, debate continues over the appropriateness of using control structures during the monitoring and rest period that has been implemented on the Whitney and Templeton Allotments. The measurement of the rate of recovery of the riparian communities and their ability to recover on their own to provide natural resilience/resistance to natural disturbance, such as high water run-off or flood events, could be influenced by the use of artificial structures. Structures could add “noise” to the analysis of determining the rate of natural recovery with the removal of cattle. Due to this factor, watersheds where monitoring is implemented to test the recovery rate will most likely not have artificial means of controlling headcut migration, unless it is determined that failure to do so would mean losing a critical component of the watershed function and/or California golden trout habitat.

5.4 Existing Land Uses, Sequoia National Forest

The majority of the historic habitat for California golden trout on the SQF is located within the South Sierra and Dome Land Wildernesses. Access is limited to a series of trails, with the exception of Forest Road 22S05 that provides a travel corridor to Kennedy Meadows and beyond. The headwater areas of most tributary streams are roaded and these areas have had timber management activities in the past. Current primary uses on this portion of the Forest are recreation and grazing. There are currently no proposed vegetation manipulation projects (such as timber or fuel reduction projects) on the SQF within the drainage of the SFKR. The Manter Fire burned through portions of the drainage in 2000. Subsequent to the fire there have been some activities to remove hazard trees adjacent to travel corridors. Some additional site preparation and planting may occur within the fire area. There are two Wildland Urban Intermix zones on the SQF along this portion of the SFKR, which are near Black Rock Station and Troy Meadow. There are three cattle grazing allotments on the SQF that drain to the SFKR (see section 4.1)

6.0 PAST CONSERVATION MEASURES

The Golden Trout Wilderness was established on February 24, 1978 by Public Law 95-237, specifically to provide protection for California golden trout. Extensive management, conservation and restoration efforts have been undertaken beginning in 1969 to stop the decline and protect the genetic integrity of the California golden trout. Much of this effort has concentrated on understanding the genetic and population status and distribution of non-hybridized California golden trout populations. Trout samples have been collected annually since 1991 and analyzed by geneticists at the UCD and University of Montana. The results of these allozyme analyses formed the basis of the 1999 Volcano Creek [California] Golden Trout Conservation Strategy, and have guided management actions since that time. Management actions have changed in response to the information acquired by further genetic testing using molecular DNA analysis in 2001 and 2003 by Cordes et al. The following is a brief summary of recent management actions.

6.1 South Fork Kern Fish Migration Barriers

When brown trout were discovered in the headwaters of the SFKR in 1969, the California golden trout restoration program was initiated. A series of initial chemical treatments failed to eliminate these non-native trout throughout the native range of the California golden trout because non-native brown and rainbow trout downstream of the treatment area still had migratory access to headwater stream reaches. Due to the large watershed area, it was determined that fish migration barriers would be needed to preserve the native habitat for California golden trout. The result was the systematic construction of a series of three barriers (Ramshaw, Templeton and Schaeffer) and the restoration of California golden trout to waters upstream of these barriers over the last 30 plus years. As part of this Strategy, the potential for an additional fish barrier, at the proposed Dutch John Barrier site (Figure 3), will be evaluated toward the end of this 5-year planning period (Table 3, Task 1.2u).

6.1.1 Ramshaw Barrier

Located in the gorge between Tunnel and Ramshaw Meadows, the Ramshaw Barrier is the uppermost barrier on the SFKR. It is a natural waterfall, but was originally only a partial barrier. In 1970 and 1973, joint INF and CDFG crews constructed an impassable barrier by blasting and moving rock to fill a small side channel. It has required only minimal maintenance over the years and continues to function as an effective barrier to upstream fish passage.

6.1.2 Templeton Barrier

The Templeton Barrier, at the lower end of Templeton Meadow, was first constructed of steel fence posts and chain link fencing in 1973. It was replaced by a more substantive rock and wire gabion (wire baskets staked to form a barrier) structure in 1980. In 1994 a determination was made by CDFG and INF engineers that both the Templeton and Schaeffer Barriers were on the verge of collapse. This was due to the high bed-load carried by the river and continuous sand blasting of the wire baskets during high-flow events. There was a concern that due to the deteriorated condition of the Templeton Barrier, that larger trout might be able to migrate upstream over the barrier during high flows.

Templeton Fish Barrier was replaced with a rock and concrete dam in 1996. At present, this structure is preventing the upstream movement of brown trout and non-native rainbow trout x golden trout hybrids into the headwaters of the SFKR. It is believed to be a secure and effective barrier with a 50 to 100 year life expectancy (G. Heise, CDFG engineer, pers. comm.**).**

6.1.3 Schaeffer Barrier

The Schaeffer Barrier, another rock and wire gabion structure was built just below the Golden Trout Wilderness boundary in 1981. For several reasons this barrier was never totally effective at preventing the upstream migration of fish. A large jump pool eventually formed at the downstream base of the barrier, increasing the likelihood of brown trout and rainbow x golden trout being able to move upstream over the barrier during high flows. Additionally, as the barrier began to deteriorate, sections in the middle section collapsed during heavy runoff in the 1990s, and had to be repaired several times by CDFG and INF crews. This barrier was replaced with a reinforced concrete dam in 2003. The height of the barrier was increased by two feet, and a cyclopean concrete apron was installed below the spillway to prevent the formation of a jump pool below the dam.

6.2 South Fork Kern River Chemical Treatments

In 1968, brown trout were discovered as far upstream as Tunnel Meadow on the SFKR. Initial efforts to eliminate these non-native trout used backpack electrofishers which stunned the fish and allowed for their capture and removal. However, this methodology only removes a portion of the fish present and is ineffective at completely removing all fish in a reach of stream. The only completely effective tool for removal of all the fish in a stream is the use of chemical piscicides.

6.2.1 Headwater to Ramshaw Barrier Reach

In an effort to save the California golden trout in the headwaters from predation by brown trout, a series of chemical treatments using calcium hypochlorite (a common swimming pool disinfectant) were conducted in 1969, 1970, 1971 and 1973 by CDFG upstream of Ramshaw Falls (Figure 6). Although the numbers were reduced, the chemical treatment did not eliminate brown trout from the headwaters and a more effective chemical was sought to accomplish the task (Pister 1998). Because there was no barrier to upstream fish movement, brown trout continued to re-invade the headwaters. After the completion of the Ramshaw barrier in 1973, Antimycin-A (Fintrol®) was authorized for use in 1976 to remove fish from the headwaters to Ramshaw Barrier.

Prior to the 1976 chemical treatment, approximately 6,000 presumed California golden trout were electrofished out of the SFKR between the headwaters and Tunnel Meadow and held in GTC for restocking after the chemical treatment (Pister, 1998). The trout were held a side channel blocked at either end by a chicken wire fence for 8 to 13 days. One night a severe thunderstorm caused the waters of GTC to flood, and the CDFG crews stayed up all night trying to keep the flow in the side channel from washing away the cages (D. Christenson, CDFG retired, pers. comm.). It was believed that no fish escaped from the cages, but when the fish were retrieved for restocking, fewer than half (2,650) remained in the cages. Cannibalism was the presumed cause for the loss of trout from the cages (Pister 1998). It is now known that the trout in both GTC and the upper SFKR are slightly hybridized with rainbow trout, and it is suspected that the origin of some of the rainbow trout alleles in the GTC population could have been from escapees from the cages placed in GTC in 1976. Because brown trout had ascended the SFKR to the headwaters by that date, it can be assumed that rainbow trout or rainbow x golden hybrids may have also migrated upstream to that point. At that time, biologists used physical appearance to separate pure from hybrid trout.

6.2.2 Ramshaw to Templeton Barrier Reach

Templeton Barrier was originally constructed using chain link fencing stretched across the river, supported by metal fence posts, lined with filter fabric and filled with rock. Once the barrier was completed, a chemical treatment was conducted in 1973 using Fintrol® and a rotenone formulation. Trout were still able to move upstream over this make-shift barrier during high flows, and it was replaced with a gabion barrier in 1980. After the construction of the gabion barrier, a successful chemical treatment using rotenone was conducted in 1981. All fish were eliminated from this 7-mile reach of the SFKR between Ramshaw and Templeton Barriers. The treatment included all of the tributaries with the exception of Mulkey Creek above the barriers near its mouth. This reach and its tributaries were restocked in 1981, 1982 , 1983 and 1984 with approximately 3600 California golden trout collected from the SFKR at Tunnel Meadow (Pister, 1998).

6.2.3 Templeton to Schaeffer Barrier Reach

Although chemical treatments were conducted between the Templeton and Schaeffer Barriers in 1981, 1985 and 1987, eradication of brown trout and restoration of California golden trout upstream of Schaeffer Barrier proved to be problematic. It became increasingly obvious that Schaeffer Barrier was not an effective barrier to upstream fish passage under high stream flow conditions. In the years after each chemical treatment, monitoring of the fish population above Schaeffer Barrier revealed that brown trout were again present upstream of the barrier. It is likely that as the barrier deteriorated, fish were able to move upstream during high flow events (G. Heise, CDFG Engineer, pers. comm.). Below it, a deep jump pool had formed, further facilitating trout movement up and over the barrier. In 1994, another emergency chemical treatment was conducted by CDFG fishery biologists to reduce the trout population, especially large brown trout, between Templeton and Schaeffer Barriers. The concern at that time was that large brown trout might be able to move upstream over the failing Templeton Barrier under high flows. This was a prophylactic action, and not intended to eliminate all fish. Since 1994, brown trout have repopulated this section of the river, although annual monitoring has shown they have not been able to ascend the reconstructed Templeton Barrier. No chemical treatments have been conducted in this section of the river since 1994.

6.2.4 Movie Stringer Creek

Movie Stringer Creek is a western tributary to the SFKR immediately upstream of Templeton Barrier (Figure 6). Genetic analysis of California golden trout in 1998 revealed that the trout in Movie Stringer Creek were hybridized with rainbow trout from the Kern River (Bagley et al. 1998). It is believed these fish were illegally introduced into Movie Stringer from near-by Strawberry Creek. In 2000, Movie Stringer was chemically treated using a rotenone based piscicide to eliminate all fish. It is believed that this treatment was successful. This is difficult to confirm because fish from the river move up into the tributary stream during high flows. The fish in this area will be subjected to future genetic analysis.

6.3 Trout Population Monitoring

Permanent transects were established for fish population monitoring on the Kern Plateau. They were monitored annually between 1985 and 1988 and periodically from 1999 to present. Population estimates were made using the multiple pass depletion method (Serber and LeCren 1967). Results were compared over time to see if there were trends in fish numbers, density, biomass and condition factors. Data collected include species, numbers, lengths and weights, along with stream channel parameters.

While the early data from the SFKR was influenced by the stocking of adult California golden trout in fishless habitat (rapid growth and low density), the number of trout per mile continue to increase in the Templeton Meadow sample site inside and outside the cattle grazing exclosure from 1985 to 1999 (Table 2). The data shows that since 1988, there has been a slight decline in the decline in the trout biomass while the number of trout per mile continues to increase. The average condition factor was 0.8. This would be consistent with the observation of an overabundance of small trout in the main channel. It is speculated that the current condition of the trout population is related to poor instream and riparian habitat.

The California golden trout population in lower Strawberry Creek is quite different than the population in the SFKR. The stream channel and riparian habitat is in better condition than in the main channel. The stream is narrow with stable substrate and some overhanging vegetation. Trout ranged in size from 37-203 mm (1.5-8 inches) with a mean of 133 mm (5.2 inches). The average condition factor for all fish was 1.02. A 1998 population estimate found the population in good condition at 185 pounds of trout per surface acre and 2,753 trout per mile (CDFG unpublished report).

This type of information provides the baseline to compare future trout population monitoring results. Monitoring of the trout population needs to continue at permanent transect sites so that results can be comparable.

6.4 Gill Netting to remove non-native trout from headwater lakes in the Golden Trout Creek Watershed

Fish thought to be non-hybridized California golden trout derived from the Cottonwood Lakes broodstock were planted in the headwater lakes (Johnson, Rocky Basin and Chicken Spring lakes) in the GTC watershed by CDFG between 1955 and 1993. It is now known this broodstock became introgressed with non-native rainbow trout (Leary 1995) well prior to this period, likely as early as the 1930s (P. Pister, CDFG retired, pers. comm.). Once it was learned that the trout

Table 2 – Summary of trout per mile and biomass estimates at two transects, inside and outside the Templeton Meadow cattle exclosure, SFKR between 1985 and 1999.

	Inside Exclosure			**Outside Exclosure**	
Year	**Biomass (lbs/acre)**	**Trout per mile**		**Biomass (lbs/acre)**	**Trout per mile**
1985	28.7	1,921		37.7	2,884
1986	37.1	2,672		134.7	7,896
1987	126.0	6,872		103.3	6,035
1988	154.5	6,938		131.4	7,332
1999	123.0	8,939		95.3	7,612

in the headwater lakes in the GTC watershed were hybridized with non-native rainbow trout, efforts were begun to eliminate these fish using mechanical rather than chemical means. Knapp and Matthews (1998) demonstrated that trout can be eliminated from lakes less than 5 surface acres using gill nets.

Gill netting of Chicken Spring Lake, the four Rocky Basin Lakes, and Johnson Lake was first done experimentally in 1995 by biologists from the CDFG Bishop office. Except for a small segment of flowing stream at the outlet containing fish, Chicken Spring Lake appeared to be fishless. Two of the Rocky Basin Lakes were shallow and contained no fish. The other two larger Rocky Basin Lakes contained only a few large fish and apparently have no spawning habitat available, except in the wettest years. Johnson Lake, however, has had spawning habitat available except during extended drought periods, and has supported a large self-sustaining population of hybrid trout.

In 1999, an extensive gill netting effort was begun in Rocky Basin, and Johnson Lakes. In the summer, crews were assigned to tend the nets on a daily basis for up to five weeks. Initially, large numbers of trout were caught. Multiple gill nets were set late in the fall and left in the lakes over the winter which proved to be very effective. Rocky Basin and Johnson lakes have been fished for three winters and appear to be fishless. Gill netting over the winter of 2002/2003 verified that these lakes are fishless.

Chicken Spring Lake was intensively gill netted during September, 2000 for three weeks, with only one fish caught. No fish were caught in 16 days of intensive gill netting in the lake during June 2001, however 18 fish were captured during this period by electrofishing in the small outlet stream below the lake. During the past several dry years between 2000 and 2003, this stream has been flowing during late summer and fall for a distance of only about 820 feet (250m) before going completely dry. In October, 2002, a portion of this creek was dewatered using a hand pump, and three adult fish were removed. However, one pool proved to be too large for hand pump dewatering. A gasoline-powered pump was used there during the fall of 2003, but the pump was inadequate to dewater the stream due to too much water seepage into the pool from an adjacent meadow. Gill netting will be conducted in this pool in 2004, and annual over-winter gill netting will be continued in the lake. The outlet stream will be observed annually in the spring for spawning activity and later in the summer or fall for young of the year. If drought conditions persist in 2004, hand pumping will again be used to dewater the short flowing section of the outlet stream.

These headwater lakes are located near the tops of valleys, and the streams that drain the lakes are steep and contain multiple waterfall barriers preventing fish from entering the lakes from the creeks below. In most years the streams below the lakes are dry by late season. In addition, recent water years have been below normal, which has resulted in no detectable trout reproduction in Rocky Basin, Chicken Springs or Johnson Lakes. This combined with no recruitment from downstream has contributed to the success of the gill netting efforts to remove fish from these lakes.

7.0 STATUS AND DISTRIBUTION

7.1 Status

7.1.1 New Genetic Analysis Techniques

The 1999 Volcano Creek [California] Golden Trout Conservation Strategy (CDFG 1999) was developed based on genetic analysis of Kern Plateau trout populations using protein electrophoresis (allozyme). This technique has been used for more than twenty years to evaluate the relationships between various California golden trout populations as well as many other fish species. A 1997 allozyme study concluded that trout in the SFKR above Templeton Barrier and most of GTC represented non-hybridized California golden trout (Leary 1997). In the headwaters of the GTC watershed, however, it showed that there were hybridized trout populations in all of the lakes and in Stokes Stringer, the outlet stream from Chicken Spring Lake (*ibid*). This correlated with the trout stocking history, since the lakes were aerially stocked by CDFG between 1955 and 1993 with fingerling trout derived from the Cottonwood Lakes broodstock. It is now known that Cottonwood Lakes contain hybrid California golden x rainbow trout (Leary 1995). There is a significant risk that hybridized trout would gradually move downstream throughout the GTC watershed during high flow events.

Beginning in 2000, much more sophisticated and sensitive DNA analysis techniques were adopted by researchers at the UCD to help discriminate among golden trout and rainbow x golden trout hybrids. Two studies were conducted using microsatellite and single copy nuclear (scnDNA) markers. The first study, completed in 2001, analyzed trout samples from throughout the GTC watershed, Cottonwood Lakes basin, and one sample from the upper SFKR (Cordes et al. 2001). The second study was a comprehensive analysis of trout samples from the SFKR basin. Completed in 2003, it also included samples from the Cottonwood Lakes and 14 other populations originating from California golden trout transplants outside the native range (Cordes et al. 2003).

7.1.2 Results Based on New Genetic Analysis Techniques

With the application of the new DNA technology, it was determined that rainbow trout introgression was far more widespread than formerly thought. The 2001 study revealed that all but one of the populations in the GTC watershed was slightly hybridized with non-native rainbow trout. A single sample from the SFKR above Ramshaw Barrier was analyzed and also found to be introgressed with rainbow trout (Cordes et al. 2001). In the GTC watershed, it was shown that out of a typical sample of thirty trout, one to several fish in each sample contained low levels of non-native rainbow trout genetic material. This level and frequency of introgression was not previously detected using allozyme analysis (except for Stokes Stringer and headwater lakes). Although slight, the introgression level varies from location to location and ranges from an average of less than 1% in Middle Johnson Creek to 8% at the mouth of Barigan Stringer, the outlet stream of the Rocky Basin Lakes (Figure 6). Introgression levels were highest in the headwater lakes (now fishless), and were shown to decrease going downstream (*Ibid*).

In the 2003 DNA study, 15 trout samples were evaluated from throughout the SFKR basin. Unlike the results of allozyme analysis performed by Leary (1997) and Bagley et al. (1998), the DNA work by Cordes et al. (2001, 2003) shows that California golden trout populations in the SFKR are all hybridized with non-native rainbow trout. The results of these studies showed a different pattern of rainbow trout introgression than that seen in the GTC populations. In most of the GTC samples, introgression was evident in only a small percentage of individual fish in each sample, with the introgression decreasing in a downstream direction. Conversely, introgression in the SFKR basin was shown to be highest in the downstream reaches of the watershed (88% at Kennedy Meadows), and gradually decreasing in the upstream direction, (41% at Schaeffer Barrier) with the lowest levels (13-20%) seen in the headwater populations (Cordes et al. 2003). Under the present management recommendations, it is considered important to protect the populations upstream of Templeton Barrier from the more highly introgressed downstream populations (Cordes et al. 2003). The newly reconstructed Schaeffer Barrier is now a key element in preventing the upstream infusion of additional non-native trout genetic material from downstream.

Fourteen out-of-basin transplant California golden trout populations were analyzed in the 2003 study (Cordes et al. 2003). Twelve of these originated from early direct transplants from endemic waters in GTC, but these appear to have been influenced by later stocking with hybridized fish from the Cottonwood Lakes broodstock and contain small amounts of rainbow trout introgression. The remaining two samples (Diaz and Ash creeks) were more recent transplants from upper Mulkey Creek, itself a transplant population of questionable origin (probably the SFKR). Only one of these transplanted populations showed no evidence of rainbow trout introgression. This may be due to sampling error and its conservation value is limited, because it is a small population with low genetic diversity and an unclear stocking history (Cordes et al. 2003).

A number of additional documented transplants of California golden trout outside of GTC watershed are slated to be sampled and analyzed in a forthcoming DNA study. These transplanted populations, which originated mostly from GTC between 1876 and the early 1900s (Ellis and Bryant 1920; Dill 1950; Schreck and Behnke 1971), will be examined to determine if they have become introgressed with non-native trout and, their genetic diversity will be evaluated. It is likely that some of these populations introduced outside of the native range may have since become hybridized with other trout species or be on a different evolutionary trajectory than the native populations (Moyle et al. 1995).

All of the scientific work to date does provide a basis for managing the California golden trout in SFKR and GTC as separate entities. The microsatellite data showed a statistically significant difference in allele frequencies between GTC and SFKR populations of California golden trout (Cordes et al. 2001, 2003). Given the history of rainbow trout hybridization, the brief hydrologic connection in the late 1800's at the Tunnel, and the chemical treatment/restocking in the SFKR, combined with the lack of a reference population for that watershed, it may no longer be possible to determine the prehistoric genetic relationships between the GTC and SFKR California golden trout populations.

Additional scnDNA and microsatellite genetic markers are being explored for future studies, and new molecular DNA analysis techniques are being developed that will contribute to an even greater understanding of the relationships between the various trout populations. The currently defined levels of introgression are likely to change as these new techniques are applied. Therefore, the results presented above must be considered preliminary and will be refined as new molecular DNA markers and technology become available.

7.1.3 Consequences of Low Level Hybridization

Barring the new input of non-native genetic material from additional sources, the long-term consequences of this low level of genetic contamination are uncertain and could follow at least one of two possible paths. If the assumption is that the genetic contamination is from hatchery produced rainbow trout (which is most likely correct) it is possible that any inherited genetic material would have either a neutral or negative selection value in nature. In this case, the level of genetic contamination over time would occur in a greater percentage of the population at a lower level (J. Cordes, UCD, pers. comm.). Eventually, it may become undetectable by current methodology. The other possible path is that the genetic contribution by non-native rainbow trout would be positively selected for by the environment and would increase in successive California golden trout generations. Other groups studying and managing wild salmonid populations have attempted to come up with percentages for acceptable threshold levels of hybridization (UDWR 2000). It has been suggested that percentage cutoffs may not be the solution, and that the process of restoration should use adaptive management strategies (Allendorf et al. 2001). Monitoring populations to determine whether or not management activities are facilitating the reduction of hybrid populations over time may be the most appropriate approach to the management of the California golden trout.

There is little certainty about the long-term consequences of the current level of genetic contamination by non-native rainbow trout on the populations of California golden trout in their native range. Because the consequences of genetic contamination are not predictable, a prudent action would be to establish as soon as possible two types of refuge populations of California golden trout: non-hybridized refuge populations and refuge populations containing relatively low levels of hybridization and introgression. Otherwise, the genotypes of the different remaining populations are at risk of being lost (Leary and Booke 1990).

7.2 Distribution

Based on the analysis to date using DNA, it appears that non-hybridized California golden trout are restricted to less than 1% of their native range (Cordes et al. 2001, 2003). The actual figure could be even less. In the endemic California golden trout habitat, genetic contamination from non-native rainbow trout appears to have affected almost the entire 52 miles (84 km) of the GTC watershed with the exception of one small tributary, and the entire SFKR watershed. The one exception on GTC is isolated from introgressed trout populations by a natural bedrock barrier near the mouth. However, researchers concluded that this population showed reduced genetic diversity and was genetically distinct from the other GTC populations. The present recommendation is that these trout not be used as a source for establishing new California golden trout populations (Cordes et al. 2001). Further genetic analysis of this population, including the analysis of additional trout, using new DNA methodology may produce a different picture.

Thousands of California golden trout were transplanted from GTC mostly to the north. These transplants occurred between 1876 and the early 1900s (Ellis and Bryant 1920; Schreck and Behnke 1971). Many of these trout were introduced into fishless waters. However, many of these waters were subsequently stocked with other non-native trout. Some of these documented transplanted populations will be examined in future DNA studies and could prove to be uncontaminated by non-native trout. Their value as unique populations of California golden trout will be evaluated; they will be protected and, if appropriate, they may be utilized as donor populations for restoration or as refuges.

8.0 CONSERVATION ACTIONS TO PROTECT AND RESTORE CALIFORNIA GOLDEN TROUT

The desired conditions for California golden trout will have been met upon completion of these tasks. However, because this plan is based on adaptive management, tasks may be removed, added or adjusted annually as new information is realized, and thus incorporated into the plan for conservation and management of California golden trout.

Conservation actions that will significantly contribute to the protection and restoration of California golden trout have been identified and prioritized for each of the three primary goals of this Strategy. The implementation of these objectives is detailed in Table 3. The Table provides details on the steps needed to accomplish these goals, including the objectives, tasks, time lines, estimated costs and responsible agencies or non-governmental organizations (NGOs).

GOAL 1: PROTECT AND RESTORE CALIFORNIA GOLDEN TROUT GENETIC INTEGRITY AND DISTRIBUTION IN ITS NATIVE RANGE.

This goal seeks to preserve the native California golden trout genome and the traits that make this fish unique. Remaining populations exhibiting the unique genetic, phenotypic, ecological and behavioral attributes associated with native California golden trout need to be identified and protected within their native range, at key locations where they have been transplanted outside their native range, and in refuges.

OBJECTIVE 1.1: IDENTIFY AND MONITOR EXTANT CALIFORNIA GOLDEN TROUT POPULATIONS

The systematic genetic analysis of California golden trout populations within the South Fork Kern River (SFKR), Golden Trout Creek (GTC) and waters where they have been transplanted outside their native range, will provide clarification on the present distribution and genetic status of the California golden trout. The most current information is based on sampling conducted on populations throughout most of the endemic habitat, and a relatively small number of populations sampled from locations outside the native range, using a limited number of genetic markers. With the results of additional genetic analysis, including the development of new genetic markers, this Strategy will be modified to adapt to the new information.

Task 1.1a –Capture and summarize trout stocking records from CDFG Region 6 (Bishop) Offices. Trout planting records from CDFG's Region 4 Fresno office and some historical trout stocking information from reports and literature have been summarized into a database. The addition of planting records from CDFG's Region 6 files, located in the Bishop Office and Mt. Whitney Hatchery, will contribute to a better understanding of the possible distribution of California golden trout outside its native range. This understanding will, in turn, guide CDFG biologists in selecting sites for the collection of additional genetic samples. The Region 6 files include information on California golden trout transplanted directly from GTC, and plants of hatchery-reared trout originating from offspring of the Cottonwood Lakes broodstock. It is believed that the Cottonwood Lakes stock became hybridized with non-native rainbow trout sometime before or during the early 1930's, and thus have a diminished conservation value.

Task 1.1b - Collect trout fins for genetic analysis. As of December 2003, trout fin tissue samples have been collected and analyzed from throughout the GTC watershed and from most of the SFKR watershed. Additional trout tissue samples will be collected outside the native range where known or suspected transplants of California golden trout have occurred. Beginning in 2004, NGOs will assist in the collection of the samples under the direction of CDFG biologists. Volunteers for this program will be required to attend training in the protocols for tissue sample collection, data recording, and Global Positioning System (GPS) methodology.

Task 1.1c - Conduct baseline DNA analysis of trout within the South Fork Kern River and Golden Trout Creek basins. Trout populations have been analyzed genetically from throughout the SFKR and GTC watersheds in order to define the natural variability in genetic composition among the various populations. The initial baseline DNA studies were completed by Cordes et al. in September 2001, and December 2003. There are a few populations in the more downstream reaches of the SFKR basin which will be sampled in 2004, and may contribute additional data to the baseline DNA analysis.

Task 1.1d - Monitor hybridization and introgression levels in California golden trout populations within the South Fork Kern River and Golden Trout Creek basins. Continued periodic genetic sampling and analysis of trout populations in the endemic California golden trout waters will be conducted to monitor whether the low levels of non-native rainbow trout introgression are remaining stable, increasing or decreasing. The time frame recommended by UCD for re-sampling previously analyzed populations is every five years. Monitoring is also necessary in order to detect any illegal introductions of non-native trout.

Task 1.1e - Conduct DNA analysis of suspected California golden trout populations outside their native range. CDFG biologists have collected fin samples from a few potentially non-introgressed California golden trout populations occurring outside of their native range. These populations reportedly were established using trout from GTC (CDFG, unpublished records, Ellis et al. 1920). While non-native trout may have been planted on top of some of these populations, water bodies have been selected where there are no records of this occurring. If any of these out-of basin populations are identified as non-hybridized and have adequate genetic diversity, their preservation would contribute to the pool of genetic diversity available in conservation efforts for this species.

Task 1.1f – Collect information on the location of archived California golden trout museum specimens. One of the factors limiting the thorough genetic analysis of California golden trout is the lack of a reference stock for the south fork Kern River that gives a clear picture of their genetics prior to the first transplanting of fish in the area. Museum or other collections from the early 1900s or earlier could provide some clues. This task involves locating California golden trout specimens and determining what type of preservative was used. If stored in formaldehyde, they are not currently usable for DNA analysis; however, some specimens were reported to have been stored, at least initially, in alcohol (i.e. whisky). While fins from these specimens may be collected, at present this task has limited value, since museum collections generally provide only a small sample size. As DNA technology advances, results may become more meaningful, at which time DNA analysis of museum specimens will be reevaluated. This task will be coordinated with geneticists from UCD or elsewhere.

OBJECTIVE 1.2: MAINTAIN AND IMPROVE THE GENETIC INTEGRITY, POPULATION STRUCTURE AND ECOSYSTEM ELEMENTS OF CALIFORNIA GOLDEN TROUT.

MANAGEMENT ACTIONS BASED ON THE CURRENT UNDERSTANDING OF GOLDEN TROUT GENETICS

Task 1.2a - Develop and implement a genetics management plan. As the results of new DNA studies become available, a working group will be engaged consisting of geneticists, fishery conservation biologists, and agency representatives to collaborate on producing a California golden trout genetics management plan. The purpose of this plan will be to interpret the results of these studies and develop a plan for the optimal management and conservation of the existing California golden trout genetic diversity. Options for expanding the range of the best remaining representative populations will be explored in detail in this plan. Peer review of the genetics management plan will also be critical to ensuring a scientifically sound document.

Another critical component of this task is peer review of the genetic studies, the methodologies being used, and the interpretation of the results. The initial DNA report (Cordes et al. 2001) has been reviewed by geneticists within CDFG, who have found the methodology used and the reported results satisfactory (J. Banks, CDFG, pers. comm.). Other experts are being asked to review both DNA reports (Cordes et al. 2001 and 2003), and their comments are pending.

Task 1.2b - Remove trout from GTC headwater lakes. The headwater lakes capable of supporting trout in the GTC watershed are Chicken Spring Lake, the four Rocky Basin Lakes, and Johnson Lake. Trout in these lakes were found to be significantly introgressed with non-native rainbow trout (Cordes et al. 2001). They are most likely the major source of downstream genetic contamination in GTC. Gill nets have been used to remove trout from the lakes beginning in 1995, and most recently have been used to verify that the lakes are fishless. The INF is supporting the gill netting effort by purchasing many of the gill nets used by CDFG field personnel and by providing INF packers and pack stock to transport equipment and supplies to the lakes. Based on recent gill netting efforts, it appears that Rocky Basin and Johnson Lakes are now fishless. Over-winter gill net sets failed to catch any fish in these two lakes for two consecutive winters in 2001-02 and 2002-03. If no fish are found in a lake over a two year period of gill netting, it will be considered to be fishless.

Each spring during the gill netting, the inlets and outlets of these lakes were surveyed for spawning trout. From 1998 to present (2004), water years have been below normal and lake levels were progressively lower each year in Rocky Basin and Johnson Lakes. Their inlets and outlets have been mostly dry, no trout have been present, and no spawning habitat has been available.

A few fish may still persist in the outlet stream of Chicken Spring Lake, although in 2003 it appeared no fish were present, and no spawning has occurred here from at least 2000, through present (2004). Since 2000, the stream below the outlet has been intermittent and has flowed for only a short distance before going dry. Backpack electrofishing gear was initially used to remove the majority of the trout from the outlet. Three adult fish were removed from the outlet stream when it was dewatered using hand pumps in 2002. Permission was granted by the USFS to use gasoline-powered pumps to attempt to dewater the outlet stream in 2003, but due to higher flows, the dewatering was unsuccessful. Over-winter gill netting will be continued in this lake, and the outlet stream will continue to be monitored for presence of fish. No fish have been caught in the gill nets since 2000, when only one fish was caught over the winter in the nets. While we now believe all the headwater lakes are fishless, we want to recheck all lakes in 2007 to confirm this assumption.

Task 1.2c - Reduce trout numbers in selected streams within GTC watershed with high levels of non-native trout genetic material. Until a genetics management plan is in place and agreed upon by the agencies and their consulting geneticists, no action will be taken to remove trout from streams in the GTC watershed with the exception of the outlet streams of the headwater lakes. The headwater lakes, themselves, are currently fishless or nearly fishless. The present understanding of the genetics of the GTC populations are that, even though they are slightly introgressed with rainbow trout, they are still the best available representatives of that genome. Consequently, there are no plans to significantly alter that population. The purpose of this task is to reduce or eliminate the spread of non-native genetic material known to be derived from the headwater lakes. This action would involve the removal of trout in stream reaches where genetic analysis shows higher levels of introgression.

Task 1.2d - Prepare written plans for integration of California golden trout population and habitat protection into INF and SQF fire pre-suppression planning. Wildfire suppression activities typically employ both aerial water drops and ground operations that could potentially introduce non-native fish, diseases or other non-native aquatic organisms into California golden trout waters. Additionally, some of the formulations of fire retardant are known to be toxic to fish when dropped directly into water bodies. Written plans for protection of California golden trout populations and habitat will be integrated into both INF and SQF fire pre-suppression plans to insure that fire overhead teams give consideration to native trout protection when conducting fire suppression activities.

Task 1.2e - Eliminate fish from targeted waters if warranted per the genetics management plan. This action involves the possibility of non-native trout removal and subsequent replacement with California golden trout. After a California golden trout genetic management plan is developed (Task 1.2a), decisions will be made regarding whether selected populations of non-native trout will be eliminated within the endemic California golden trout habitat. If required, an Environmental Analysis will be prepared under the National Environmental Policy Act of 1969, as amended (NEPA), and the California Environmental Quality Act (CEQA), to determine the most appropriate means of eliminating undesirable trout and will include the analysis of using mechanical means as well as using a piscicide (chemical fish toxicant). The NEPA and CEQA analysis will also evaluate whether to, and if so, how to repopulate the affected stream reach with California golden trout after undesirable fish have been removed.

Monitoring of mountain yellow-legged frogs (MYLF) and aquatic macroinvertebrates will take place prior to any trout removal efforts. Specifics on the methods needed to safeguard MYLF during trout removal efforts will be included in planning if they are found to be present within the project area. The INF and CDFG will monitor both the MYLF and macroinvertebrate populations before and after any chemical fish removal project. The goal of this monitoring will attempt to determine the impact of fish removal processes on the numbers and diversity of non-target organisms in light of the understanding that these populations fluctuate naturally around a mean. Monitoring will likely occur over a multi-year period. Details of the monitoring will be included in a separate monitoring plan.

Selected native aquatic biota will be restocked where they previously existed following any fish removal project, including projects where piscicides are the selected method for fish removal. A representative number of native Sacramento suckers may be collected and held off-site for later restocking to their original locations.

FISH POPULATION MONITORING

Task 1.2f -Establish additional locations for fish population monitoring and coordinate with INF and SQF stream habitat monitoring. The measurement of stream channel morphology features is conducted regularly along established reaches of stream by INF and SQF biologists in both the SFKR and GTC watersheds to track changes in habitat conditions. The CDFG has established a number of trout population monitoring locations at sites on the SFKR within these reaches that were historically sampled on a regular basis. Additional population monitoring in the GTC watershed was begun by CDFG in 2003. More of these fish population monitoring sites will be added by CDFG within the INF and SQF habitat monitoring reaches in both watersheds. Trends in the age, growth and size composition of the fishery will be evaluated over time in relationship to changes in the habitat. Grazing impacts, absence of grazing, and recreational impacts will be factors considered in the evaluations.

Task 1.2g – Conduct 1-3 fish population estimates per year at the established monitoring sites. One to three of the above described fish population estimates will be conducted per year by CDFG, rotating sites so that each site is monitored every five to seven years. Stream channel morphology measurements are a component of the CDFG population monitoring.

REFUGES FOR CALIFORNIA GOLDEN TROUT POPULATIONS

Task 1.2h – Establish criteria for identifying refuges for California golden trout.

Because non-hybridized populations of California golden trout are so limited in numbers and distribution, it is important to establish refuge populations within and/or outside their native range. Criteria for identifying refuge locations for California golden trout will be developed following guidelines provided in the genetics management plan. Additionally, based on the most current DNA studies, the genetics management plan will provide guidance in identifying donor populations and procedures to be followed in establishing refuge populations.

Task 1.2i - Investigate locations for refuges within the California golden trout native range. The CDFG and INF are currently investigating possible refuge locations within the native range. Locations being considered are Rocky Basin Lake #1, Johnson Lake and Chicken Spring Lake. The CDFG will coordinate with the INF, Sierra Nevada Aquatic Research Lab, local horse packers and other organizations to develop a plan to restock one or more of these headwater lakes in GTC drainage. No California golden trout will be used for restocking any waters within the basin unless their genetic composition has recently been evaluated and it is verified that they contain only genetic information characteristic of California golden trout. Additionally, prior to stocking, surveys for MYLF will be conducted by CDFG. While there are no historical records documenting mountain yellow-legged frogs in the area of the lakes, if they become listed under the ESA, reconsideration of trout stocking may have to occur.

Task 1.2j - Investigate locations for refuges outside of the species' native range. Potential locations for refuges outside the native range, both within and outside of the State of California will be explored. This will require coordination with other land management agencies such as Sequoia-Kings National Parks and out-of-state agencies. Donor populations will be agreed upon and will be consistent with the genetics management plan. Testing of donor populations will be conducted by CDFG pathologists to verify that they are free of diseases and cleared for movement to other waters. New introductions could require approval of the Fish and Game Commission and the land manager.

Task 1.2k – Establish refuges for California golden trout
Refuges for California golden trout will be established following the guidelines described in tasks 1.2h, 1.2i, and 1.2j. The genetics management plan will provide recommendations for numbers of adult fish needed to replicate the genetic diversity of the donor population. Transplants will be made over multiple years to strengthen this genetic diversity. Five years after refuges are established, genetic characteristics will be compared with the donor populations. Additional fish will be transplanted if the refuge population does not represent the genetic diversity of the donor population.

MANAGEMENT ACTIONS FOR CONTROLLING UPSTREAM MOVEMENT OF NON-NATIVE TROUT

Task 1.2l - Monitor the integrity of the South Fork Kern River Barriers. The Ramshaw, Templeton and Schaeffer Barriers will be inspected by a CDFG biologist every 1-5 years to determine whether maintenance is required. If any questions or concerns arise regarding the effectiveness and integrity of the barriers, the opinion of an appropriate engineer will be sought. A small amount of water piping has occurred since the reconstruction of the Templeton Barrier in 1996. Some minimal corrective actions have already been taken to reduce this and will be continued as needed. These barriers have a life expectancy of 50 to 100 years, thus ongoing maintenance will be required and they may eventually need to be replaced.

Task 1.2m – Assess the hydrological effectiveness of Templeton and Schaeffer Barriers. In order to assess whether the barriers are functioning as designed, both structures will be evaluated by a hydrologist and other appropriate experts to determine the level of the highest downstream elevation as a means of estimating the potential depth of the jump pools below the barriers.

Task 1.2n – Monitor the effectiveness of Templeton and Schaeffer Barrier. Since 1999, electrofishing has been conducted annually in the SFKR in the quarter mile downstream of the Templeton Barrier. All golden trout that are captured are marked with a fin clip and released where they were caught. The waters upstream of the barrier are then electrofished in subsequent years to search for marked fish that may have ascended the barrier. To date no marked fish or brown trout have been found upstream of the barrier, thus it is believed the barrier is effective at preventing upstream fish movement. This evaluation will continue annually when possible but is required in above-normal water years.

Task 1.2o - Determine the current status and distribution of brown trout and reduce their numbers at the upstream extent of their distribution. Electrofishing surveys in the SFKR below and above Templeton Barrier will continue to be conducted annually to assess whether brown trout have ascended the barrier. Strawberry Creek will also be surveyed annually for brown trout. These surveys will be used to assess and reduce the population of brown trout in the SFKR within the reach ¼ mile downstream of Templeton Barrier and in the entire length of Strawberry Creek.

Task 1.2p – Revegetate the access road and Schaeffer Barrier construction site. Some soil and vegetation disturbance occurred as a result of the temporary reopening of a one-half mile long access road to the Schaeffer Barrier construction site. The construction zone was also impacted during the Schaeffer Barrier improvement project. While most of the road has been restored to pre-project condition and some revegetation work has been completed, additional revegetation is needed to ensure these sites are fully restored. INF and CDFG will complete the restoration in the spring of 2004.

Task 1.2q - Evaluate the Strawberry Connection during runoff and map hydrologic flow patterns. Current plans are to have this situation evaluated by a hydrologist and staff from Inyo National Forest in 2004. There will be an assessment of the level of risk of these two watersheds being hydrologically connected under high flows and what, if anything can be done to eliminate this connection or prevent/reduce fish passage.

Task 1.2r- Modify the hydrologic connection between Templeton Meadow basin and Strawberry Creek. Based on the results of the field survey (Task 1.2q), a plan will be developed to address the hydrologic connection between the north fork of Strawberry Creek and the Templeton Meadow basin (Figure 6). This is a critical issue because under above average runoff, trout are able to swim around Templeton Barrier via the Strawberry Connection (see section 5.1.2). A brief initial survey in 2002 revealed that hydrologic flow patterns in the area of the connection are more complex than initially believed. The connection cannot be eliminated by simply redirecting the flow in one channel of the upper portion of Strawberry Creek as was originally thought. There is a broad area of sheet flow through the meadow in the area of the Templeton Cow Camp during spring runoff that flows into both watersheds. It may not be possible to completely eliminate the hydrologic connection between the two watersheds. If that is the case, complete removal of the brown and hybrid trout populations (with hybridization and introgression levels higher than those from Ramshaw to Templeton barriers) from the south fork Kern watershed between Templeton and Schaeffer Barriers becomes a critical and urgent measure for the protection of the less hybridized California golden trout above Templeton Barrier in the SFKR watershed.

Task 1.2s - Remove all trout from Strawberry Creek and monitor movement of GTxRT hybrids in the area of the Strawberry Connection. An electrofishing survey of upper Strawberry Creek conducted by CDFG and volunteers in the fall of 2003 revealed that a number of large brown trout had ascended Strawberry Creek from the SFKR as far upstream as the junction of the two forks of Strawberry Creek. All of the brown trout that were caught were removed, and the golden x rainbow hybrids caught were marked with an adipose fin clip and returned to the creek. Because 2003 was a dry year, the creek became intermittent in the north fork, and habitat for large trout was not available. No brown trout were detected by the electrofishing crew in the area of the Strawberry Connection. This situation could change dramatically in a year of heavy runoff.

Because the Strawberry Connection poses the threat during high flows that fish will almost certainly circumvent the Templeton Barrier, urgency demands some immediate, temporary action. Beginning in 2004, trout in Strawberry Creek will be removed by electrofishing annually from the headwaters to the mouth. When possible, hybrid trout will be relocated to the SFKR. If this is not practical, fish will be destroyed and buried. This drastic action is necessary to reduce the likelihood that non-native trout will swim around Templeton Barrier.

Task 1.2t - Revise the CDFG Kennedy Meadows catchable non-native trout stocking program. The CDFG has stocked catchable sized rainbow and brown trout in the SFKR at Kennedy Meadows since about 1947. The current trout allotment is for 2,400 triploid (sterile) catchable-size rainbow trout (1,200 pounds [544 kg]). Angling for these stocked trout is an extremely popular activity and is supported by the small community at Kennedy Meadows. The stocking of fertile catchable sized rainbow trout has been an issue in the past because these trout have hydrological access upstream to Schaeffer Barrier. The CDFG plans to continue planting catchable sized trout in the SFKR at Kennedy Meadows to sustain the recreational fishery through 2010 while other high priority tasks are completed. Beginning with the 2004 trout planting season, the trout planted at Kennedy Meadows will be triploid trout, of which 99 to 100 percent are sterile. At the end of this period the CDFG managers will review this management practice and determine what options are available. However, the goal of this Conservation Strategy should be in compliance with the Fish & Game Commission's Golden Trout Policy that "rainbow trout and other species of trout shall not be planted in designated golden trout waters." (FGC 2004). CDFG will meet with the residents and business owners in the area to inform them of this Conservation Strategy.

Task 1.2u – Assess the need for an additional barrier downstream of the Schaeffer Barrier. A long-range goal of this Strategy is to give consideration to the construction of a new fish barrier on the SFKR between Monache and Kennedy Meadows. This would allow reclamation of 62 miles of stream within the native range of California golden trout. A CDFG fisheries biologist and an engineer surveyed this reach of river in 1997, and three possible barrier sites were identified (Stephens 1997). A NEPA assessment for this project was initiated in 1997, but was not completed. The proposed barrier sites need to be resurveyed with engineers from the CDFG and USFS experienced with in-channel design. The proposed barrier would have to be permanent, low maintenance, and acceptable to INF and SQF. Although the Wilderness Act and Wild and Scenic Rivers Act make allowances for such a structure, there are some limitations that will have to be met. However, the CDFG believes it is critical, not only to expand California golden trout into more of their historical range, but to reduce the chance of non-native trout being introduced upstream of Schaeffer Barrier either naturally or by man. Because both the Templeton and Schaeffer Barriers have a limited life expectancy (50 to 100 years), a more permanent barrier downstream would provide better long-term protection of the subspecies. There are many tasks to be completed before serious consideration can be given to this action. However, we anticipate that during this 15 year planning period this issue will deserve serious consideration and the NEPA review process will be reinitiated.

OBJECTIVE 1.3: STRATEGIC PROGRAM MANAGEMENT

Task 1.3a - Conduct annual coordination meetings among the involved agencies; modify management tasks based on new genetic and habitat information; produce annual reports of expenditures, major findings, and accomplishments; and develop and secure the budget for the coming year. The purpose of these meetings is to review the management actions taken the previous field season and to discuss changes needed in the plan based on new genetic information, land management directives, changes in habitat conditions, funding, etc. Draft monitoring reports will be exchanged between the agencies prior to the meetings, and results will be discussed at the meetings.

Funding sources will be identified from both within and outside the agencies. The estimated cost of each management action is listed in Table 3. Even though an action is identified and a cost estimated, that action cannot be implemented unless the funding is available. Every effort will be made to secure funding prior to the date of implementation. However, if this does not occur, an action may have to be moved to a later date. Also, the initiation of some actions is dependent upon the completion of other actions. Where practical, these are identified in Table 3.

Interested parties may attend these coordination meetings to get updates and provide input. However, only the cooperating agencies are involved in planning and decision making.

Task 1.3b - Review and update the Implementation Plan. The Plan will be reviewed and updated annually at the coordination meetings. To meet the goals of the strategy, new actions and changes will be added as necessary using principles of adaptive management.

Task 1.3c – Review of management direction – It is important that the process we are following be reviewed by managers of the cooperating agencies. On a three years cycle, managers will review the recovery progress to date and the current status of the California golden trout to ensure the current management direction is appropriate.

GOAL 2: IMPROVE RIPARIAN AND INSTREAM HABITAT FOR THE RESTORATION OF CALIFORNIA GOLDEN TROUT POPULATIONS

To provide continued existence of quality habitat for the California golden trout, habitat restoration and monitoring of restoration activities needs to take place to ensure appropriate actions are being taken and improvements are being achieved. Optimizing habitat conditions will increase the likelihood that California golden trout populations will survive catastrophic events, and will allow them to develop more desirable population characteristics.

OBJECTIVE 2.1: EVALUATE HABITAT RESTORATION EFFORTS AND NEEDS

Task 2.1a - Evaluate and document the success of past habitat restoration efforts. Watershed improvement projects completed in the past by the INF need to be analyzed and monitored to document their effectiveness and to identify any weaknesses. Starting in 2004, a report will be compiled by INF to assess the effectiveness of past restoration activities in order to determine appropriate future actions.

Task 2.1b - Evaluate opportunities for future watershed restoration efforts within SFKR and GTC watersheds. The INF will continue to assess and prioritize watershed restoration projects within these watersheds in order to apply for funding and priority standing with other Forest projects.

Task 2.1c - Monitor habitat changes in Templeton and Whitney allotments during 10 year grazing hiatus. A monitoring plan is currently being developed by the INF under the direction of the Forest Service Regional Office to document the effectiveness of the grazing suspension which started in the summer of 2001. The monitoring plan will look at the changes in recovery rates for physical and biological systems in the ungrazed allotments (Whitney and Templeton Allotments) and compare that to recovery rates in the grazed allotments (Mulkey and Monache Allotments). The INF will be the primary agency responsible for the collection and synthesis of data. This is a multi-resource project and will take eight years to collect the initial data. The results of the monitoring will be used by INF to analyze the appropriate level of grazing, if any, to be authorized after the 10 year grazing rest.

Task 2.1d - Monitor the effectiveness of best management practices that could affect California golden trout habitat. A number of “best management practices” are typically implemented in association with any activity occurring on the forest. When these management practices are implemented, they will be monitored by the INF and SQF to determine their effectiveness in protecting golden trout habitat. The INF or SQF will prepare an annual report for inclusion in the overall annual report (Task 1.3a).

Task 2.1e – Monitor stream water temperatures to document possible changes over time. Preliminary data from temperature monitoring locations on the SFKR (headwaters downstream to below Monache Meadows) shows that summer water temperatures can reach 25° C. Temperatures fluctuating diurnally between 25.2° C and 10.4 ^{o} C (77.4° F and 50.7° F) have been recorded. These high temperatures are a concern and may be resulting in stress as trout cease feeding at these temperatures (Behnke 1992). The goal is to monitoring water temperatures to determine if they change as riparian habitat improves in on the Templeton-Whitney allotment during the ten years of rest from grazing.

Task 2.1f – Complete roads analysis in SFKR watershed including CDFG property. Roads through Monache Meadows allow vehicular traffic through sensitive riparian areas. CDFG and the INF will initiate a roads analysis in 2004 to determine if these routes are appropriately placed, or if they need to be re-routed. If re-routing of roads is warranted, the appropriate forest will pursue it.

Task 2.1g - Monitor Fish Creek habitat. The SQF will continue to monitor the physical habitat parameters of Fish Creek, a lower tributary stream to the SFKR, on an annual basis. The Stream Condition Inventory plot will be established in 2004, and will be monitored every five years. Annual monitoring for bank stability within the Plot was initiated in 2003 and will be repeated annually. Cooperative fish population sampling with CDFG will be conducted every five years, the state's schedule for repeat sampling. The SQF will provide these results for inclusion in the annual report (Task 1.3).

Task 2.1h - Monitor and evaluate the effects of beaver to the California golden trout within the SFKR and GTC. Beaver have been gradually extending dam habitat throughout the Ramshaw Meadows and other areas on the Kern Plateau. Their population appears to be expanding into new areas. The overall effects of their activities on golden trout habitat are unknown. CDFG and INF will coordinate to monitor and evaluate the effect of beaver activity on golden trout habitat, starting in 2004. A draft report will be compiled with results and suggestions for management.

Task 2.1i - Assist CDFG's Wildlife Management Division with the completion of a Monache Wildlife Area Management Plan. This plan covers management of property owned and managed by the CDFG on the northern end of Monache Meadows. The management plan is currently in a draft and needs to be completed before implementation.

OBJECTIVE 2.2: RESTORE DEGRADED HABITATS

Task 2.2a - Implement watershed restoration opportunities as appropriate. Following assessment recommendations (from task 2.1.b), restoration activities will be implemented by the INF watershed crew. Restoration activities could include headcut arrestment, stream-bank stabilization, fencing sensitive areas, vegetation planting/establishment or removing other impacts from the area. This will assist in the continuation of an ongoing effort by the INF and CDFG.

Task 2.2b - Consider habitat monitoring results in grazing allotment re-issuance. The INF will include and consider habitat monitoring results generated from all ongoing and proposed monitoring within the Kern Plateau in other cattle grazing allotment decisions. The Monache and Mulkey allotments will be considered for re-issuance in 2007, at which time NEPA will be initiated by the INF, and results of habitat monitoring will be included in the EA.

Task 2.2c - Prevent water transfers from non-native water bodies into golden trout waters. This will be a cooperative effort between the INF, SQF and the CDFG to ensure that transfer of water from non-native water bodies into California golden trout waters will not occur during fire suppression activities, or during other management activities that may include the use of large quantities of water. This will ongoing on an as-needed basis.

Task 2.2d - Continue habitat improvement on CDFG Property in Monache Meadows. CDFG will continue to implement activities to improve riparian habitat on their property in Monache Meadows. This is continued and ongoing, and includes activities such as fencing to exclude cattle, willow planting and other activities.

Task 2.2e - Investigate the acquisition of private property from willing sellers with the purpose of habitat improvement. INF, SQF and the CDFG will investigate potential sellers who own land encompassing important habitat for the California golden trout. This process will be initiated when the opportunity arises.

Task 2.2f - Re-route access roads through INF into CDFG property outside the riparian zones. If determined feasible through the analysis as described in Task 2.1.e, INF and CDFG will initiate re-routing of the access roads to CDFG property after 2004.

GOAL 3: EXPAND EDUCATIONAL EFFORTS REGARDING CALIFORNIA GOLDEN TROUT RESTORATION AND PROTECTION.

OBJECTIVE 3.1: EXPAND PUBLIC EDUCATION ABOUT THE CALIFORNIA GOLDEN TROUT STATUS AND CONSERVATION NEEDS.

For this Strategy to be effective there is a need to foster public acceptance of California golden trout restoration and protection efforts. Resource management agencies need to do a better job of informing the public and especially pack station operators about the status of the California golden trout and actions being taken to prevent the extinction of the State fish. This is especially true of such activities as barrier reconstruction, gill netting of lakes, and any other activities that could impact recreational users and pack station operators.

Task 3.1a - Inform the public about proposed and planned management actions. The INF will continue to inform the public about management issues and activities within the Kern Plateau through the Schedule of Proposed Activities, as posted in the Inyo National Forest Web-site. This process is ongoing.

Task 3.1b - Conduct an annual coordination meeting with stakeholders. INF and CDFG will coordinate to plan an annual meeting with the SQF and USFWS to discuss progress of this conservation strategy, and to update stakeholders on results from genetic and population monitoring of golden trout, and monitoring and restoration efforts of California golden trout habitat.

Task 3.1c - Produce an annual forest user's brochure. A simple annual forest user's brochure will be produced annually informing the public of current California golden trout management activities. This will be a one-page leaflet for individuals and groups traveling into the project area that explains the recovery program and the current year's activities. It will be produced cooperatively by the CDFG and INF and made available at area ranger stations for anyone traveling in the project area.

Task 3.1d - Develop a golden trout web page and update it annually. The INF and CDFG will coordinate to determine an appropriate method to develop a California golden trout web site. At this time several non-profit groups have demonstrated interest in hosting a web site for this educational venture. The INF, SQF and CDFG will provide information about the California golden trout and management actions. Links to other appropriate web pages will be included. This information will be updated at least annually.

Task 3.1e – Produce and distribute full-color California golden trout brochure. INF and CDFG are currently collaborating with Cal Trout to utilize Orvis grant funding to complete a full-color brochure. This brochure will highlight the resource and genetic issues facing the trout, and describe future desired conditions with the goal of educating the public. It will be produced and distributed in the summer of 2004.

Task 3.1f - Build additional educational kiosks on the California golden trout. Expand the public education efforts by building kiosks similar to the one located at Horseshoe Meadow Trailhead. Among possible new kiosk locations are the Monache Jeep Road and at Blackrock Ranger Station. A portion of the funding, planning and logistics for this task will be supplied by the NGOs under the direction of CDFG, INF and SQF.

Task 3.1g - Produce additional Kern Basin native trout distribution maps. Several years ago the SQF produced a poster-sized golden trout distribution map depicting the historic range of all three trout native to the Kern Basin. The original map contained several errors that needed to be corrected. The new map production has required working with a graphic artist to improve the poster and make the necessary corrections. A master template is being produced that can be used to make additional posters, as well as smaller versions, as needed. This task was initiated by SQF in 2003. Planning and design is in the final stages, and it is expected to be produced in 2004.

OBJECTIVE 3.2: ENFORCE STATE FISH AND GAME LAWS TO PROTECT CALIFORNIA GOLDEN TROUT.

Task 3.2a - Work with Wildlife protection and USFS law enforcement personnel to enforce resource laws. The two most critical fish and game laws for enforcement are the possession limit in Monache Meadows area and the prevention of anglers moving live fish. Notices will be posted so that visitors are aware of both of these regulations. Discussions will be held with both CDFG wildlife protection personnel and INF law enforcement personnel to ensure they understand the importance of preventing anglers from possessing and transporting live trout within the California golden trout's range, and action that is prohibited except under permit from the CDFG.

Task 3.2b - Ensure angling regulations are posted at key public access locations. Angling regulations will be posted in areas where fishing is allowed and appropriate.

Table 3 - Summary of Management Tasks and Estimated Costs

						Cost Estimates ($1,000)					
Priority	**Task No.**	**Task Description**	**Task Duration (years)**	**Lead Agency**	**Status**	**Total Estimated Cost**	**2004**	**2005**	**2006**	**2007**	**2008**
GOAL 1: Protect and restore California golden trout genetic integrity and distribution in its native range											
Objective 1.1 Identify and monitor extant California golden trout populations.											
1	1.1a	Capture and summarize trout stocking records from CDFG R6 Bishop offices.	2004-2007	CDFG	Begin 2004	4	0.5	2.5	1		
1	1.1b	Collect trout fins for genetic analysis.	Annual	CDFG NGOs	Ongoing	85 70	20 20	20 20	15 10	15 10	15 10
1	1.1c	Conduct baseline DNA analysis of trout within the SFKR and GTC basins.	Annual beginning in 2005	CDFG	Ongoing	49		25	8	8	8
1	1.1d	Monitor hybridization and introgression levels in California golden trout populations within the SFKR and GTC basins	Annual beginning in 2005	CDFG	Ongoing	100		25	25	25	25
1	1.1e	Conduct DNA analysis of suspected California golden trout populations outside their native range.	Annual beginning in 2005	CDFG	Ongoing	250		100	100	25	25
3	1.1f	Collect information on the location of archived GT-C museum specimens	1 years	CDFG NGOs	Begin 2006	2 0.5			2 0.5		
Objective 1.2 Maintain and improve the genetic integrity, population structure and ecosystem elements of California golden trout.											
Management actions based on the current understanding of golden trout genetics											
1	1.2a	Develop and implement a genetics management plan.	3 years	CDFG INF SQF	Ongoing	5 0.375 0.375			3 0.125 0.125	1 0.125 0.125	1 0.125 0.125
1	1.2b	Remove trout from GTC headwater lakes	5 years	CDFG INF	Ongoing	14 6	2 1	2 1	2 1	6 2	2 1
1	1.2c	Reduce trout numbers in selected stream reaches within GTC watershed.	2 years	CDFG INF	Ongoing	8 8		4 4			4 4

Table 3 (Continued)

						Cost Estimates ($1,000)					
Priority	**Task No.**	**Task Description**	**Task Duration (years)**	**Lead Agency**	**Status**	**Total Estimated Cost**	**2004**	**2005**	**2006**	**2007**	**2008**
1	1.2d	Prepare written plans for integration of GTC population and habitat protection into INF and SQF fire pre-suppression planning	Begun in 2003	CDFG INF SQF	Ongoing	2.5 4 0.75	0.5 2 0.25	0.5 0.5 0.125	0.5 0.5 0.125	0.5 0.5 0.125	0.5 0.5 0.125
2	1.2e	Eliminate fish from targeted waters if warranted per the genetics management plan	3 years	CDFG INF	3 years	178 26			8 10	85 8	85 8
Fish population monitoring											
2	1.2f	Establish additional locations for fish population monitoring and coordinate with INF and SQF stream habitat monitoring	2 years	CDFG INF SQF	Initiated 2002	0.5 0.5	0.25 0.25	0.25 0.25			
2	1.2g	Conduct 1-3 fish population estimates per year at the established monitoring sites.	Annual	CDFG INF	Ongoing	5 2.5	1 0.5	1 0.5	1 0.5	1 0.5	1 0.5
Refuges for California Golden Trout Populations											
1	1.2h	Establish criteria for identifying refuges for California golden trout.	2 years	CDFG INF SQF	Pending genetics management plan	2 0.25 0.25		1 0.125 0.125	1 0.125 0.125		
1	1.2i	Investigate locations for refuges within the California golden trout native range.	4 years	CDFG INF	Pending genetics management plan	4		1	1	1	1
1	1.2j	Investigate locations for refuges outside of the species' native range.	4 years	CDFG	Ongoing	8		2	2	2	2
1	1.2k	Establish refuges for California golden trout	2 years	CDFG INF	Pending genetics management plan	6 4				3 2	3 2
Management actions for controlling upstream movement of non-native trout											
1	1.2l	Monitor the integrity of SFKR Barriers	Annual	CDFG	Ongoing	5	1	1	1	1	1

Table 3 (Continued)

						Cost Estimates ($1,000)					
Priority	**Task No.**	**Task Description**	**Task Duration (years)**	**Lead Agency**	**Status**	**Total Estimated Cost**	**2004**	**2005**	**2006**	**2007**	**2008**
1	1.2m	Assess the hydrological effectiveness of Templeton and Schaeffer Barriers	2 years	CDFG INF	Ongoing	2 2		1 1	1 1		
1	1.2n	Monitor the effectiveness of Templeton and Schaeffer Barriers	Annual	CDFG	Ongoing	10	2	2	2	2	2
1	1.2o	Determine the current status and distribution of brown trout and reduce their numbers at the upstream extent of their distribution	Annual	CDFG	Ongoing	10	2	2	2	2	2
1	1.2p	Revegetate the access road and Schaeffer Barrier construction site	1 year	CDFG INF	Initiated in 2004	1 1	1 1				
1	1.2q	Evaluate the Strawberry Connection during runoff and map hydrologic flow patterns.	Map 2005 Monitor Annually	CDFG INF	Ongoing	5 2.5		3 1	1 1	0.5 0.5	05
1	1.2r	Modify the hydrologic connection between Templeton Meadow basin and Strawberry Creek	1 year	CDFG INF	Summer 2004 or 2005	2 8				2 8	
1	1.2s	Remove all trout from Strawberry Creek and monitor movement of GTxRT hybrids in the area of the Strawberry Connection	4 years	CDFG INF	Ongoing	12 4	3 1	3 1	3 1	3 1	
2	1.2t	Revise the Kennedy Meadows catchable non-native trout stocking program	5 years	CDFG	Initiated in 2002	1.25	.25	.25	.25	.25	.25
3	1.2u	Assess the need for an additional barrier downstream of the Schaeffer Barrier	Unknown	CDFG INF SQF	2008	1 12.5 12.5					1 12.5 12.5
Objective 1.3 Strategic Program Management											
1	1.3a	Conduct annual coordination meetings among the involved agencies; modify management tasks based on new genetic and habitat information; produce annual reports of expenditures, major findings, and accomplish-ments; and develop and secure the budget for the coming year	Annual	CDFG INF SQF USFWS NGO’s	Ongoing	22.5 5 1.25	4.5 1 0.25	4.5 1 0.25	4.5 1 0.25	4.5 1 0.25	4.5 1 0.25

Table 3 (Continued)

					Cost Estimates ($1,000)						
Priority	**Task No.**	**Task Description**	**Task Duration (years)**	**Lead Agency**	**Status**	**Total Estimated Cost**	**2004**	**2005**	**2006**	**2007**	**2008**
1	1.3b	Review and update the Implementation Plan	Annual	CDFG INF SQF NGO's	Ongoing	5 2.5 1.25	1 0.5 0.25	1 0.5 0.25	1 0.5 0.25	1 0.5 0.25	1 0.5 0.25
1	1.3c	Review of management direction - Managers from the cooperating agency to meet to review the progress of the recovery effort and status of the species. Determine if current direction is still appropriate	one week	CDFG INF SQF USFWS	Schedules for 2006	0.5 0.5 0.5 0.5			0.5 0.5 0.5 0.5		
Goal 2: Improve riparian and instream habitat for the restoration of GT-C po0.5pulations											
Objective 2.1 Evaluate habitat restoration efforts and needs											
1	2.1a	Evaluate and document the success of past habitat restoration efforts	Annual	INF	Ongoing	5	1	1	1	1	1
1	2.1b	Evaluate opportunities for future watershed restoration efforts within SFKR and GTC watersheds	Annual	CDFG INF SQF	Ongoing	2.5 5 0.625	0.5 1 0.125	0.5 1 0.125	0.5 1 0.125	0.5 1 0.125	0.5 1 0.125
1	2.1c	Monitor habitat changes in Templeton and Whitney allotments during 10 year grazing hiatus	Annual	INF	Ongoing	150	30	30	30	30	30
2	2.1d	Monitor the effectiveness of best management practices that could affect golden trout habitat	Annual	INF SQF	Ongoing	25 0.625	5 0.125	5 0.125	5 0.125	5 0.125	5 0.125
	2.1e	Monitor stream water temperatures to document possible changes over time.	Annual	CDFG	Ongoing	10	2	2	2	2	2
2	2.1f	Complete roads analysis in the SFKR watershed including CDFG property	2 years	CDFG INF	Begin 2005	2		1	1		
2	2.1g	Monitor Fish Creek habitat	Annual	SQF	Ongoing	3.5	2.5	0.25	0.25	0.25	0.25
3	2.1h	Monitor and evaluate the effects of beaver to California golden trout within the SFKR and GTC	Annual	CDFG INF	Ongoing	2.5	0.5	0.5	0.5	0.5	0.5

Table 3 (Continued)

Priority	Task No.	Task Description	Task Duration (years)	Lead Agency	Status	Total Estimated Cost	2004	2005	2006	2007	2008
Objective 2.2 Restore degraded habitats											
					Cost Estimates ($1,000)						
3	2.1i	Assist CDFG Wildlife Management Division with completion of Monache Wildlife Area Management Plan	1 years	CDFG	Ongoing	1	1				
1	2.2a	Implement watershed restoration opportunities as appropriate	Annual	CDFG INF	Ongoing	5 25	1 5	1 5	1 5	1 5	1 5
1	2.2b	Consider habitat monitoring results in grazing allotment re-issuance	every 10 years for each allotment	INF	Ongoing	12					12
1	2.2c	Prevent water transfers from non-native water bodies into golden trout waters	Annual	CDFG INF SQF	Ongoing	2.5	0.5	0.5	0.5	0.5	0.5
2	2.2d	Continue habitat improvement on CDFG Property in Monache Meadows	Annual	CDFG NGO's	Ongoing	10	2	2	2	2	2
3	2.2e	Investigate the acquisition of private property from willing sellers with the purpose of habitat improvement.	Initiate 2003	CDFG INF SQF	2 – 5 years	2.5	0.5	0.5	0.5	0.5	0.5
3	2.2f	Re-route access roads through INF into CFDG property outside the riparian zones.	2 - 3 years	CDFG INF	Assessment to begin in 2006	40 10				20 5	20 5
Goal 3: Expand education efforts regarding California golden trout restoration and protection.											
Objective 3.1 Expand public education about the California golden trout status and conservation needs											
1	3.1a	Inform the public about proposed & planned management actions	Annual	CDFG INF SQF	Ongoing	2.5 2.5 0.625	0.5 0.5 0.125	0.5 0.5 0.125	0.5 0.5 0.125	0.5 0.5 0.125	0.5 0.5 0.125
1	3.1b	Conduct annual coordination meetings with stakeholders	Annual	CDFG INF SQF NGOs	Annual	5 5 2.5	1 1 0.5	1 1 0.5	1 1 0.5	1 1 0.5	1 1 0.5
1	3.1c	Produce an annual forest user's brochure	Annual	CDFG INF SQF	Ongoing	2.5 2.5 0.75	0.5 0.5 0.25	0.5 0.5 0.125	0.5 0.5 0.125	0.5 0.5 0.125	0.5 0.5 0.125

Table 3 (Continued)

						Cost Estimates ($1,000)					
Priority	**Task No.**	**Task Description**	**Task Duration (years)**	**Lead Agency**	**Status**	**Total Estimated Cost**	**2004**	**2005**	**2006**	**2007**	**2008**
1	3.1d	Develop a golden trout web page and update annually	Annual beginning in 2005	CDFG INF SQF NGOs	Ongoing	4 2 0.5		1 0.5 0.125	1 0.5 0.125	1 0.5 0.125	1 0.5 0.125
1	3.1e	Produce and distribute full-color California Golden Trout brochure	2 years	CDFG INF NGO	Complete in 2004	2 2 20	1 1 10	1 1 10			
2	3.1f	Build additional educational kiosks on the California golden trout	2 years	CDFG SQF NGOs	Pending Funding	1 3 10	0.5	0.5 3 10			
2	3.1g	Produce additional Kern Basin native trout distribution maps	1	CDFG INF SQF NGOs	Pending Funding	0.5 1 0.5 10	0.5 1 0.5 10				
Objective 3.2 Enforce State Fish and Game laws to protect California golden trout.											
1	3.2a	Work with Wildlife protection and USFS law enforcement personnel to enforce resource laws	Ongoing	CDFG INF SQF NGOs	Ongoing	1.25	0.25	0.25	0.25	0.25	0.25
1	3.2b	Ensure angling regulations are posted at key public access locations	Ongoing	CDFG INF SQF	Ongoing	1.25	0.25	0.25	0.25	0.25	0.25

TOTAL FINANCIAL COMMITMENT BY ORGANIZATION*

							Cost Estimates ($1,000)				
						TOTAL	**2004**	**2005**	**2006**	**2007**	**2008**
CDFG						896.25	51.5	215	197.25	219.25	215.25
INF						3336.625	53.25	56.375	61.75	73.625	91.625
SQF						29.5	4.875	5.125	2.75	2.125	14.625
USFWS						0.5	0	0	0.5	0	0
NGO						110.5	40	40	10.5	10	10
Grand Total						**1,375.375**	**149.625**	**316.5**	**272.75**	**305**	**331.5**

*** Contingent on funding availability**

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10.0 APPENDIX A – FOREST WIDE STANDARDS AND GUIDELINES FOR RESOURCE PROTECTION

This appendix contains the details pertinent to forest land management activities, standards and guidelines that were discussed within the body of this document. The four items referenced in the document include:

1. Inyo National Forest Land and Resource Management Plan
2. Sequoia National Forest Land and Resource Management Plan
3. Sierra Nevada Forest Plan Amendment direction
4. National Direction for Fire Suppression as related to aquatic resources

The standards and guidelines detailed in this appendix are those that affect resource management as generally related to the California golden trout. The full direction for land management activities can be found within the Land and Resource Management Plans for each Forest, and is on file at the respective forests and the Fish and Wildlife Service office in Sacramento.

10.1 INYO NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN

DIRECTION SPECIFIC FOR MANAGING FISHERIES RESOURCES.

10.1.1 FOREST-WIDE STANDARDS AND GUIDELINES FOR SPECIFIC RESOURCE: Fish

- Manage all stream reaches of all state designated wild trout waters according to the following:
  1. Any activity that results in trampling and chiseling should not exceed 10 percent of any given stream reach. A reach is defined as a continuous portion of a stream with homogeneous physical characteristics. Use the current situation as documented in the Final Environmental Statement as a reference point.
  2. Restore unstable or eroding streambanks to attain a streambank system that is no more than 10 percent unstable at any given time.
  3. Streamside vegetation should provide a minimum of 90% of the habitat's capability to provide stream shading and fish cover.

- Coordinate with the California Department of Fish and Game to establish standards for viable populations and tolerable levels of depletion for resident fish species.

- Manage all stream reaches containing resident fish according to the following
  1. Any activity that results in trampling and chiseling should not exceed 20 percent of any given stream reach. Use the current situation as documented in the LRMP Final Environmental Impact Statement (FEIS) as a reference point.
  2. Restore unstable or eroding streambanks to attain a streambank system that is no more than 20 percent unstable at any given time. (LRMP p. 78, 79)

Wildlife

- Develop and implement a consistent, systematic, biologically sound strategy to manage sensitive species and their habitats so that federal listing does not occur.

Range

- Develop range resources to their reasonable potential and manage them for sustained yields.

- Manage grazing allotments according to a planned management system.

- Develop range Allotment Management Plans (AMP's) before term permits are issued where possible. Incorporate in those plans provisions for implementing Best Management Practices (BMP's) for range management.

- Use individual grazing AMP's as the instrument to guide the avoidance of unacceptable damage to soil, water quality, and fish habitat and the resolution of incompatibilities between livestock and known key mule deer fawning areas. Institute positive measures such as delaying the grazing season and/or directing livestock away from riparian areas by herding, salting, water developments, or fencing. Amend AMP's to include adopted means of resolution and needed mitigation measures. If mitigation is unsuccessful in preventing unacceptable resource damage, as a last resort livestock grazing will be reduced or eliminated.

    1. Develop a priority schedule, with an annual review, of AMP's to be revised for the planning period. Each AMP will be revised commensurate with available funding.
    2. After AMP's are revised, they will be updated on an average of every 10 years.

- Consider the benefit to fisheries, wildlife, recreation, and watershed as well as range when designing range improvements.

- Assess impacts on riparian areas within permit boundaries during grazing permit re-evaluations. Require structural and/or non-structural measures to correct unacceptable deterioration of riparian-dependent resources.

- Graze meadow only when "range-ready" as defined in Forest Service Handbook 2209.21.

- Conduct annual utilization checks on selected meadows and key wildlife habitats in grazing areas.

- Where feasible, locate all range improvements away from travel corridors, especially trails, popular fisheries, and other watercourses.

- AMP's will display use, improvement, maintenance, and other management data.
  Use criteria will be established and documented for each unit of each grazing allotment. These criteria will be developed through the interdisciplinary team approach using long-term trend studies and identified limiting factors. These criteria will define permissible grazing levels. This standard should be observed in the process--soil and vegetation are the basic

resources. The condition of these two resources must be maintained or improved. If they are in satisfactory condition, then they must be maintained in this condition. If they are in a less than satisfactory condition, then allowance must be made for improvement in condition.

- Inform the California Department of Fish and Game before planning and implementing revegetation projects. Grant extensions of season of use only when this does not conflict with the AMP's objectives.

- Locate salt and sheep bedgrounds outside riparian areas and at least 1/4 mile away if possible and reasonable. (LRMP p. 84, 85, 86)

Riparian areas

Give emphasis to riparian-dependent resources in the management of riparian areas.

- Protect streams, streambanks, shorelines, lakes, wetlands, and the plants and animals dependent on these areas.

- Use AMP's as the vehicle for ensuring protection of riparian areas from unacceptable impacts from grazing. Institute positive measures such as salting, herding, water developments, fencing, rest rotation, deferred rotation, and other grazing systems as mitigation measures. If mitigation is unsuccessful in protecting unacceptable resource damage to the riparian habitat, as a last resort, livestock grazing will be reduced or eliminated in the affected areas.

- Rehabilitate and/or fence riparian areas that consistently show resource damage for any cause if conflicts cannot be resolved.

- Apply the following earth disturbance standards to each zone within each stream type. These standards apply to the amount of post-project disturbance. Earth disturbance is defined as complete removal of vegetating or a percentage of bare ground resulting from the disturbance. (LRMP p. 89, 90)

- Maintain the integrity of desert springs in the White and Inyo Mountains and the South Sierra Eastern Escarpment to conserve plant and wildlife habitat.

- Recognize the important and distinctive values of riparian areas when implementing management activities. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.

- Delineate and evaluate riparian areas before implementing any planned management activity.

- Design range, fish, and wildlife habitat improvement projects and/or silvicultural prescriptions to maintain or enhance riparian area dependent resources.

Earth Disturbance Standards

ZONE	Stream Type	Amount of Earth Disturbance Permitted on any 100 Meter Reach
Aquatic - Standing or running water		See Forest-wide Standards and Guidelines
Riparian - Terrestrial habitat adjacent to water bodies where plants are rooted in water or saturated soil	A B C	3% 5% 10%
Terrestrial- Upland area adjacent to riparian zone, in which water availability influences land form and vegetation	A B C	10% 20% * (No Restriction)

* If entrenched, on unstable terrain, or on a slope 40%, allow only 5% disturbance.

- Give priority to the rehabilitation of riparian areas when planning range, wildlife habitat, and watershed improvement projects.

- Move existing livestock watering locations out of riparian areas when and where feasible. (LRMP p. 89, 90, 91)

10.1.2 MANAGEMENT PRESCRIPTIONS

Management Prescriptions specify how all the Forest resources will be managed to emphasize a specific resource. There is management direction for the golden trout within the Designated Wilderness and Wild and Scenic Rivers sections. Direction pertinent to the Golden Trout is listed below.

<u>Page 107: Designated Wilderness</u>
Element: Wildlife

Protect the integrity of natural ecological processes by restoring those processes that have been altered by human activities.

<u>Page126: Wild and Scenic Rivers</u>
Element: Fisheries

Protect and improve golden trout habitat.

10.1.3 MANAGEMENT AREA DIRECTION

Management Area Direction provides general direction for management of an area whose boundaries are defined with reference to its unique characteristics. The direction for each area addresses the management situations and resource conditions that are specific to it. The Golden Trout management area contains specific management direction for golden trout.

Page 235: Golden Trout Management Area (#19)

Fish: Strive to attain high quality habitat as defined in the Habitat Capability Model for all golden trout streams. Manage the habitat as the best that can be achieved given the incised conditions of stream channels as defined by quantitative methodologies such as GAWS, COWFISH, etc.

Range: Allow no increases in grazing where this would significantly degrade fish or wildlife habitat. Amend allotment plans to include needed mitigating measures and take corrective action where grazing is significantly impacting wildlife habitat.

Water: Place watershed restoration priorities in areas where sediment reduction, fish habitat and visual resources would receive the most benefit.

10.2 Sequoia National Forest Land and Resource Management Plan

10.2.1 FOREST-WIDE STANDARDS AND GUIDES

Management direction pertaining to aquatic/riparian resources found in the FLRMP, MSA, and the SNFPA can be grouped into three categories:

1. General Aquatic and Riparian Species,
2. Riparian Areas and Streams, and
3. Desired Future Condition

Additional direction is given for the management of Threatened and Endangered Species.

<u>General Aquatic and Riparian Species</u>

General aquatic and riparian species are those species that are not listed as Federal or State Threatened or Endangered, Proposed for Listing, R5 USFS Sensitive Species, or California Species of Special Concern.

The direction in the FLRMP for managing general aquatic and riparian species is to increase the diversity of the animal communities and also provide well-distributed habitat diversity on each Ranger District for all indigenous aquatic species (USDA, 1988). To do this, habitat is to be maintained or increased to ensure that aquatic species will have adequate population levels and distribution to provide for their continued existence throughout their current range (*ibid.*). Habitat management will be emphasized for species that utilize riparian areas and down log habitats (*ibid.*).

<u>Riparian Areas and Streams</u>

Riparian areas provide valuable habitat for a variety of species and are sensitive to disturbance. They provide an important contribution to landscape diversity and the forest ecosystem (USDA, 1988). Riparian areas should provide a visual contrast from adjacent lands in the conifer forest used for timber harvest, thus contributing to the diversity of the landscape and forest ecosystems (*ibid.*).

Riparian areas will be managed for old growth values under the principles of multiple use and sustained yields, while emphasizing protection and improvement of soil, water, vegetation, and fish and wildlife resources (USDA, 1990). Riparian areas will be managed to maintain or restore habitats for riparian species as well as those species associated with late successional stages of vegetation (*ibid.*).

During the planning and implementation of land and resource management activities, protection and improvement of riparian areas and streams are to be emphasized (USDA 1988; 2004). Within riparian areas, the stream channels and vegetation adjacent to the stream channel will be protected to maintain or improve overall aquatic species habitat and water quality (*ibid.*).

Desired Future Condition

Integration of goals from the FLRMP; Mediated Settlement; and the Final Supplement to the Sierra Nevada Forest Plan Amendment during project design will help achieve the desired future condition identified for fisheries and aquatic/riparian resources.

A primary purpose of the Sierra Nevada Forest Plan Amendment is to develop regional direction that will protect and restore aquatic, riparian, and meadow ecosystems and provide for the viability of native plant and animal species associated with these ecosystems. This region direction is represented by an array of features that constitute an aquatic management strategy for the Sierra Nevada. The fundamental principle of the strategy is to retain, restore, and protect the processes and landforms that provide habitat for aquatic and riparian-dependant organism, and produce and deliver high-quality waters for which the national forests were established. Strategy goal relate to water quality; species viability; plant and animal community diversity; species habitat; watershed connectivity; floodplains and water tables; watershed condition; streamflow patterns and sediment regimes; and streambanks and shorelines and will support the Forest Service's mission to provide habitat for riparian- and aquatic-dependant species under the National Forest Management Act, Organic Act, Safe Drinking Water Act, Endangered Species Act, and Electric Consumers Protection Act (USDA 2004). The following goals are part of the Aquatic Management Strategy from the Sierra Nevada Forest Plan Amendment:

- **Water Qualit**y: Maintain and restore water quality to meet goals of the Clean Water Act and Safe Drinking Water Act, providing water that is fishable, swimmable, and suitable for drinking after normal treatment.
- **Species Viabilit**y: Maintain and restore habitat to support viable populations of native and desired non-native plant, invertebrate, and vertebrate riparian-dependent species. Prevent new introductions of invasive species. Where invasive species are adversely affecting the viability of native species, work cooperatively with appropriate State and Federal wildlife agencies to reduce impacts to native populations.

- **Plant and Animal Community Diversit**y: Maintain and restore the species composition and structural diversity of plant and animal communities in riparian areas, wetlands, and meadows to provide desired habitats and ecological functions.
- **Special Habitat**s: Maintain and restore the distribution and health of biotic communities in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and marshes) to perpetuate their unique functions and biological diversity.
- **Watershed Connectivit**y: Maintain and restore spatial and temporal connectivity for aquatic and riparian species within and between watersheds to provide physically, chemically and biologically unobstructed movement for their survival, migration and reproduction.
- **Floodplains and Water Table**s: Maintain and restore the connections of floodplains, channels, and water tables to distribute flood flows and sustain diverse habitats.
- **Watershed Conditio**n: Maintain and restore soils with favorable infiltration characteristics and diverse vegetative cover to absorb and filter precipitation and to sustain favorable conditions of stream flows.
- **Streamflow Patterns and Sediment Regime**s: Maintain and restore in-stream flows sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and keep sediment regimes as close as possible to those with which aquatic and riparian biota evolved.
- **Stream Banks and Shoreline**s: Maintain and restore the physical structure and condition of stream banks and shorelines to minimize erosion and sustain desired habitat diversity.

The desired future condition for streams with fisheries is that aquatic habitat will be improved. Overall, habitat for native fisheries is expected to improve, with Little Kern golden trout population (which is outside the project planning area) increased to occupy their entire critical habitat by the management plan (USDA, 1988).

<u>Threatened, Endangered, and Sensitive Aquatic and Riparian Species</u>

Habitat for Federal and State Threatened and Endangered species is to be managed to maintain and improve the habitats for these species and to meet the objectives set forth in the individual species recovery and management plans (USDA, 1988).

R5 USFS Sensitive Species, Species Proposed for Listing, and California Species of Special Concern are to be managed so that these species are either removed from Federal listing or are prevented from being listed as Threatened or Endangered (*ibid.*).

10.2.2 SOUTHERN SIERRA FISHER CONSERVATION AREA

The southern Sierra fisher conservation area encompasses the known occupied range of the Pacific fisher in the Sierra Nevada. This consists of an elevational band from 3,500 feet to 8,000 feet on the Sequoia National Forest.   The standards and guidelines in this section provide direction for managing the southern Sierra fisher conservation area. Unmapped allocations (such as PACs, den site buffers, riparian areas, and meadows) overlap the southern Sierra fisher conservation area. Standards and guidelines for PACs, den site buffers, and California spotted owl home range core areas supercede standards and guidelines for the southern Sierra fisher conservation area. Management direction for overlapping riparian conservation areas, meadows, and critical aquatic refuges complements southern Sierra fisher conservation area management direction; in these overlaps, the standards and guidelines of both allocations apply.

The Desired Condition within known or estimated female fisher home ranges outside of the Wildland Urban Interface is for a minimum of fifty percent of the forested area has at least sixty percent canopy cover. Where home range information is lacking, use Hydrologic Unit Code 6 watersheds (watersheds at an approximate scale between 10,000 and 40,000 acres) are to be used as the analysis area for this desired condition (USDA 2004). Additional direction is found in Framework Standard and Guideline 90 “Prior to vegetation treatments, design measures to protect important habitat structures as identified by the wildlife biologist, such as large diameter snags and oaks, patches of dense large trees typically ¼ to 2 acres, large trees with cavities for nesting, clumps of small understory trees, and coarse woody material. For example, use firing patterns, place fire lines around snags and large logs, and implement other prescribed burning techniques to minimize effects to these attributes. Use mechanical treatments when appropriate to minimize effects on preferred fisher habitat elements.” (USDA 2004)

<u>Grazing:</u> Under the Sierra Nevada Forest Plan Amendment, several standards and guidelines are adopted related to cattle grazing:

- Prevent disturbance to meadow-associated streambanks and natural lake and pond shorelines caused by resource activities from exceeding 20% of stream reach or 20 percent of natural lake and pond shorelines.
- For meadow in early seral status: limit livestock utilization of grass and grass-like plants to 30 percent (or minimum 6-inch stubble height).
- For meadows in lat seral status: limit livestock utilization of grass and grass-like plants to a maximum of 40% (or minimum of 4-inch stubble height.
- Determine ecological status on all key areas monitored for grazing utilization prior to establishing utilization levels.
- Limit browsing to no more than 20% of the annual leader growth of mature riparian shrubs and no more than 20% of individual seedlings.

10.3 Sierra Nevada Forest Plan Amendment (SNFPA)

Riparian Conservation Objectives (RCOs) have been developed as means to implement the Aquatic Management Strategy for the Final Supplement to the Sierra Nevada Forest Plan Amendment. Standards and guidelines associated with the Aquatic Management Strategy are:

91. Designate riparian conservation area (RCA) widths as described in Part B of this appendix. The RCA widths displayed in Part B may be adjusted at the project level if a landscape analysis has been completed and a site-specific RCO analysis demonstrates a need for different widths.

92. Evaluate new proposed management activities within CARs and RCAs during environmental analysis to determine consistency with the riparian conservation objectives at the project level and the AMS goals for the landscape. Ensure that appropriate mitigation measures are enacted to 1) minimize the risk of activity-related sediment entering aquatic systems and 2) minimize impacts to habitat for aquatic- or riparian-dependent plant and animal species.

93. Identify existing uses and activities in CARs and RCAs during landscape analysis. At the time of permit re-issuance, evaluate and consider actions needed for consistency with RCOs.

94. As part of project-level analysis, conduct peer reviews for projects that propose ground-disturbing activities in more than 25 percent of the RCA or more than 15 percent of a CAR.

123. Determine which critical aquatic refuges or areas within critical aquatic refuges are suitable for mineral withdrawal. Propose these areas for withdrawal from location and entry under U.S. mining laws, subject to valid existing rights, for a term of 20 years.

124. Approve mining-related plans of operation if measures are implemented that contribute toward the attainment or maintenance of aquatic management strategy goals.

The RCO's that apply to the management area of the California Golden Trout are listed below.

Riparian Conservation Objective #1: Ensure that identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses. Standards and Guidelines associated with RCO #1 are:

95. For waters designated as "Water Quality Limited" (Clean Water Act Section 303(d)), participate in the development of Total Maximum Daily Loads (TMDLs) and TMDL Implementation Plans.

96. Execute applicable elements of completed TMDL Implementation Plans.
Ensure that management activities do not adversely affect water temperatures necessary for local aquatic- and riparian-dependent species assemblages.

97. Limit pesticide applications to cases where project level analysis indicates that pesticide applications are consistent with riparian conservation objectives.

98. Within 500 feet of known occupied sites for the California red-legged frog, Cascades frog, Yosemite toad, foothill yellow-legged frog, mountain yellow-legged frog, and northern leopard frog, design pesticide applications to avoid adverse effects to individuals and their habitats.

99. Prohibit storage of fuels and other toxic materials within RCAs and CARs except at designated administrative sites and sites covered by a Special Use Authorization. Prohibit refueling within RCAs and CARs unless there are no other alternatives. Ensure that spill plans are reviewed and up-to-date.

Riparian Conservation Objective #2: Maintain or restore: 1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fend, wetlands, vernal pools, springs; 2) steams, including in stream flows; and 3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species. Standards and Guidelines associated with RCO #2 are:

100. Maintain and restore the hydrologic connectivity of streams, meadows, wetlands, and other special aquatic features by identifying roads and trails that intercept, divert or disrupt natural surface and subsurface water flow paths. Implement corrective actions where necessary to restore connectivity.

101. Ensure that culverts or other stream crossings do not create barriers to upstream or downstream passage for aquatic-dependent species. Locate water-drafting sites to avoid adverse effects to in stream flows and depletion of pool habitat. Where possible, maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows, wetlands, and other special aquatic features.

102. Prior to activities that could affect streams, determine if relevant geomorphic characteristics, including bank angle, channel bank stability, bank full width-to-depth ratio, embeddedness, channel-floodplain connectivity, residual pool depth, or channel substrate, are within the range of natural variability for the reference stream type as described in the Pacific Southwest Region Steam Condition Inventory protocol. If properties are outside the range of natural variability, implement restoration actions that will result in an upward trend.

103. Prevent disturbance to meadow-associated streambanks and natural lake and pond shorelines caused by resource activities (for example, livestock, OHVs, and dispersed recreation) from exceeding 20 percent of natural lake and pond shorelines. Disturbance includes bank sloughing, chiseling, trampling and other means of exposing bare soil or cutting plant roots. This standard does not apply to developed recreation sits and designated OHV routes.

104. In stream reaches occupied by, or identified as "essential habitat" in the conservation assessment for, the Lahontan and Paiute cutthroat trout and the Little Kern golden trout, limit streambank disturbance from livestock to 10 percent of the occupied or essential habitat stream reach. Cooperate with State and Federal agencies to develop streambank disturbance standards for threatened, endangered and sensitive species. Use the regional streambank assessment protocol implement corrective action where disturbance limits have been exceeded.

105. At either the landscape or project-scale, determine if the age class, structural diversity, composition, and cover of riparian vegetation are within the range of natural variability for the vegetative community. If conditions are outside the range of natural variability, consider implementing mitigation and/or restoration actions that will result in an upward trend. Actions could include restoration of aspen or other riparian vegetation where conifer encroachment is identified as a problem.

106. Cooperate with Federal, Tribal, State and local governments to secure in stream flows needed to maintain, recover, and restore riparian resources, channel conditions, and aquatic habitat. Maintain in stream flows to protect aquatic systems to which species are uniquely adapted. Minimize the effects of stream diversions or other flow modifications from hydroelectric projects on threatened, endangered, and sensitive species.

107. For exempt hydroelectric facilities on national forest lands, ensure that special use permit language provides adequate in stream flow requirements to maintain, restore, or recover favorable ecological conditions for local riparian- and aquatic-dependent species.

RCO #3: : Ensure a renewable supply of large down logs that: 1) can reach the stream channel and 2) provide suitable habitat within and adjacent to the RCA. (RCO #3 is linked to the following AMS goals: #2: Species Viability; #3: Plant and Animal Community Diversity). The Standard and Guideline associated with RCO #3 is:

108. Determine if the level of coarse large woody debris (CWD) is within the range of natural variability in terms of frequency and distribution and is sufficient to sustain stream channel physical complexity and stability. Ensure proposed management activities move conditions toward the range of natural variability.

RCO#4: Ensure that management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.

109. Within CARs, in occupied habitat or “essential habitat” as identified in conservation assessments for threatened, endangered or sensitive species, evaluate the appropriate role, timing and extent of prescribed fire. Avoid direct lighting within riparian vegetation; prescribed fires may back into riparian vegetation areas. Develop mitigation measures to avoid impacts to these species whenever ground-disturbing equipment is used.

110. Use screening devices for water drifting pumps. (Fire suppression activities are exempt during initial attack). Use pumps with low entry velocity to minimize removal of aquatic species, including juvenile fish, amphibian eggs masses and tadpoles, from aquatic habitats.

111. Design prescribed fire treatments to minimize disturbance of ground cover and riparian vegetation in RCA’s. In burn plans for project areas that include, or are adjacent to RCAs, identify mitigation measures to minimize the spread of fire into riparian vegetation. In determining which mitigation measures to adopt, weigh the potential harm of mitigation

measure, for example fire lines, against the risks and benefits of prescribed fire entering riparian vegetation. Strategies would recognize the role of fire in ecosystem function and identify those instances where fire suppression of fuel management actions could be damaging to habitat or long-term function of the riparian community.

112. Post-wildfire management activities in RCAs and CARs should emphasize enhancing native vegetation cover, stabilizing channels by non-structural means, minimizing adverse effects from the existing road network, and carrying out activities identified in landscape analyses. Post-wildfire operations shall minimize the exposure of bare soil.

113. Allow mechanical ground disturbing fuels treatments, hazard tree removal, salvage harvest, or commercial fuel wood cutting within RCAs or CARs when the activity is consistent with RCO's. Projects providing for public health and safety, such as the felling of hazard trees or fuel reduction activities within the defense zone of the urban wildland intermix zones, are permitted. Utilize low ground pressure equipment, helicopters, over the snow logging, or other non-ground disturbing actions to operate off of existing roads when needed to achieve RCO's. Prior to removing trees within RCAs or CARs, determine if existing down wood is sufficient to sustain the stream channel physical complexity and stability required to maintain or enhance the aquatic- and riparian-dependent community. Ensure that existing roads, landings and skid trails meet Best Management Practices. Minimize the construction of new skid trails or roads for access into RCAs for fuel treatments, salvage harvest, commercial fuel wood cutting, or hazard tree removal.

As appropriate, assess and document aquatic conditions following the Regional Stream Condition Inventory protocol prior to implementing ground disturbing activities within suitable habitat for California red-legged frog, Cascades frog, Yosemite toad, foothill and mountain yellow-legged frogs, and northern leopard frog.

115. During fire suppression activities, consider impacts to aquatic- and riparian-dependent resources. Where possible, locate incident bases, camps, helibases, staging areas, helispots and other centers for incident activities outside of RCAs or CARs. During pre-suppression planning, determine guidelines for suppression activities, including avoidance of potential adverse effects to aquatic- and riparian-dependent species as a goal.

Identify roads, trails, OHV trails and staging areas, developed recreation sites, dispersed campgrounds, special use permits, grazing permits, and day use sites during landscape analysis. Identify conditions that degrade water quality or habitat for aquatic and riparian-dependent species. At the project level, evaluate and consider actions to ensure consistency with standards and guidelines or desired conditions.

Riparian Conservation Objective #5: Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens and wetlands, to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas. Standards and Guidelines associated with RCO #5 are:

117. Assess the hydrologic function of meadow habitats and other special aquatic features during range management analysis. Ensure that characteristics of special features are, at a minimum, at PFC, as defined in the appropriate Technical Reports: 1) "Process for Assessing PFC", "PFC for Lotic Areas" or 2) "PFC for Lentic Riparian –Wetland Areas".

Prohibit or mitigate ground-disturbing activities that adversely affect hydrologic processes that maintain water flow, water quality, or water temperature critical to sustaining bog and fen ecosystems and plant species that depend on these ecosystems. During project analysis, survey, map, and develop measures to protect bogs and fens from such activities as trampling by livestock, pack stock, humans, and wheeled vehicles. Criteria for defining bogs and fens include, but are not limited to, presence of: 1) sphagnum moss *(Spagnum sp*p.); 2) mosses belonging to the genus *Meessi*a; and 3) sundew *(Drosera sp*p.) Complete initial plant inventories of bogs and fens within active grazing allotments prior to re-issuing permits.

119. Locate new facilities for gathering livestock and pack stock outside of meadows and riparian conservation areas. During landscape analysis, evaluate and consider relocating existing livestock facilities outside of meadows and riparian areas. Prior to re-issuing grazing permits, assess the compatibility of livestock management facilities located in riparian conservation areas with riparian conservation objectives.

120. Under season-long grazing:
For meadows in early seral status: limit livestock utilization of grass and grass-like plans to a maximum of 30 percent (or minimum 6-inch stubble height).
For meadows in late seral status: limit livestock utilization of grass and grass-like plants to a maximum of 40 percent (or a minimum of 4-inch height)

Determine ecological status on all key areas monitored for grazing utilization prior to establishing utilization levels. Use Regional ecological scorecards and range plant list in regional range handbooks to determine ecological status. Analyze meadow ecological status every 3 to 5 years. If meadow ecological status is determined to be moving in a downward trend, modify or suspend grazing. Include ecological status data in a spatially explicit Geographical Information system database.

Under intensive grazing systems (such as rest-rotation and deferred rotation) where meadows are receiving a period of rest, utilization levels can be higher than the levels described above if the meadow is maintained in late seral status and meadow-associated species are not being impacted. Degraded meadows (such as those in early seral status with greater than 10 percent of the meadow area in bare soil and active erosion) require total rest from grazing until they have recovered and have moved to a mid- or late seral status.

121. Limit browsing to no more than 20 percent of the annual leader growth of mature riparian shrubs (including willow and aspen) and no more than 20 percent of individual seedlings. Remove livestock from any area of an allotment when browsing indicates a change in livestock preference from grazing herbaceous vegetation t browsing woody riparian vegetation. Herd sheep away from woody riparian vegetation at all times.

Riparian Conservation Objective #6: Identify and implement restoration actions to maintain, restore or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species.

122. Recommend and establish priorities for restoration practices in: 1) areas with compaction in excess of soil quality standards; 2) areas with lowered water tables; or 3) areas that are either actively down cutting or that have historic gullies. Identify other management practices, for example, road building, recreational use, grazing and timber harvests, that may be contributing to the observed degradation.

10.4 National Direction for Fire Suppression

Below is direction given in March 2000 relating to retardant drops during fire suppression activities within or near riparian zones:

File Code:	5160	Date:	April 20, 2000
Route To:			

Subject: Guidelines for Aerial Application of Retardants and Foams in Aquatic Environments

To: Regional Foresters and Area Director

Enclosed are revised guidelines for aerial delivery of retardant and foams which are to be implemented immediately. These guidelines will be effective until we complete additional field studies which will allow us to amend and refine the guidelines. With these guidelines in place, we were able to issue a Resume Work Order to FIRE-TROL Holdings, LLC.

In addition to these guidelines, we have committed to undertake two interagency studies which will start this field season. One will address the residual effects of the retardant on the forest environment and will look at areas where retardant was dropped during the 1999 fire season. The other study will look at the applicability of the laboratory results of the Columbia Environmental Research Center as recommended in their report. It is anticipated, with the results of these two studies, that we will be able to develop additional guidelines which will be acceptable to all agencies for emergency fire response.

Background information on this issue can be found on the web at: www.fs.fed.us/fire/.
If there are questions regarding these guidelines, please contact your forest or regional fire staff.

/s/ Phil Janik

PHIL JANIK
Chief Operating Officer
Enclosure

Guidelines for Aerial Delivery of Retardant or Foam near Waterways

Definition:

WATERWAY – Any body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life.

Guidelines:

Avoid aerial application of retardant or foam within 300 feet of waterways.

These guidelines do not require the helicopter or airtanker pilot-in-command to fly in such a way as to endanger his or her aircraft, other aircraft, or structures or compromise ground personnel safety.

Guidance for pilots: To meet the 300-foot buffer zone guideline, implement the following:

- Medium/Heavy Airtankers: When approaching a waterway visible to the pilot, the pilot shall terminate the application of retardant approximately 300 feet before reaching the waterway. When flying over a waterway, pilots shall wait one second after crossing the far bank or shore of a waterway before applying retardant. Pilots shall make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant within the 300-foot buffer zone.

- Single Engine Airtankers: When approaching a waterway visible to the pilot, the pilot shall terminate application of retardant or foam approximately 300 feet before reaching the waterway. When flying over a waterway, the pilot shall not begin application of foam or retardant until 300 feet after crossing the far bank or shore. The pilot shall make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant within the 300-foot buffer zone.

- Helicopters: When approaching a waterway visible to the pilot, the pilot shall terminate the application of retardant or foams 300 feet before reaching the waterway. When flying over a waterway, pilots shall wait five seconds after crossing the far bank or shore before applying the retardant or foam. Pilots shall make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant or foam within the 300-foot buffer zone.

Guidelines for Aerial Delivery of Retardant or Foam near Waterways:

Exceptions:

- When alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns or lack of ground personnel, it is acceptable to anchor the foam or retardant application to the waterway. When anchoring a retardant or foam line to a waterway, use the most accurate method of delivery in order to minimize placement of retardant or foam in the waterway (e.g., a helicopter rather than a heavy airtanker).

- Deviations from these guidelines are acceptable when life or property is threatened and the use of retardant or foam can be reasonably expected to alleviate the threat.

- When potential damage to natural resources outweighs possible loss of aquatic life, the unit administrator may approve a deviation from these guidelines.

Threatened and Endangered (T&E) Species:

The following provisions are guidance for complying with the emergency section 7 consultation procedures of the ESA with respect to aquatic species. These provisions do not alter or diminish an action agency's responsibilities under the ESA.

Where aquatic T&E species or their habitats are potentially affected by aerial application of retardant or foam, the following additional procedures apply:

1. As soon as practicable after the aerial application of retardant or foam near waterways, determine whether the aerial application has caused any adverse effects to a T&E species or their habitat. This can be accomplished by the following:

    a. Aerial application of retardant or foam outside 300 ft of a waterway is presumed to avoid adverse effects to aquatic species and no further consultation for aquatic species is necessary.
    b. Aerial application of retardant or foam within 300 ft of a waterway requires that the unit administrator determine whether there have been any adverse effects to T&E species within the waterway.

    These procedures shall be documented in the initial or subsequent fire reports.

2. If there were no adverse effects to aquatic T&E species or their habitats, there is no additional requirement to consult on aquatic species with Fish and Wildlife Service (USFWS) or National Marine Fisheries Service (NMFS).

Guidelines for Aerial Delivery of Retardant or Foam near Waterways:

3. If the action agency determines that there were adverse effects on T&E species or their habitats then the action agency must consult with USFWS and NMFS, as required by 50 CFR 402.05 (Emergencies). Procedures for emergency consultation are described in the Interagency Consultation Handbook, Chapter 8 (March, 1998). In the case of a long duration incident, emergency consultation should be initiated as soon as practical during the event. Otherwise, post-event consultation is appropriate. The initiation of the consultation is the responsibility of the unit administrator.

Each agency will be responsible for insuring that the appropriate guides and training manuals reflect these guidelines.