TESTIMONY OF JEAN BALDRIGE

Prepared for:

STATE WATER RESOURCES CONTROL BOARD
CACHUMA PROJECT HEARING
APPLICATIONS 11331 AND 11332

Cachuma Member Units Exhibit No. 226

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BEFORE THE STATE WATER RESOURCES CONTROL BOARD
ON BEHALF OF THE CACHUMA CONSERVATION RELEASE BOARD AND
SANTA YNEZ RIVER WATER CONSERVATION DISTRICT, IMPROVEMENT DISTRICT NO. 1

I am a fisheries biologist employed by ENTRIX, Inc. (ENTRIX) since 1985, where I am a Senior Consultant in Fisheries located in the Walnut Creek, California office. I have been employed as an environmental consultant since 1976. I received my Bachelor's degree from Grinnell College and my Master of Science degree from the School of Fisheries, University of Washington. I have worked on issues related to salmonid biology and habitat assessment on the West Coast. Much of my work has been with California salmonids since 1987. I have evaluated habitat needs for steelhead, salmon, trout, and char in West Coast rivers. In the Russian River, I am assessing the effects of water diversion, flood control, channel maintenance, and fish production facilities on steelhead, coho salmon, and Chinook salmon. In the Ventura River and in Malibu Creek, I evaluated the potential restoration actions that may contribute to recovery of steelhead stocks. I have been working with the City of Santa Cruz to improve fish passage at Felton Diversion. I am assisting the City of Santa Cruz in preparing a Habitat Conservation Plan for its activities in the San Lorenzo watershed and in the coastal streams affected by the City's water diversions. I evaluated the effects of water diversion on steelhead and coho salmon in Lagunitas Creek. I am also engaged in work in the Salmon and Clearwater rivers, where I am assisting the Nez Perce Tribe and the Department of Interior in the Snake River Adjudication. My work there has involved determining instream flows and habitat restoration actions in the 220 streams in the Salmon River and Clearwater River basins to benefit steelhead, Chinook salmon, and resident salmonids.

I began working in the Santa Ynez River Valley in 1990, when I was asked by the City of Santa Barbara and Montecito Water District to review information on the Santa Ynez River in preparation for the State Water Resources Control Board's (SWRCB) Consolidated Hearing on the Santa Ynez River. In 1993, I assisted the Cachuma Member Units[1] (MUs) in formulating the Memorandum of Understanding (MOU) that initiated the Santa Ynez River Technical Advisory Committee (SYRTAC). I have been a member of the Biological Subcommittee of the SYRTAC since its formation. In 1996, a new position, Study Coordinator, was created by the SYRTAC to oversee the Santa Ynez River studies. Since then, I have been the Study Coordinator for the SYRTAC, in addition to my role on the Biological Subcommittee. I coordinate SYRTAC activities, oversee the development and implementation of specific investigations and monitoring studies, synthesize and analyze information, and prepare reports resulting from various

[1] The Cachuma Member Units (MUs) are the City of Santa Barbara, the Goleta Water District, the Montecito Water District, the Carpinteria Valley Water District, and the Santa Ynez River Water Conservation District (SYRWCD), Improvement District No. 1 (ID #1).

MOUs, as identified in Section 3(b) of SWRCB Order WR 94-5. I have worked closely with the California Department of Fish and Game (CDFG) representative leading the SYRTAC, and with the Bureau of Reclamation (Reclamation) in their role as chair of the Santa Ynez River Consensus Committee (Consensus Committee). I also assisted Reclamation with the Section 7 Consultation for the Cachuma Project and worked closely with the National Marine Fisheries Service (NMFS, now called NOAA Fisheries) staff in conducting the supplemental analysis to support the revised project description and effects analysis for the biological assessment (BA). In addition, I assisted Reclamation, the Cachuma Conservation Release Board[2] (CCRB), and the Santa Ynez River Water Conservation District (SYRWCD) Improvement District #1 (ID #1) with preparation of the environmental report (Reclamation and the Cachuma Operation and Maintenance Board [COMB[3]] 2003), attached hereto as Exhibit No. MU 226(a)), for implementation of NOAA Fisheries' Biological Opinion (BO; NMFS 2000, Exhibit No. SWRCB 9).

1.0 INTRODUCTION

The original fisheries MOU established the Consensus Committee[4] and the SYRTAC[5]. The purpose of the MOU is to cooperatively develop the science necessary to make management decisions relative to public-trust resources downstream of Bradbury Dam and to recommend appropriate management actions for the benefit of those resources. The Consensus Committee designated the SYRTAC to implement this process, with management oversight by the Consensus Committee. The result of this seven-year process is the Lower Santa Ynez River Fish Management Plan ("Plan;" SYRTAC 2000a, Exhibit No. MU 35). The Plan prioritizes management actions and targets an implementation schedule for each action. The process used to develop the Plan was broad-based, inclusive, and used a consensus approach to create, refine, evaluate, and prioritize the recommended management actions.

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[2] The Cachuma Conservation Release Board (CCRB) is composed of the City of Santa Barbara, the Goleta Water District, the Montecito Water District, and the Carpinteria Valley Water District.

[3] The Cachuma Operation and Maintenance Board (COMB) is composed of the Cachuma MUs.

[4] The Consensus Committee is composed of the signatory agencies to the MOU, which include those agencies with an interest in the operations of the Cachuma Project (Reclamation, U.S. Fish and Wildlife Service [USFWS], CDFG, CCRB, ID#1, SYRWCD, City of Lompoc, Santa Barbara County Water Agency, and Santa Barbara County Flood Control and Water Conservation District).

[5] The SYRTAC consists of the signatories to the MOU as well as local experts and interested parties (e.g., NOAA Fisheries, U.S. Forest Service (USFS), U.S. Department of Agriculture Natural Resources Conservation Service, California Trout, Santa Barbara Urban Creeks Council, Central Coast Regional Water Quality Control Board, Central Coast Water Authority, Santa Barbara County Fish and Game Commission, California Coastal Commission, and Santa Barbara citizens and local landowners).

The Plan is an aggressive effort that includes most of the feasible opportunities[6] that were analyzed in the Santa Ynez River Fisheries Management Alternatives Report (SYRTAC 1998a, Exhibit No. MU 15) to provide a substantial biological benefit to steelhead and other public-trust resources. The Plan addresses the limiting factors for steelhead in the lower basin by recommending actions that enhance or protect oversummering habitat as well as actions that provide a migration pathway to important spawning and rearing habitat downstream of Bradbury Dam. The Plan includes an implementation plan for the recommended actions, provides the flexibility needed to implement actions identified in the future, and proposes an adaptive management strategy to take advantage of future opportunities. The actions recommended in the Plan are also consistent with those presented in CDFG's Steelhead Restoration and Management Plan for California (McEwan and Jackson 1996). The adaptive management strategy will continue to evaluate data from various monitoring programs, consider public and agency input, and account for annual hydrological conditions to maximize the Plan's success. In addition to the recommended actions, a long-term monitoring program has been implemented to track changes in the rainbow trout/steelhead population and their habitat and to provide feedback to the adaptive management process.

During the process outlined above, the Southern California Steelhead evolutionarily significant unit (ESU) was listed as endangered by NOAA Fisheries (NMFS 1997). A companion process to the Plan development was therefore initiated under Section 7 of the Endangered Species Act (ESA) so that Reclamation could obtain an incidental take statement from NOAA Fisheries for operation and maintenance of the Cachuma Project. Reclamation provided a draft BA in 1998 (Reclamation 1998), and a final BA in 1999 (Reclamation 1999, Exhibit No. SWRCB 10 to NOAA Fisheries, the latter consistent with the actions developed in the draft Plan (SYRTAC 1999b, Exhibit No. SWRCB 7). After engaging in consultation with NOAA Fisheries, Reclamation submitted a supplement to the BA in 2000 (Reclamation 2000, Exhibit No. SWRCB 10), which included changes to project operations developed in concert with NOAA Fisheries. NOAA Fisheries issued a BO to Reclamation in September 2000 (NMFS 2000, Exhibit No. SWRCB 9), which evaluated the effects of the Cachuma Project operations on the Southern California steelhead population in the Santa Ynez River. The BO found that the actions of Reclamation did not pose jeopardy to the Southern California Steelhead ESU and, in fact, supported recovery of steelhead in the Santa Ynez River (NMFS 2000, Exhibit No. SWRCB 9). The proposed actions in the BA and terms and conditions stipulated in the BO were incorporated into the final Plan published in 2000 after the BO was issued (SYRTAC 2000a, Exhibit No. MU 35).

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[6] Feasible opportunities that were found to have very low biological benefits were not included in the Plan. For example, the biological benefits of trapping and trucking adults outside of the Santa Ynez River drainage were found to be very low. This option would not increase steelhead production in the Santa Ynez River and could adversely affect fish population dynamics in the receiving streams. Therefore, this option was not further pursued in the Plan.

As discussed in greater detail below, it is my opinion that execution of the Plan will provide substantial benefits to steelhead and other public-trust resources in the Lower Santa Ynez River. I believe that the actions necessary to protect this habitat and the species that utilize it are included in the Plan. The continuing investigations, performance monitoring, and the adaptive management process included in the Plan provide the necessary feedback and mechanisms to provide protection to public-trust resources. The information will be used to evaluate the actions, to continue implementing those elements of the Plan that prove to be effective, to adjust management actions as needed, and to identify and implement additional actions where opportunities present themselves.

2.0 ALTERNATIVE DEVELOPMENT AND SELECTION PROCESS

Forty-eight actions were identified in a collaborative process to evaluate opportunities to improve habitat conditions for steelhead in the Santa Ynez River and reported in the Santa Ynez River Fisheries Management Alternatives (SYRTAC 1998a, Exhibit No. MU 15). The management actions recommended in the Plan were chosen primarily from these alternatives. Each of the 48 alternatives were screened and ranked by the SYRTAC members based on feasibility, biological benefits to fisheries resources, cost, likelihood of success, and logistical constraints such as access to land, water operations, and institutional coordination. Actions that were determined to have a biological benefit and were found to be feasible and practical were included as a recommended action within the Plan. Hydrological and fisheries studies conducted by the SYRTAC provided a technical understanding of the limitations, constraints, and opportunities for applying actions developed as part of the alternatives process (SYRTAC 2000b, Exhibit No. MU 35).

3.0 IDENTIFICATION OF OPPORTUNITIES AND CONSTRAINTS

Since 1993, the SYRTAC and CDFG have conducted cooperative studies of the Santa Ynez River basin below Bradbury Dam. The SYRTAC studies address the hydrology, water quality, water temperature, habitat characteristics, and fish resources of the Santa Ynez River and its tributaries downstream of Bradbury Dam. These studies were used to identify the major limiting factors affecting steelhead in the lower river basin and to develop and evaluate opportunities to enhance the steelhead population and benefit public trust resources. These investigations show that the seasonal and interannual variation in instream flow, habitat conditions within the mainstem and tributaries, seasonal patterns in water temperature and dissolved oxygen (DO), impediments to migration, and the small steelhead population are among the principal constraints to steelhead populations.

These studies have identified opportunities such as locations within the lower basin where releases from Bradbury Dam can create perennial habitat of suitable quality, the ability to improve access to suitable habitat within the mainstem and tributaries, and the ability to improve habitat quality. Several of these enhancement opportunities are further

constrained by access; however, public education and outreach can create opportunities for addressing access issues.

Habitat surveys were conducted in accessible parts of the Lower Santa Ynez River and its tributaries to assess the quantity and quality of fish habitat. Some of the tributaries provide the best rearing habitat in this part of the watershed. The south-side tributaries of the lower watershed have the best potential as rainbow trout/steelhead rearing habitat because these streams generally have perennial flow through the summer, at least in their upper reaches. In contrast, the north-side tributaries do not retain summer flows and are too dry to support year-round habitat for aquatic species. The availability of, and access to, year-round rearing habitat with appropriate water temperatures was determined to be the major constraint associated with steelhead stocks in the Santa Ynez River. Therefore, the Plan's approach is to seize the opportunity afforded by the perennial flow portions of the south-side tributaries and to propose management actions for several of them.

The SYRTAC identified Hilton Creek, a small, intermittent stream immediately downstream of Bradbury Dam, as a priority stream that, with supplemented summer flows, could provide good rearing habitat year-round. Early SYRTAC surveys identified successful spawning and early rearing in the lower reach of this tributary, although this habitat dried up in the summer and therefore did not provide habitat in the critical late summer/fall period. In June 1998, approximately 831 YOY rainbow trout/steelhead and 3 adults were rescued from this Hilton Creek habitat, demonstrating its productivity. For reasons of its close proximity to Bradbury Dam and Lake Cachuma, and because the lower stream is on Reclamation property, Hilton Creek is a unique management opportunity.

Several constraints limit potential opportunities to enhance habitat in the mainstem to a few miles below Bradbury Dam. Downstream of Solvang, the river changes to a predominantly sand-bedded system, which the SYRTAC studies indicate is primarily used by steelhead as a migration route. An assessment of spawning habitat indicates suitable spawning habitat in the Refugio Reach and in the State Highway 154 Reach. The availability of spawning habitat, however, must be linked with rearing habitat which is not found in the mainstem during the low-flow summer season. In the reaches near Bradbury Dam, mainstem habitat had suitable structure but limited flow. The Plan takes advantage of opportunities to develop new water supplies through surcharge of the reservoir and to stretch existing supplies through conjunctive use of SWRCB Order WR 89-18 ("WR 89-18") releases.

The Hilton Creek Supplemental Watering System is an important opportunity to release water from deep within Lake Cachuma to provide cool water to Hilton Creek and to the mainstem near Bradbury Dam. Steelhead prefer cooler water. However, the natural warming occurs quickly and the ability to control stream water temperatures with water releases from Lake Cachuma decreases in a downstream direction and constrains our ability to manage the mainstem as rearing habitat downstream of the State Highway 154 Reach. Fry and juvenile rearing habitat was found to be more limiting to steelhead populations than the amount of available spawning habitat (ENTRIX 1995, Exhibit No.

SWRCB 5). Some rearing habitat is available in the south-side tributaries. Additional habitat suitable for rearing may be available in the Santa Ynez River lagoon, although its distance from suitable spawning habitat may constrain its use until steelhead numbers increase.

Bradbury Dam operation detains some storm flow, constraining passage opportunities for migrating steelhead in the mainstem in some years. Passage models for the mainstem Santa Ynez River developed by CDFG and the SYRTAC were used to assess the amount of flow needed for passage over areas with potentially insufficient depth for upstream spawning migration (SYRTAC 1999c, Exhibit No. MU 226(c)). Fish passage impediments in the mainstem were generally related to beaver dams, shallow riffles, and gravel bars rather than permanent geomorphic features. Minimum flow for passage was based on water depth measurements in riffles and shallow runs. Flow augmentation during storm events was also evaluated to find opportunities to facilitate passage of steelhead to quality spawning and rearing habitat in the State Highway 154 Reach and in south-side tributaries including Hilton Creek.

The Santa Ynez River watershed has high variability in precipitation and runoff, with extremely wet and extended drought periods (SYRTAC 2000a, Exhibit No. MU 35). During wet years, high runoff and spills over Bradbury Dam provide passage opportunities for adult upstream spawning migrations. Storage of additional water in Lake Cachuma during these wet years (i.e., surcharge) can provide a water source for managed water releases from Lake Cachuma in subsequent years. Releases provide additional passage opportunities for adult steelhead and smolt (i.e., juvenile fish that are physiologically prepared to migrate to the ocean) passage to the ocean.

Steelhead passage into the south-side tributaries is also currently affected by numerous passage impediments. Studies have identified opportunities for remedying tributary passage impediments, including several road crossings. Habitat quality, both in the mainstem and the tributaries, could be improved with better riparian management and erosion control. Public education and outreach can create opportunities for implementing habitat and passage enhancement projects in these areas.

Habitat degradation is a primary factor in the decline of the steelhead population in this system ((NMFS 2000, Exhibit No. SWRCB 9). The opportunities outlined above can improve habitat conditions in the river, thereby creating opportunities for steelhead restoration. However, the severely depleted stocks within the Santa Ynez River and the Southern California Steelhead ESU will be an obstacle to steelhead recovery.

The Lower Santa Ynez River has been studied since 1993 during a predominantly wet period. As the majority of the watershed is privately owned, studies have been restricted to those areas where permission to access the river could be obtained. Further, as management actions are implemented, the response of habitat and fish to those actions will be studied, creating opportunities to learn from the results of those actions. Adaptive management provides an important opportunity to continue to improve the Plan into the future.

The Plan recognizes a number of existing constraints and limitations, that set bounds on what measures can be implemented while still meeting the essential purposes of the Cachuma Project for water supply and downstream water rights releases. Some Plan actions have been implemented, such as target flow releases from Lake Cachuma for summer rearing and the Hilton Creek Supplemental Watering System, with visible benefits. Other elements, such as fish passage projects on Quiota Creek, or the demonstration projects on El Jaro Creek, require additional environmental review and regulatory approvals prior to implementation.

The Plan acknowledges the constraints in the basin and takes advantage of the basin's opportunities to propose a suite of actions designed to improve habitat conditions in the Lower Santa Ynez River. As NOAA Fisheries concluded in the BO, implementation of Plan actions will benefit steelhead and their habitats and promote recovery of steelhead within the Santa Ynez River (NMFS 2000, Exhibit No. SWRCB 9). It is my opinion that the actions outlined in the Plan, if implemented, will provide substantial biological benefit for steelhead and other public-trust resources in the Lower Santa Ynez River.

4.0 COMPONENTS OF THE PLAN

4.1 Plan Objective

The Plan objective is to identify, evaluate, and recommend potential management actions that will benefit fish and other aquatic resources in the Lower Santa Ynez River. A management priority is to improve conditions for native fishes in general, and rainbow trout/steelhead in particular, while avoiding adverse impacts to other species of special concern or habitat values in the Lower Santa Ynez River.

4.2 Overview of Actions Recommended in the Plan

Actions that improve or create quality habitat for spawning, rearing, and migration for rainbow trout/steelhead also benefit other public-trust resources in the Lower Santa Ynez watershed. Actions that improve aquatic habitat and the riparian corridor will benefit aquatic species such as California red-legged frogs (especially in the tributaries) and Pacific lamprey.

The actions important for improving or creating habitat for rainbow trout/steelhead are actions that focus on:

(1) improving habitat quality in, or access to, priority tributaries for spawning and rearing;

(2) improving habitat quality in priority reaches immediately downstream of Bradbury Dam and in Hilton Creek for spawning and rearing; and

(3) increasing the opportunities for upstream and downstream steelhead migration in the Santa Ynez River mainstem.

Because most of the watershed in the Lower Santa Ynez River basin is in private ownership, the implementation of management actions, including monitoring studies, is constrained by access to lands and facilities. Actions on private land are an important component of the Plan and represent significant opportunities to provide additional habitat for rainbow trout/steelhead. A public outreach program to increase public awareness and voluntary support for beneficial actions is an integral component of the Plan.

Management actions recommended in the Plan fall into four categories:

I. **Create New Habitat.** Actions to increase the availability and quality of habitat for steelhead and other aquatic resources include:

A. Conjunctive releases of fishery flows with downstream water rights releases to maintain specific flow targets. This will provide year-round rearing habitat in the mainstem reaches between Bradbury Dam and State Highway 154.

B. Modifications to lower Hilton Creek to provide additional, new year-round rearing habitat by providing a reliable water supply to the lower 2,980 feet of habitat. A second phase under consideration is the construction of a 1,500-foot-long channel to extend Hilton Creek along the floodplain of the Santa Ynez River to increase the rearing area.

C. Creation of an Adaptive Management Account with 500 acre-feet (AF) of water that can be used to improve rearing or spawning habitat conditions in Hilton Creek or the mainstem, or to augment passage flow releases.

II. **Improve Existing Habitat.** Actions to increase the quality of habitat for steelhead include:

A. Protection and enhancement of steelhead spawning and rearing habitat in tributaries through the establishment of conservation easements and/or leases. Also, implementation of habitat improvements such as riparian plantings, structural improvements to instream habitat, and bank stabilization.

B. Structural improvements in mainstem pools and riparian plantings to increase the amount and quality of suitable habitat.

III. **Improve Access to Habitat.** Actions to provide or improve access to existing habitat include:

A. Establishment of a Fish Passage Account to provide 3,200 AF of dedicated water supply in spill years to create additional migration opportunities for steelhead in years following a spill.

B. Modification of fish passage impediments and barriers in the tributaries to enhance and increase the availability of habitat for steelhead spawning and rearing.

IV. **Increase Public Awareness.** Actions to increase public awareness and support for beneficial actions on private land include:

A. Public education and outreach to increase awareness by local landowners and the public on types of actions and land-use practices that will benefit aquatic resources. This action may also include the deterrence of poaching by posting the fish moratorium and publicizing citations.

B. Technical assistance and funding acquisition for voluntary actions to improve steelhead habitat on private land.

4.3 Conjunctive Use of Water Rights and Mainstem Rearing Releases

To be successful, steelhead must be able to complete all stages of their lifecycle. One of the key stages that can limit the size of a population is juvenile rearing. Young rainbow trout/steelhead remain in fresh water throughout the year. Flows in southern California streams are typically at their lowest in late summer or early fall when the amount of habitat space can be reduced to its lowest point and the quality of that habitat (e.g., water temperature) can be at its poorest. The amount of physical space available and water quality, particularly water temperature, are two of the most important flow-related aspects of rearing habitat and were found to be limiting in the Lower Santa Ynez River watershed. Therefore, we examined opportunities for conjunctive use of water rights releases and releases of stored project water to provide additional rearing habitat and critical oversummering habitat.

The objective of conjunctive use of fishery water and downstream water rights releases is twofold: to meet specific flow targets that will provide habitat in Hilton Creek and the mainstem between Bradbury Dam and State Highway 154. Flow augmentation in these reaches will improve habitat conditions for steelhead and public trust resources. Designation of priority reaches for conjunctive use of water rights and mainstem-rearing releases are based on the quality of existing habitat, water temperature characteristics, and the likelihood for successful protection and improvement of steelhead populations.

4.3.1 SYRTAC Habitat Study Program

A number of studies were implemented to provide the data necessary to determine what type of release regime from Bradbury Dam could result in biological benefits to aquatic and riparian resources downstream. Flow and spatial habitat studies were designed and conducted by CDFG, in association with the SYRTAC (SYRTAC 1999a, Exhibit No. MU 226(b). The relative amount of habitat available was evaluated in response to flow releases ranging from 2 cfs to 50 cfs in the Refugio and Alisal reaches. This study evaluated how the wetted width of the river (top-width), an index of the amount of habitat

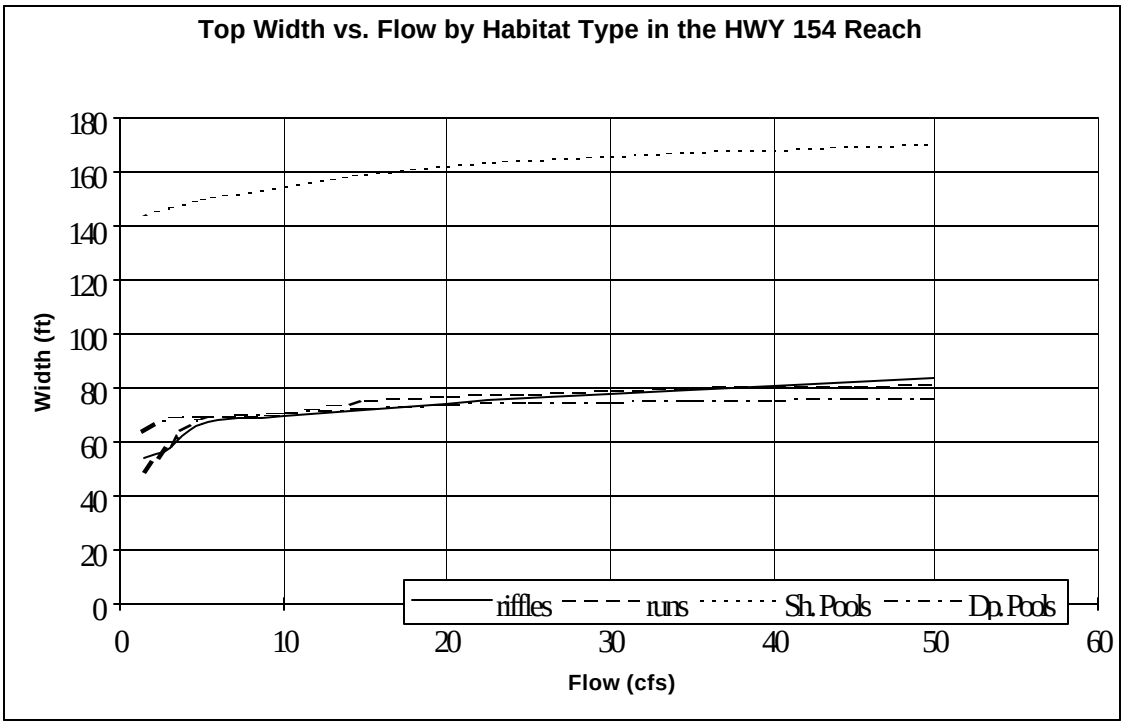
available, changed in response to changing flow levels in riffles, runs, glides, and pools during WR 89-18 water releases in late summer 1997. Much of the State Highway 154 Reach is on inaccessible private property, so transects developed by the California State Department of Water Resources (DWR) and used in Fisheries Technical Report (ENTRIX 1995, Exhibit No. SWRCB 5) were re-evaluated to develop similar relationships for the river area between Bradbury Dam and State Highway 154. The information from the flow versus habitat analysis (SYRTAC 1999a, Exhibit No. MU 226(b)) was used in developing the target flows proposed in the BA (Reclamation 1999, Exhibit No. SWRCB 10).

Figures 1, 2, and 3 present the top-width versus flow relationships for riffles, runs, shallow pools, and deep pools in the State Highway 154, Refugio, and Alisal reaches, respectively. These figures also present the percent change in top-width versus flow for these reaches and therefore illustrate at what flow ranges the more substantial increases in habitat (i.e., top-width) occur. In the State Highway 154 management reach, for riffles and runs, the most dramatic increase is found below 5 cfs. For pools in this reach, increases are also highest at lower flows. In the Refugio and Alisal reaches, similar results were seen for all units although the percent change in top-width was not as dramatic between 0 and 5 cfs as in the management reach. All units in the reaches continue to show increases in habitat space with increases in flow as would be expected. However, these increases are smaller relative to the amount of additional flow released.

The effect of flow on water temperatures was assessed with a water temperature model developed by the SYRTAC (using the SNTEMP model originally developed by the U.S. Fish and Wildlife Service [USFWS] Instream Flow Group). This model was applied to the Santa Ynez River and calibrated using water temperature data collected in the Long Pool (0.3 miles downstream of Bradbury Dam), San Lucas Ranch (1 mile downstream), and Alisal Bridge in Solvang (9.8 miles downstream). Results of the water temperature simulation indicate that water temperatures increase rapidly with distance from the dam. Stressful summer (primarily July and August) water temperatures were predicted within 4.4 miles below the dam under all scenarios considered, regardless of flow release. These results were confirmed by a longitudinal flow versus temperature study conducted in 1996 (SYRTAC 1997, Exhibit No. MU 34). These high temperatures reduce the utility of otherwise suitable habitat as potential oversummering habitat for rainbow trout/steelhead. The results confirm that benefits of releases on water temperature are greatest nearer to the dam and decrease in a downstream direction as the water warms.

4.3.2 Management Recommendations

Based on the SYRTAC studies on flow and temperature, and additional SYRTAC surveys of habitat composition and quality, priority reaches for flow management were identified. The management reaches were selected primarily on the basis of habitat structure, thermal characteristics, and channel permeability. The priority reaches and management activities are described below, in order of priority, and subsequent sections summarize the resulting benefits of these activities for steelhead.



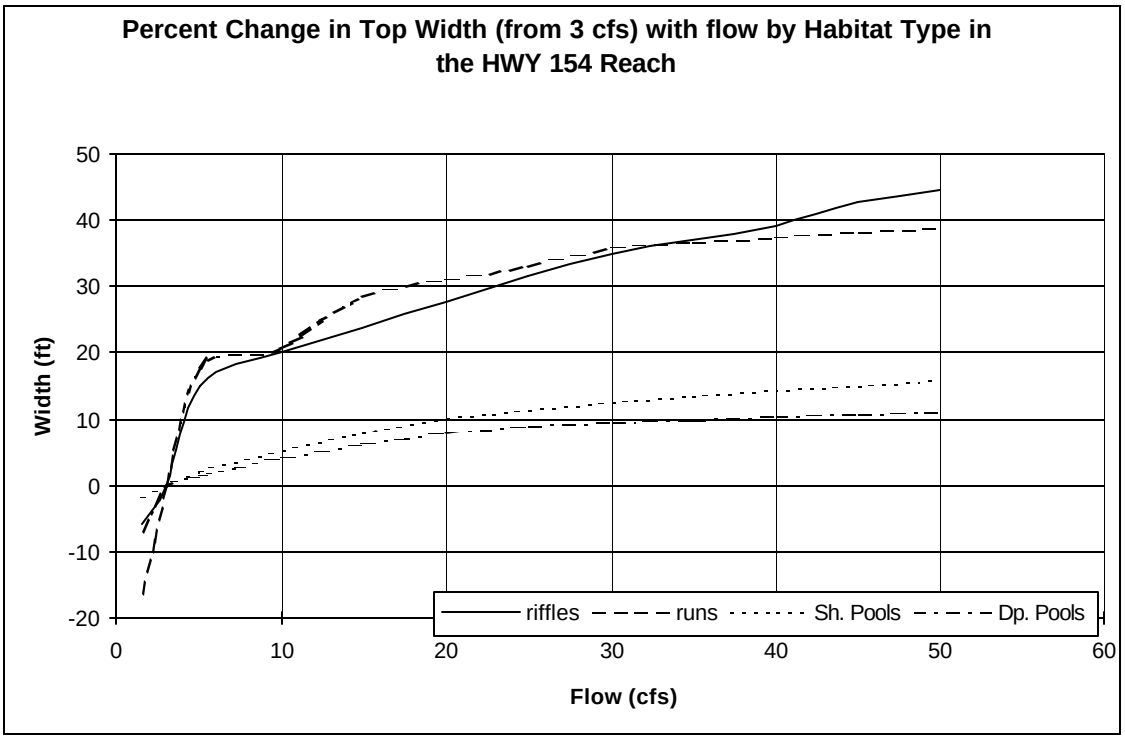
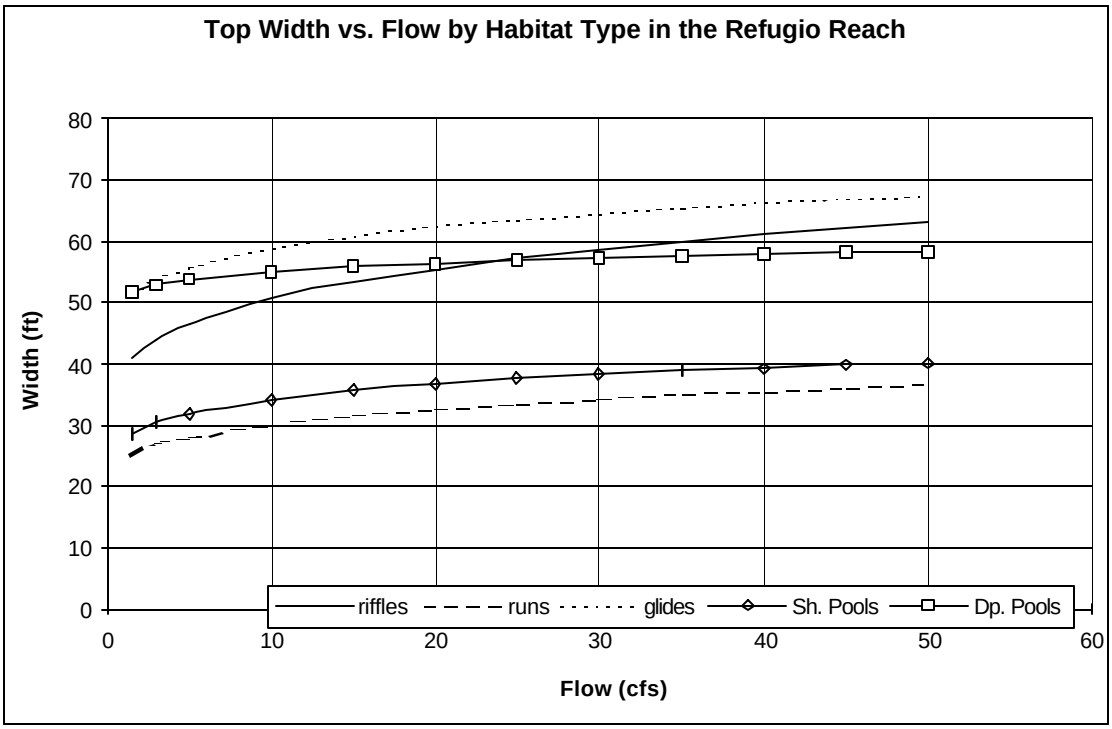


Figure 1. Top-Width versus Flow Relationship in the Highway 154 Reach



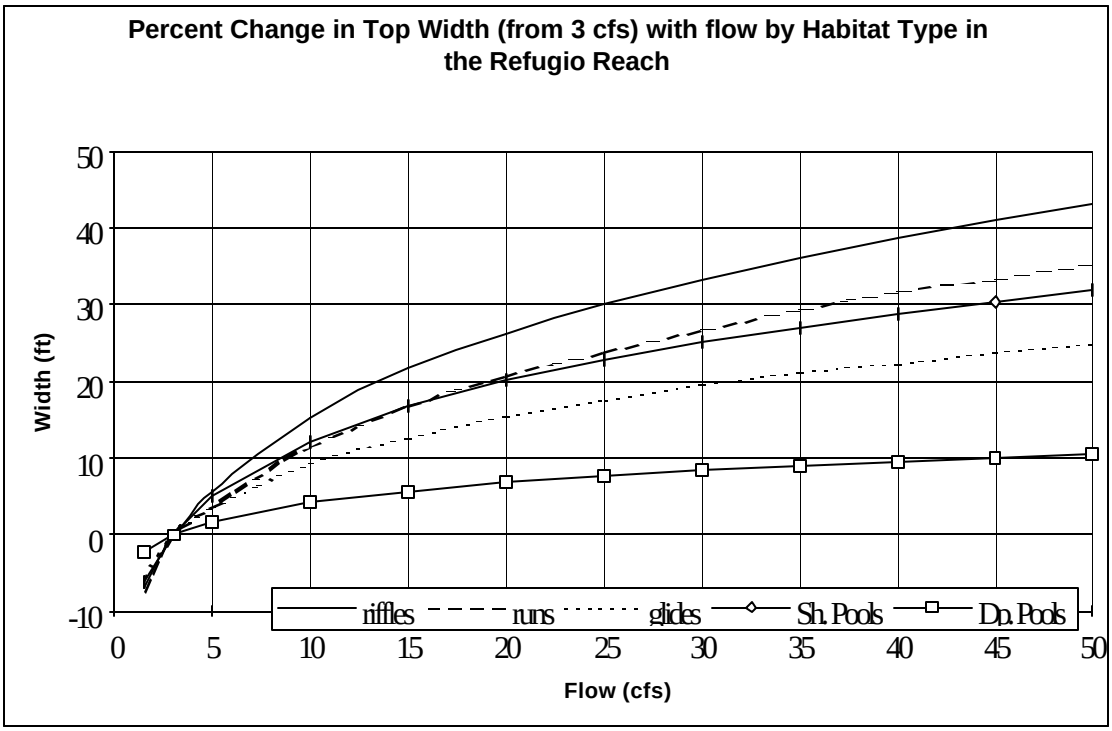
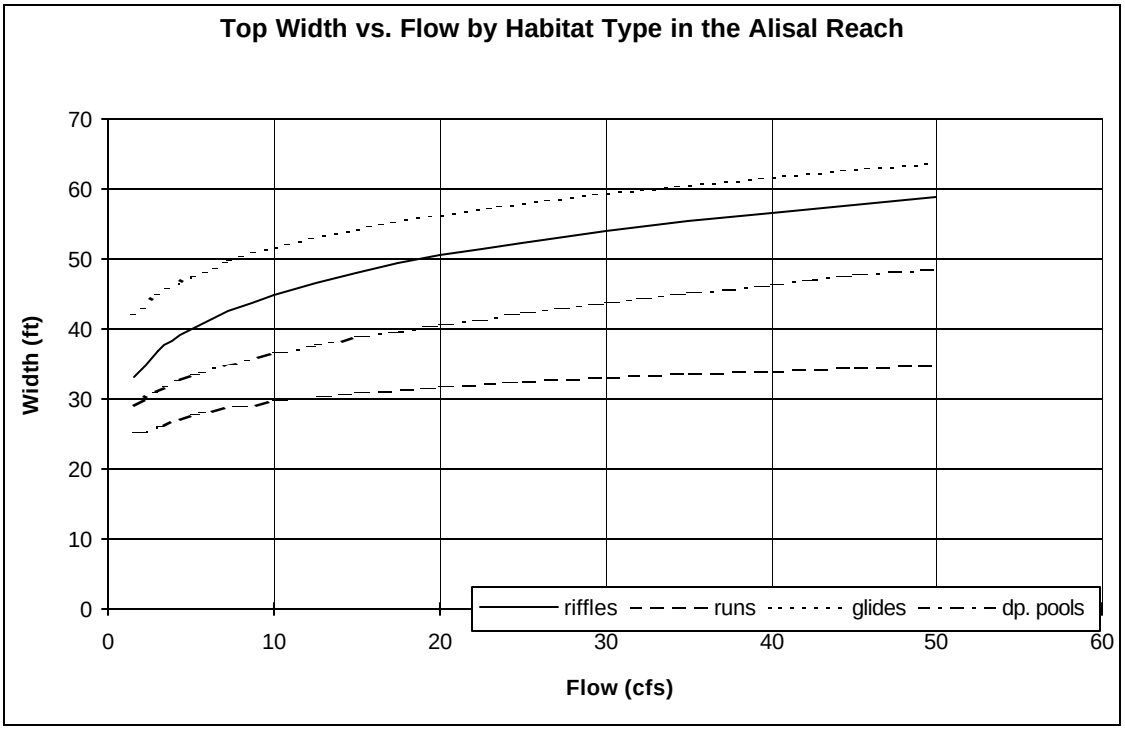


Figure 2. Top-Width versus Flow Relationship in the Refugio Reach



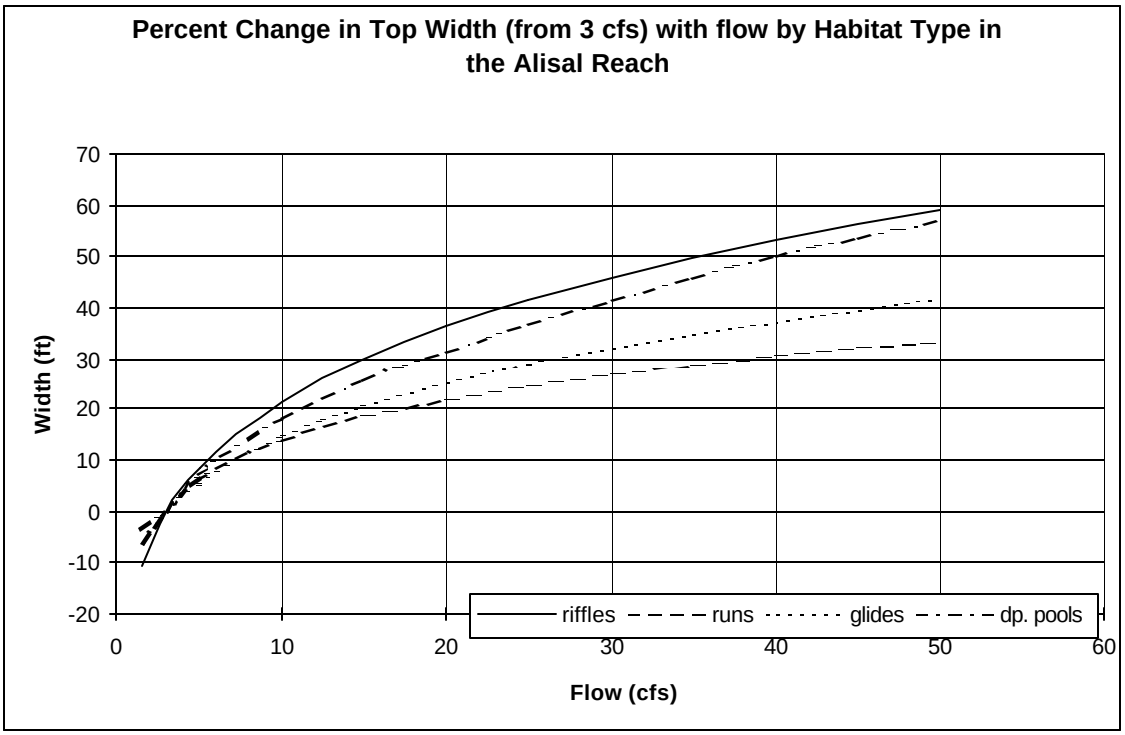


Figure 3. Top-Width versus Flow Relationship in the Alisal Reach

1. **Hilton Creek.** Good habitat conditions occur in Hilton Creek. Rainbow trout/steelhead have been observed spawning and rearing in lower Hilton Creek until the natural flow dried up in lower Hilton Creek in the early summer. Hilton Creek begins to lose water to underflow as the channel reaches the floodplain for the Santa Ynez River. Before the supplemental water project, young rainbow trout/steelhead were stranded and desiccated. At the recommendation of the SYRTAC and NOAA Fisheries, the temporary watering system was put in place in 1997 as a part of the Seismic Retrofit Project. Winter/spring of 1998 saw substantial rainfall in the Santa Ynez River and Hilton Creek. In 1998 when the permanent system was under construction, no additional water could be provided to Hilton Creek. By June of 1998, flows in lower Hilton Creek were declining and water quality was deteriorating. A fish rescue was conducted and 831 YOY and 3 adult rainbow trout/steelhead were rescued and relocated.

   A flow target of 2 cfs measured at the Hilton Creek gage was established for Hilton Creek. Flow can be released from the upper or the lower release point of the Hilton Creek Supplemental Watering System. The upper release point located near the boundary of the Reclamation property is normally used to provide a longer wetted channel. Since 2000, water releases have provided year-round, good-quality habitat for fish and other aquatic species.

2. **Mainstem from Bradbury Dam to Hilton Creek.** Much of this reach is occupied by the Stilling Basin, which can support rainbow trout/steelhead. Snorkel data indicate that most rainbow trout/steelhead in the Stilling Basin are greater than 8 inches in length. The large number of bass and channel catfish that are usually in the Stilling Basin have reduced its value as rearing habitat for small fish (less than 6 inches). Water can be released directly to the Stilling Basin from one of the three release points of the Hilton Creek Supplemental Watering System. Water can be released to this reach at the direction of the Adaptive Management Committee.

3. **Mainstem from Hilton Creek to State Highway 154 Bridge.** This portion of the mainstem has suitable habitat for both spawning and rearing steelhead. Water temperatures can be maintained below stressful levels for steelhead on a reliable basis. Habitat has good structure with pool development and undercut banks. Gravel/cobble substrate predominates. Riparian vegetation along the stream corridor has increased since flow releases began.

   Flow targets have been established as shown in Table 1 for this reach and vary by water-year type and reservoir storage levels. A discussion of the development of the target flow levels is below. Originally, flow targets were measured at State Highway 154 Bridge. This portion of the river is privately-owned and Reclamation has access only at the easement owned by the California Department of Transportation. The channel conditions in the easement are not suitable for accurate streamflow measurements. Reclamation and the Cachuma MUs are investigating an alternative monitoring program that will provide reliable estimates of flows in this reach under the flow releases.

Table 1. Long-Term Rearing Target Flows

Target Flow Triggers		Management Reach	Long-Term Target Flow	Percent of Time Flow Likely to be Met[2]
Lake Cachuma Storage (AF)	Reservoir Spill (AF)			
> 120,000	Spill > 20,000	Bradbury Dam to State Highway 154 Bridge	10 cfs	38%
	Spill > 20,000 & 1 Year After	State Highway 154 Bridge to Alisal Road Bridge	1.5 cfs[1]	75%
> 120,000	Spill < 20,000 or No Spill	Bradbury Dam to State Highway 154 Bridge	5 cfs	77 %
< 120,000		Bradbury Dam to State Highway 154 Bridge	2.5 cfs	98%
> 30,000		Lower Hilton Creek	2 cfs	98%
Critical Drought Years				
< 30,000	No Spill	Stilling Basin and Long Pool	Periodic release: 30 AF per month	Occurred 3 times in 76 years

[1] When rainbow trout/steelhead are present in the Alisal Reach (not always present due to migration out of reach, warmwater temperatures, and minimal riparian cover).
[2] Based on Santa Ynez River Hydrology Model (SYRHM) analysis.

4. **State Highway 154 Bridge to Solvang.** Habitat in this reach begins to lose the complexity found in the upstream areas. The channel widens and sand becomes more prevalent. Water temperature increases, and summer flows are often intermittent, sinking into the river channel and appearing on the surface further downstream. Rearing habitat is provided by pools in the reach. Some pool habitats are maintained by surface flow and/or by underflow. Pool habitats in this reach shift, form, or are filled as the channel shifts during high flows.

   In the reach between State Highway 154 and the Alisal Bridge, flow targets are established in certain years under certain hydrological conditions to maintain oversummering pools (Table 1). Flow targets are measured at the United States Geological Survey (USGS) gage at Solvang. The USGS is working with Reclamation and the Cachuma MUs to improve the reliability of this gage under low flows.

As noted above, specific target flows are called for in the Plan. Meeting these flows requires that Reclamation implement the conjunctive water rights release program for project water and downstream water rights releases. The BO and the Plan also provide for interim target flows until a 3.0-foot surcharge at Bradbury Dam is in place. Reclamation began meeting target flow requirements in September 2000, when the BO

was issued. Interim target flow levels will be in place until water from the 3-foot surcharge is available.

Implementation of long-term mainstem-rearing target flows depends on installation of the proposed 3-foot reservoir surcharge, which will replace the existing 0.75-foot surcharge. A surcharge is created when the height of the spillway gates at the dam is raised and the water volume stored in the reservoir at full pool is increased. The mainstem-rearing target flow releases replace the Fish Reserve Account created for the SYRTAC under the MOU.

To provide additional rearing habitat, long-term target flows were established for two reaches on the mainstem (Table 1):

1. Continuous flow will be provided during all but the driest (2 percent) years in the reach from Bradbury Dam to the State Highway 154 Bridge (2.9 miles downstream of Bradbury Dam).

2. In very wet years (spills greater than 20,000 AF) and the year following such a wet year, flow will be maintained in the reach between State Highway Bridge 154 and Alisal Road Bridge (10.5 miles downstream of Bradbury Dam).

If storage recedes to less than 30,000 AF, 30 AF per month will be reserved to provide refreshing flows to the Stilling Basin and Long Pool immediately downstream of Bradbury Dam.

Implementation of mainstem-rearing target flows has increased the amount of rearing habitat available to steelhead and other aquatic resources in the Lower Santa Ynez River and improved water quality conditions in this reach as described below.

4.3.3 Benefits of Mainstem-Rearing Target Flows to Rearing Habitat

The mainstem target flows provide year-round habitat in the portion of the Santa Ynez River from Bradbury Dam downstream to State Highway 154 in almost all years. Suitable rearing habitat extends downstream to the Refugio Reach and in some years extends into the Alisal Reach. Summer rearing is a critical period for fish in the Santa Ynez River as suitable habitat is limited by high water temperatures, low DO, and reduced wetted area. Under the Plan, the releases create suitable habitat in previously dry channels, including suitable water temperatures and DO.

To analyze likely benefits of the mainstem-rearing target flows, the SYRTAC used the habitat studies and flow exceedence curves developed from flows generated from the Santa Ynez River Hydrology Model (SYRHM) and daily flow gage data over a 52-year period of record (1941 to 1993) for three reaches. These included: (1) below the confluence of Hilton Creek (representing the State Highway 154 Reach), (2) at State Highway 154 (representing the Refugio Reach), and (3) at Alisal Bridge (representing the Alisal Reach).

Three conditions were analyzed: first, operation of the project as directed in WR 89-18, which was considered baseline or existing conditions. The second was pre-Bradbury Dam flow conditions (i.e., pass-through operations), which are considered historic conditions. The third condition was the proposed operations included in the Plan, both interim and long-term (3.0-foot surcharge) targets.

Model results show the following. The Cachuma Project operation in accordance with the Plan results in substantial new and improved rearing habitat for steelhead compared to habitat available under project operation in accordance with WR 89-18 during all seasons in dry and normal years, and in July through December in wet years (SYRTAC 2000b, Exhibit No. MU 35, Tables 4-3 to 4-5, pp. B-4-9 to B-4-13). The historic condition provides more rearing habitat than the proposed operations from January through June in normal and wet years, but provides substantially less rearing habitat in the latter half of these years, particularly in the lower portion of the Alisal Reach.

Under proposed (long-term) operations at Alisal, minimum daily flows would generally be substantially better than flows under historic conditions or WR 89-18 operations (SYRTAC 2000b, Exhibit No. MU 35, Table 4-6, p. B-4-15). Thus, the Plan will reduce the most severe bottleneck in rearing habitat: the minimum daily flow during a year, which typically occurs in the latter half of the year.

Under historic conditions (i.e., pass-through conditions), the reaches downstream of Bradbury Dam have little or no flow during summer/fall in all year types. Under WR 89-18 operations, only a small amount of flow (<1 cfs) exists below the Hilton Creek confluence in about a third of all the years, and flow would cease for at least one day in most years at both the State Highway 154 and Alisal reaches. Under the proposed operation (long-term), the minimum daily flow is:

- At least 2.5 cfs in all but three years at State Highway 154.
- 1.5 cfs in 38 percent of all years at Alisal Bridge.
- Approaching 0 cfs below Hilton Creek in only three years (1951, 1952, and 1991), which occurred at the end of prolonged droughts. During these years, refuge habitat would be maintained in the pool habitats downstream of Bradbury Dam. DO, temperature, and water levels in the pools in the upper reaches would be maintained by refreshing flows from the dam.

The proposed operation will provide substantially more mainstem spawning habitat in all three reaches between Bradbury Dam and Alisal Road in normal and dry years than WR 89-18 operations. Furthermore, perennial flows in the river under the proposed operations have resulted in the increased growth of willows and other riparian plant species, which could benefit public-trust resources that use riparian habitat.

In summary, the target flows provided by the Plan will increase the amount of aquatic habitat from the dam to Alisal Bridge, in general, and will increase the availability of

summer-rearing habitat in the State Highway 154 Reach in all but the driest years. In doing so, the Plan addresses the habitat bottleneck that limits the existing population. The additional rearing habitat provided by the proposed operations, in combination with the persistence of this habitat throughout the year, even under dry conditions, provides a substantial benefit to steelhead over both WR 89-18 operations and historic conditions.

4.3.4 Benefits of Mainstem-Rearing Target Flows to Water Quality

Implementation of mainstem-rearing target flows will improve water quality, both in temperature and in DO in the Highway 154 management reach. During the summer, water temperatures exceed the thermal guidelines for average daily temperature and daily maximum temperature for steelhead in several locations below Bradbury Dam. Therefore, the Plan focuses on providing, protecting, and enhancing summer-rearing habitat.

Monitoring studies, ongoing since 1993, collected data on temperature/flow relationships and on vertical stratification of temperature and DO in pool refuge habitat. These data were used to propose target rearing flows in the mainstem and continue to aid in the adaptive management of those flows.

Temperature criteria for rainbow trout/steelhead were recommended in the Fisheries Technical Report (ENTRIX 1995, Exhibit No. SWRCB 5) based on scientific literature (Hokanson et al. 1977) and CDFG standards in central and Southern California. Average daily temperatures should be less than 20ºC and daily maximum temperatures should be less than 24ºC. It should be noted that temperature tolerances of steelhead stocks in the southern portion of their range have not been well-studied. Based on available literature, rainbow trout/steelhead populations cannot obtain a net yield (positive growth minus mortality) at daily average temperatures greater than 22ºC (SYRTAC 2000b, Appendix G, Exhibit No. MU 35). The incipient lethal temperature for steelhead, including those from warmer environments, has been identified as 26.2ºC. Southern California steelhead and local rainbow trout may not have a greater upper incipient lethal temperature than steelhead stocks to the north, but may be better adapted to withstand temperatures slightly cooler than the lethal limits (SYRTAC 1997, Exhibit No. MU 34; 2000a, Exhibit No. MU 35).

DO concentration is another factor that affects rainbow trout/steelhead. Rearing salmonids function normally at DO concentrations of approximately 7.75 milligrams per liter (mg/l) or above, display symptoms of distress at 5 to 6 mg/l, and are often negatively affected at 4.25 mg/l (Davis 1975).

The proposed mainstem-rearing target flows will substantially improve summer water temperature and DO concentrations in the priority mainstem reaches.

Depending on hydrologic conditions in a given year, the summertime benefits of target releases are likely to decrease in a downstream direction because water temperature increases rapidly in a downstream direction. Temperature results indicate that an

increase in summertime flow to the lower reaches of the Santa Ynez River mainstem (downstream of Solvang) is not likely to substantially improve fish-rearing habitat. This is because summer water temperatures will remain too high to support steelhead rearing.

Changes in water temperature and DO concentrations resulting from naturally occurring flows and managed releases from Bradbury Dam have been documented in the SYRTAC studies since 1993. In addition, microhabitat conditions within the Santa Ynez River have been documented, which may be created by factors such as vertical stratification of water temperatures and cool groundwater flow to deeper pools.

Temperature monitoring studies conducted during the 1996 WR 89-18 releases indicate that water temperatures exceeded 20ºC in the mainstem within 3.4 to 9.7 miles of Bradbury Dam, depending on the release (SYRTAC 1997, Exhibit No. MU 34, Table 2). Temperature monitoring in years since 1996 supports these results.

Table 2. Distance Downstream of Bradbury Dam where Water Temperatures in the Mainstem Santa Ynez River Exceeded 20ºC during 1996 WR 89-18 Releases

Release at Bradbury Dam (cfs)	Flows @ 24 miles Downstream (cfs)	Distance where Temperatures >20ºC	Date
135	75	3.4 miles 9.5 miles	July 25 July 28
70	35	3.4 miles 7.8 miles	Aug. 4 Aug. 9
50	Not Measured	3.4 miles	Aug. 28

The data collected to date show that it is not possible to maintain water temperatures suitable for support of rainbow trout/steelhead during the summer months downstream of the priority mainstem reaches, even at high and unsustainable release levels. Habitat downstream of Alisal Bridge (10.5 miles downstream of Bradbury Dam) cannot consistently support rainbow trout/steelhead throughout the entire year.

When cool groundwater flow results in vertical temperature stratification, cool-water refuge habitat can be created in deep pools. Vertical temperature stratification has been documented in several pool habitats along the mainstem, including the Refugio and Alisal reaches. Early information (SYRTAC 1997, Exhibit No. MU 34) indicates that WR 89-19 releases may disrupt thermal stratification in pools. Additional monitoring studies conducted by the Project Biologist, indicate that thermal stratification can be transient, even in the absence of WR 89-18 releases. These pools can provide refuge habitat in some years as evidenced by fish utilization in water years.

Monitoring studies show that vertical stratification of DO occurs in deeper pools. Bottom field measurements show that the bottom water layer can become severely depleted of DO in many of these pools, especially in the early morning before daily photosynthesis renews DO levels. The data indicate that although groundwater flow may create cool-

water refuge habitat in deeper pools, DO is often low enough to stress or kill rainbow trout/steelhead. Low DO levels in the groundwater may be one factor, another is the contribution from algal accumulation. During late spring through early fall, the Santa Ynez River exhibits algae production in most of its surface waters. Although algae photosynthesis can saturate water with DO in the day, at night the algae metabolism and bacterial decomposition results in substantial oxygen depletion. Monitoring data indicate that WR 89-18 releases can increase DO. The DO increases are likely the result of flushing of algae mats that contribute to low DO.

The following conclusions can be made based on the data collected so far:

- Water temperature increases rapidly in a downstream direction from Bradbury Dam. Therefore, it appears to be impossible to maintain water temperatures adequate to support rainbow trout/steelhead during the summer months downstream of the priority mainstem reaches, even at high and unsustainable release levels.

- Vertical stratification can occur during the summer months in deeper pools such as the Alisal Pool Habitat (7.8 miles downstream of Bradbury Dam) as a result of cool groundwater upwelling.

- Water releases from Bradbury Dam improve DO levels by removing large algal mats.

Water quality monitoring is being conducted as part of the long-term monitoring program in the Plan. These data will indicate whether modifications to these rearing releases are needed to meet habitat requirements of rearing steelhead in the managed reaches consistent with the goals and objectives of the Plan (SYRTAC 2000a, Exhibit No. MU 35).

In summary, the benefits of providing the target flows in mainstem reaches are threefold. Benefits include an increased amount of aquatic habitat, reduced water temperatures in reaches close to the dam from cold-water releases and improved riparian conditions, and improved DO conditions from flowing water.

4.3.5 Benefits to Hilton Creek

Hilton Creek is a small intermittent stream just downstream of Bradbury Dam. The SYRTAC studies have documented spawning and successful production of fry during wet years. Because the lower portion of Hilton Creek historically went dry by early summer, fry were lost or stranded. Fish rescues were conducted by CDFG occasionally in Hilton Creek. The SYRTAC determined that a substantial biological benefit could be realized by releasing water into this creek to maintain habitat throughout the dry season.

The objective of the proposed measures for Hilton Creek is to provide additional, new summer-rearing habitat in this high-priority tributary.

Some or all of the releases made to meet the mainstem target flows for the Highway 154 management reach will be made via Hilton Creek. The following measures are proposed in the Plan for Hilton Creek:

- Flow augmentation from reservoir releases from Lake Cachuma to Hilton Creek via a supplemental watering system (already implemented).
- Construction of upstream passage facilities at two passage impediments.
- Construction of a 1,500-foot extension channel at the lower end of Hilton Creek.
- Ramping criteria to protect public-trust resources (already implemented).

Once the pump system is installed, a 2-cfs minimum flow will be maintained in Hilton Creek, creating the ability to water the lower reach 98 percent of the time (NMFS 2000, Exhibit No. SWRCB 9). The facility has three delivery points, two in Hilton Creek that can be used to maximize habitat availability and minimize increases in water temperature, and one to the Stilling Basin to provide improved water quality when necessary.

Modification of the lower reach of Hilton Creek is being investigated to determine whether additional rearing habitat can be developed. The conceptual plan calls for the lower reach of the Hilton Creek channel to be modified to provide additional fish habitat within an approximately 1,500-foot-long extension. The extension would use a portion of a relic overflow channel with a well-developed riparian canopy that includes mature sycamore trees. The existing channel would be used as an overflow channel to convey flows greater than 15 cfs. This extension would seek to improve rearing habitat in the lower reach of the creek. Additional investigation is ongoing.

The two passage impediments in Hilton Creek include a rocky cascade and a bedrock chute (located about 1,380 feet upstream of the confluence with the Santa Ynez River) and the State Highway 154 culvert. The proposed modification to the cascade/chute impediment will provide steelhead passage at streamflows above 5 cfs and improve passage at flows above 10 cfs (SYRTAC 2000b, Exhibit No. MU 35). Passage past the State Highway 154 culvert will provide access to upper Hilton Creek where rainbow trout/steelhead may spawn and rear when hydrologic conditions are favorable. Construction designs for both projects are completed and the projects will be implemented once all permits are completed.

Water deliveries to Hilton Creek may be halted under certain circumstances. At the low reservoir elevations that may occur in two percent of the years, the Hilton Creek Supplemental Watering System will not function. Additionally, if the supplemental watering facility fails, fish may be at risk of stranding. If necessary, a fish rescue would be performed to move fish to more suitable habitat. Potential relocation areas would be investigated to determine whether the site(s) has favorable conditions (e.g., temperature, flow, DO, rearing space for additional fish). Predator (non-native bass, catfish, and

bullhead) removal, as needed, in the receiving site would minimize losses of relocated fish.

Implementation of these measures in Hilton Creek will substantially enhance habitat for public-trust resources in a high-priority creek.

4.4 Adaptive Management Account

The Adaptive Management Account will allocate 500 AF of water in Lake Cachuma in years when the reservoir surcharges to the 3-foot level. It will allow the Adaptive Management Committee to take advantage of opportunities where releases would increase the biological benefit to the downstream aquatic public-trust resources. These opportunities are likely to arise as new information is gathered about implementation and monitoring measures proposed in the Plan.

The account water can be used to increase releases for mainstem rearing, to provide additional flows to Hilton Creek, or to provide additional water for fish passage flow supplementation. Releases to Hilton Creek and to the mainstem have the highest potential to provide additional rearing habitat during the summer months. Releases for passage flow supplementation can be timed so that downstream fish passage opportunities are provided when they would provide the most benefit.

NOAA Fisheries has required a 30-working-day review period for approval of any Adaptive Management Committee decisions that are expected to affect steelhead (NMFS 2000, Exhibit No. SWRCB 9).

4.5 Fish Passage Account

Young steelhead rear in fresh water for one to two years, then migrate to the sea to complete maturation. To complete an anadromous life-history cycle, juvenile steelhead need suitable flows to migrate downstream and adults need suitable flows to migrate upstream. Passage between ocean and freshwater habitats is an essential feature of the anadromous life-history.

The Plan would implement the Fish Passage Account and associated fish passage supplementation protocols. Reclamation will dedicate 3,200 AF of water in Lake Cachuma in years when the reservoir surcharges to 3 feet. The objective of the Fish Passage Account is to create additional migration opportunities in the mainstem for steelhead to reach the important spawning tributaries and the mainstem river near Bradbury Dam. The Fish Passage Account supplements passage flows to provide additional migration opportunities for both up- and down-migrant steelhead. Fish passage releases include provisions that allow safe passage over shallow areas of the channel, time for steelhead to reach important tributaries, and higher flows that attempt to provide migratory cues instigating movement.

Once the sandbar at the mouth of the river is open, this water will be released from January through May to extend the receding limb of naturally occurring storm hydrographs. The storm recession at a location downstream of Bradbury Dam (Alisal Bridge in Solvang) will mimic the shape of the recession upstream of Lake Cachuma as calculated from historical data. Fish Passage Account water can be released in the year following the surcharge year and in subsequent years until the balance of the passage account is exhausted or the reservoir has spilled and surcharged again.

The passage flow supplementation criteria were designed to provide additional passage opportunities to good-quality habitat in the mainstem and south-side tributaries near Bradbury Dam when that habitat is ready to receive fish. Flow would be augmented in the mainstem to be continuous to the ocean when the sandbar at the mouth of the river is open to allow access by adult steelhead. At such times the tributaries should also be flowing and connected to the mainstem river.

The passage supplementation program is experimental and may require adjustment to the timing and operational criteria that govern the releases. A monitoring program will be needed to verify that the operational criteria provide releases when appropriate based on watershed and habitat conditions. Such a program will investigate release effectiveness in providing passage opportunities and how or if fish take advantage of the opportunities. The passage program seeks to supplement passage opportunities during normal years. In dry years, the watershed conditions are not usually suitable for successful spawning and incubation. In wet years, passage opportunities are provided without supplementation.

The number of passage days provided under historical conditions, WR 89-18, and under proposed operations, was calculated based on daily flows by the SYRHM for the months of January through April of each year of a 51-year period of record (SYRTAC 2000b, Exhibit No. MU 35, Table 4-1, p. B-4-5). The proposed operations of the long-term (3,200 AF) Fish Passage Accounts were analyzed and the results for the 14 years in which supplementation would have occurred are presented in Table 3.

Table 3. Passage Opportunities in the Santa Ynez River, Based on Modeled Fish Passage Account Releases in Years in which Passage Supplementation Releases would be Made (1942-1993)

	Average Number of Passage Days[1]	Total Number of Passage Days	Number of Years with 14 Days	Percent of Years with 14 Days
Historical	32	451	8	57%
SWRCB Decision WR 89-18	8	111	1	7%
Long-Term (3,200 AF)	21	295	14	100%

[1] A passage day is defined as flow at Solvang (Alisal Reach) of greater than or equal to 25 cfs.

NOAA Fisheries has estimated that passage from the mouth of the Santa Ynez River to Hilton Creek may take as long as 14 days (NMFS 2000, Exhibit No. SWRCB 9). The combination of instream flows and Fish Passage Account releases under proposed operations has therefore been developed to provide adequate passage opportunities for successive periods of 14 days or greater per year for most years. Surcharge years are typically wet years when additional migration support is not needed. Therefore, as outlined in the Plan, supplementation occurs in years following surcharge years and thus provides additional passage opportunities in predominantly non-wet years, when it is needed most.

For normal and dry years, the modeled Fish Passage Account releases show that proposed operations provide substantially more passage days than WR 89-18 operations. In wet years, the proposed and WR 89-18 operations provide similar passage opportunities. Proposed Fish Passage Account releases provide 166 percent more passage opportunities than under WR 89-18 operations in the slightly less than one-third of all years in which supplementation would have occurred. An additional one-third of the years are historically wet years. Therefore, steelhead would have at least 14 days of passage in roughly two-thirds of years. While historical conditions provide, on average, roughly 40 percent more passage days than proposed operations, there were substantially fewer numbers of years with at least 14 days of passage opportunities under the Plan.

4.6 Tributary Habitat

The SYRTAC has collected data on habitat conditions, fish presence, and habitat use in the Lower Santa Ynez River and its tributaries for the past ten years (SYRTAC 1997, Exhibit No. MU 34; 1998b, Exhibit No. MU 27; 2000c, Exhibit No. MU 31; SYRTAC unpublished data). The results of these studies show that opportunities to enhance habitat in the mainstem are limited to a few miles below Bradbury Dam. However, substantial additional habitat is available in the tributaries to the Lower Santa Ynez River. These studies have also demonstrated that tributaries on the south side of the watershed have good potential as fish habitat because these streams generally have perennial flow through the summer, at least in their upper reaches. They run through the cool, well-vegetated, north-facing slopes in the Santa Ynez Mountains. In contrast, tributaries on the north side do not retain summer flows and are too dry to support rainbow trout/steelhead.

Many of the south-side tributaries support summer flow in stream reaches that have the potential to provide habitat for rainbow trout/steelhead. Given that summer-rearing habitat is a key limiting factor in the Lower Santa Ynez watershed, the SYRTAC evaluated the south-side tributaries to determine what management actions could result in improved conditions for steelhead. Some of the tributaries have impediments that prevent or inhibit habitat use. In other tributaries, the stream or riparian habitat has been affected by past land use or events. These tributaries represent a good opportunity to increase the area available to support rainbow trout/steelhead after access has been restored or habitat conditions improved.

The SYRTAC identified and prioritized tributaries in the Lower Santa Ynez basin according to their ability to support fish populations, available enhancement opportunities, access to public or private lands, and the level of effort necessary to achieve successful results (SYRTAC 2000a, Exhibit No. MU 35). The tributaries with substantial potential to support rainbow trout/steelhead were identified as priority tributaries. Others that provided less opportunity were evaluated and future potential actions were identified. The streams evaluated by the SYRTAC are listed below in order of priority, with Hilton Creek (#1) being the highest priority. Where tributaries have been subdivided, the reach listed first (i.e., "a") is the higher priority.

1) Hilton Creek
    a) Lower Reach (on Reclamation property)
    b) Upper Reach
2) Quiota Creek
3) Salsipuedes and El Jaro Creeks
    a) El Jaro Creek
    b) Lower Salsipuedes Creek (below junction with El Jaro Creek)
    c) Upper Salsipuedes Creek
4) Alisal Creek
    a) Lower Reach (below Alisal Dam)
    b) Upper Reach
5) Nojoqui Creek
6) San Miguelito Creek

Within each tributary, the SYRTAC created a list of potential enhancement actions that could improve conditions for steelhead. Where appropriate, further analysis and prioritization of potential projects within a particular tributary occurred. For example, a specific SYRTAC work group was established to evaluate potential restoration actions within Hilton Creek and to recommend which actions should proceed and in what order. Where possible, recommended actions first focused on the priority streams and on projects with the greatest biological benefit. In practice, however, implementation decisions and schedules are also based on access, and jurisdictional and funding constraints. Therefore, projects may occur in an order somewhat different from the recommended priorities. The overall goal is to complete all of the recommended projects.

Restoration projects, as described in the following sections, are currently recommended on the four higher priority creeks (Hilton, Quiota, Salsipuedes, and El Jaro creeks). These were tributaries identified as important by the SYRTAC and feasible, beneficial restoration actions could be identified. San Miguelito Creek ranked the lowest priority for restoration because it was deemed infeasible to remove an approximately 3-mile-long concrete box culvert and other passage barriers at the lower end of this tributary. These barriers prohibit use of the higher quality habitat found in the stream's upper reaches. A

similar problem was identified on Alisal Creek where a small reservoir blocks passage to the upper reaches. On Nojoqui Creek, substantial migration barriers and the lack of an existing rainbow trout population suggest restoration opportunities are limited here, at least until the population in the Lower Santa Ynez River begins to rebound.

The Plan relies on the execution of the full complement of recommended projects to provide improved conditions for steelhead in over 25 miles of stream habitat.

The actions recommended to enhance tributary habitat are divided into three categories:

- projects designed to improve habitat quality;
- projects designed to provide or improve access to existing habitat (i.e., barrier removal); and
- projects designed to protect existing habitat.

The actions recommended for the various tributaries may encompass one or more of these categories. An explanation of the project categories and specific projects recommended in the Plan within each category are provided below.

4.6.1 Improve Existing Tributary Habitat

Existing tributary habitat values vary within and among south-side tributaries in the lower Santa Ynez basin. Habitat quality for steelhead is dependent on a number of factors including water quality (e.g., temperature, DO), habitat complexity (i.e., presence of instream structures that provide cover), food production, canopy cover, habitat composition (e.g., distribution of habitat types), and quantity and quality of spawning habitat. A component of the SYRTAC studies includes assessment of tributary habitat to determine overall habitat quality and, within specific tributaries and reaches, what factors are limiting habitat quality. Projects designed to improve existing tributary habitat will target factors that are degrading habitat quality in a particular reach.

Overall, the Plan identifies the need to improve tributary habitat in the priority south-side tributaries. The Plan recommends a number of actions to improve habitat. Most lands targeted for habitat quality improvements are privately owned and the agencies in charge of Plan implementation must have voluntary participation of the landowner. The Plan describes the *types* of actions that could occur but does not specify projects to be implemented. The Adaptive Management Committee, along with others charged with implementing the Plan, is tasked with working with willing landowners in priority tributaries to identify, design, and implement tributary enhancement projects that will target factors that limit or degrade habitat quality in the particular stream.

Habitat quality can be improved by increasing instream cover and complexity and by enhancing riparian vegetation. Structures could be installed to create deeper pools, which result in better rearing habitat. Installing root wads, logs, or large boulders into habitat

can increase cover and habitat complexity. Restoration of riparian vegetation can enhance bank stability, thereby reducing erosion, restoring habitat complexity, and improving water quality (i.e., temperature).

Habitat enhancement measures can also include providing assistance to landowners to establish sound land conservation management practices on lands adjacent to steelhead tributaries. The SYRTAC has worked with the Natural Resource Conservation Service (NRCS) and the USFWS to assist private landowners with obtaining information and financial assistance.

To date, the SYRTAC has been granted permission to execute three bank stabilization projects on El Jaro Creek. Sediment erosion into El Jaro Creek is an important factor reducing the quality of spawning and rearing habitat within this tributary. To further increase the potential benefits of this project for steelhead, the construction project will be combined with two educational workshops designed for landowners within the Lower Santa Ynez River. The purpose of the workshops is to provide local landowners with the resources and tools to undertake similar projects on their own properties. Future enhancement actions will occur as opportunities become available.

4.6.2 Improve Access to Tributary Habitat

The SYRTAC studies identified a number of structures that impede or block steelhead passage in the priority tributaries. A project designed to modify or remove barriers typically provides a substantial biological benefit (e.g., access to upstream habitat) for the cost of the project. A SYRTAC biologist reviewed the impediments/barriers identified during the studies (see SYRTAC 2000b, Exhibit No. MU 35, Table 3-5, p. 3-37) to qualitatively assess the feasibility of fixing these problems. The feasibility assessment included technical feasibility, cost, biological benefit, access, and jurisdictional issues. Based on these feasibility criteria, the tributaries of primary interest include Hilton, Quiota, Salsipuedes, and El Jaro creeks (SYRTAC 2000b, Exhibit No. MU 35) because they have perennial flow in their upper reaches, they can support spawning and rearing, and the impediment-removal actions were deemed feasible. Specific projects on these tributaries are described below.

Two passage projects are planned on Hilton Creek. Approximately 1,380 feet upstream of the confluence with the Santa Ynez River is a bedrock cascade and chute that combine to limit the ability of steelhead to migrate upstream. A project to modify this natural impediment has been designed and permitted, and awaits California Environmental Quality Act (CEQA) compliance prior to implementation. An additional 2,800 feet upstream, State Highway 154 crosses Hilton Creek at a long concrete culvert. The culvert forms a velocity barrier at high flows and is too shallow for passage at low flows. The Plan recommends modification of this culvert to provide for passage under moderate flow conditions. Modification of the State Highway 154 culvert will restore access to the upper reaches of Hilton Creek.

On Quiota Creek, Refugio Road crosses the creek at nine low-flow crossings. Eight of the nine crossings can be substantial barriers at low flows and some limit passage at higher flows (e.g., "crossing no. 2" moving upstream). Therefore, the Plan recommends that these crossings be modified to improve passage conditions at lower flows, allowing access to the high-quality habitat within the reach with the road crossings, and above them. These crossings will be modified in partnership with the County of Santa Barbara, which owns and maintains the roads. A combination of bridges and rock-riffle fishways are planned to provide passage.

The Salsipuedes/El Jaro creek drainage is the largest of the priority tributaries. Habitat in this drainage is accessible to rainbow trout/steelhead; however, several low-flow impediments limit rainbow trout/steelhead movement upstream to higher quality, perennial habitat. One impediment, the concrete bridge apron below the U.S. Highway 101 crossing over Salsipuedes Creek, has already been modified as a result of the Plan. COMB constructed modifications to the concrete apron in late 2001 to improve low-flow passage conditions. The Plan also identifies a low-flow crossing on El Jaro Creek about one-third mile upstream from Salsipuedes Creek. A detailed feasibility study is currently underway to determine whether access to this site is possible and what technical solution is recommended for this crossing.

The Plan also envisions that additional impediment-removal projects may be identified through landowner outreach efforts and further study. Recently, a low-flow passage impediment on Salsipuedes Creek was identified just downstream of the Jalama Road bridge. Given the importance of the Salsipuedes/El Jaro drainage to the Plan, designs to modify this impediment have been completed and the project is scheduled for implementation this fall.

Overall, the passage improvements recommended in the Plan on Hilton, Quiota, and Salsipuedes/El Jaro creeks will improve access to over 18 miles of stream habitat currently impeded by partial passage barriers and provide access to over 7 miles of habitat currently not accessible. Restoring passage will expand the habitat for spawning and rearing steelhead in the lower river. Thus, this component of the tributary enhancement effort is key to the overall success of the Plan and the Plan's ability to address significant limiting factors within the lower watershed.

4.6.3 Habitat Protection

In addition to improving habitat quality and providing or improving access to habitat, a third component of the tributary actions recommended in the Plan is to protect habitat. The purpose of habitat protection is to ensure that the habitat remains available to steelhead in the long-term. Habitat protection can be used to protect existing, high-quality areas to prevent potential degradation of that habitat, or to protect lower quality areas, which can, over time, be improved through various enhancement projects.

Habitat protection activities include purchasing permanent conservation easements or obtaining long-term leases of creek and riparian corridors. Such agreements are useful to

protecting the habitat in the long-term and can also provide needed access rights for conducting habitat enhancement projects. In addition, the Plan envisions working with NOAA Fisheries and USFWS to generate interest among local landowners in entering into "Safe Harbor" agreements. Such agreements may encourage landowners to take actions that protect and improve habitat conditions for endangered and threatened species. Literature and public workshops will be offered to foster such partnerships as part of the public education and outreach program.

As with other actions in the tributaries, voluntary participation by landowners is necessary to implement these actions. Therefore, the Plan recommends outreach activities to landowners to generate interest in such programs and designates the Adaptive Management Committee with overseeing implementation of specific protection actions as opportunities become available. Currently, the MUs are in discussion with several landowners on El Jaro Creek to provide long-term protection to approximately 10 miles of steelhead habitat and the associated riparian corridor. Over time, as additional interest and partnerships are generated, more steelhead habitat can be protected and improved through habitat protection projects. Implementation of such projects is an integral component to ensuring the long-term recovery of steelhead in the Santa Ynez River.

4.7 Mainstem Habitat Enhancement and Protection

Riparian enhancement may provide additional benefits to aquatic and riparian public-trust resources. Deep pool habitat in the mainstem can provide important refuge for rainbow trout/steelhead and other native fish during low-flow summer conditions. Through groundwater upwelling and temperature stratification, pools can maintain cooler water temperatures than shallower water can. Instream structures, such as boulders and large woody debris, may improve rearing conditions for rainbow trout/steelhead and reduce their vulnerability to predation by warmwater fish species (e.g., largemouth bass) which also occupy pool habitat in the mainstem.

The goal of the habitat improvements is to increase the habitat complexity of the pools. Pools with rainbow trout/steelhead include the Stilling Basin, the Long Pool, and several pools between State Highway 154 and Alisal Road in Solvang (Refugio and Alisal reaches). Physical habitat improvements are being considered for the mainstem on Reclamation property. The remainder of the pools are on private property and partnering with interested landowners would be necessary to accomplish this action.

4.8 Public Education and Outreach

Public education and outreach is an important aspect of the Plan. The goal of the public education and outreach program is to raise public awareness of the issues involved with rainbow trout/steelhead and the programs and resources available to the general public and private landowners. The outreach program seeks to raise public awareness of what individuals can contribute to watershed health and making watershed health a part of the decisions of everyday life. Full implementation of the Plan depends in part on the voluntary, cooperative participation of private citizens.

The SYRTAC is developing a public education and outreach program to explain the activities related to protection of rainbow trout/steelhead and to solicit volunteer action from private property owners to improve rainbow trout/steelhead habitat. The SYRTAC will facilitate habitat enhancement actions on private property by providing information on the types of habitat enhancement actions that are desirable. The SYRTAC will also provide technical assistance in designing and implementing the actions. In addition, the SYTRAC will help project sponsors acquire public funds or grants from sources such as the NRCS habitat programs, CDFG grant programs, and others.

Actions to be taken under the Plan include making information available to the public on the importance of the rainbow trout/steelhead enhancement programs and the participation of private landowners. Program elements will include public workshops, newsletters, web pages, field trips, slide shows, press releases, and other tools as needed.

4.9 Continuing Investigations of Upper Basin Actions

The original SYRTAC study area was the Santa Ynez River basin downstream of Bradbury Dam. As the SYRTAC began looking into opportunities to restore access to spawning and rearing habitat, the SYRTAC wanted to consider actions that could be implemented in the area upstream of Bradbury Dam. Before construction of Bradbury Dam, the upper basin provided most of the suitable spawning and rearing habitat in the Santa Ynez River basin. The SYRTAC requested permission from the Consensus Committee, Montecito Water District, and the City of Santa Barbara to conduct some investigations into actions upstream of Bradbury Dam. The request was granted.

The SYRTAC created the Upper Basin Work Group to evaluate the opportunities to use upper basin habitat to benefit steelhead populations in the basin. The results of the work group's analysis were presented in Appendix E of the Plan (SYRTAC 2000b, Exhibit No. MU 35). The Upper Basin Work Group evaluated actions for the upper basin that could benefit the anadromous steelhead population. These included protection of genetic integrity through changes in stocking practices and increasing steelhead production through the use of upper basin habitat.

Currently, none of the upper basin actions is proposed for near-term implementation. The Plan calls for continuing consideration of upper basin opportunities while the BO identifies this investigation as a conservation measure. Implementation of these actions requires extensive coordination among various state and federal agencies. Additional data would need to be collected to develop specific plans for implementation and execution. Facilities and infrastructure would need to be constructed to support their execution. In addition, changes would need to be made to federal, state, and local regulations and policies currently governing activities on lands above Bradbury Dam. Evaluation of these actions continues. New information and new directives from NOAA Fisheries and CDFG will be incorporated through the adaptive management process.

Currently, studies are planned to provide additional data on population levels and genetic character of the upper basin stocks. The MUs are currently undertaking a three-part study of information on the upper basin that pertains to the merits of providing access to steelhead around Bradbury Dam. The three components of the study are (1) genetic makeup of the upper basin populations, (2) historical stocking practices (including stocking locations, frequency, and stocking strains), and (3) availability, quality, and relative abundance of rainbow trout in upper basin habitats. All of these studies have commenced with a search for available information from sources such as CDFG, USFWS, and the U.S. Forest Service (USFS). Additional field studies are planned once data gaps are identified for both genetic samples and rainbow trout habitat. It is anticipated that these studies will be completed by next July. The results of these studies will be made available to the Adaptive Management Committee, resource agencies, and other interested parties.

Recently, the SYRTAC data and feasibility constraints were updated by Reclamation and the Cachuma MUs in the draft EIR/EIS prepared to consider implementation of the actions included in the Plan (Reclamation and COMB 2003, Exhibit No. MU 226(a)). The update incorporated relevant new information to evaluate the technical and institutional feasibility. The results of this updated analysis are summarized here.

4.9.1 Protection of Genetic Integrity of Southern California Steelhead

Two measures have been identified to offset the potential genetic effects of stocking northern rainbow trout in Lake Cachuma and in the Santa Ynez River below Gibraltar Dam, to support the existing recreational fishery.

- Replace the northern-origin rainbow trout currently used for stocking with an equal quantity of rainbow trout having a genetic profile more typical of Southern California steelhead.

- Replace the fish currently stocked with an equal quantity of sterile rainbow trout or another sterile trout hybrid.

Hatchery Program Using Southern California Broodstock

The Upper Basin Work Group explored the possibility of developing and maintaining a broodstock in one of the existing CDFG hatcheries. Fillmore, Mt. Whitney, Whale Rock, Hot Creek, Shasta-Pit, and Lassen hatcheries were considered. Each facility was found unsuitable because of water quality, disease, distance from the Santa Ynez River, and/or space limitations (SYRTAC 2000b, Exhibit No. MU 35; Reclamation and COMB 2003, Exhibit No. MU 226(a)).

The SYRTAC examined the possibility of constructing a new hatchery facility within the ESU to best emulate local environmental conditions. Locating and acquiring land and water resources for a new hatchery would be a significant challenge and would involve

additional costs beyond the capital costs of the facilities. A new hatchery must have sufficient space (about 20 acres) and a suitable water source. Capital costs of a new facility would be between $5 million and $10 million (Reclamation and COMB 2003, Exhibit No. MU 226(a)).

Based on the technical, logistic, and financial challenges noted above, the SYRTAC determined that using fish with more compatible genetics to supply current stocking programs was not feasible at this time (SYRTAC 2000b, Exhibit No. MU 35; Reclamation and COMB 2003, Exhibit No. MU 226(a)).

Stocking Sterile Trout

The second approach to avoid the genetic introgression of native steelhead and rainbow trout with exotic strains would be to replace the rainbow trout currently planted in the lake and river below Gibraltar Dam with sterile rainbow trout. Currently, development of a triploid fish, which is sterile, is under investigation. Until this process is fully developed, the proposed stocking of sterile trout does not appear to be technically feasible at this time. With the active development of this technology by CDFG and other western fishery agencies, this technology may become feasible in the future and should continue to be considered for implementation.

4.9.2 Increase Steelhead Production Through Use of Upper Basin Habitat

Actions to use upper basin habitats to increase the Southern California steelhead population in the Santa Ynez River were also considered by the SYRTAC. These actions were considered because most historic steelhead-producing habitat in the watershed is located upstream of Bradbury Dam. Many of the upper basin tributary habitats are suitable for steelhead rearing and spawning and lie within the Los Padres National Forest.

One of the considerations regarding the use of the upper basin is the genetic character of the rainbow trout occupying it. Substantial stocking of hatchery-origin rainbow trout in and above Bradbury Dam has occurred. Thus, investigations about the genetic heritage of these fish would need to occur before mixing upper and lower basin stock. Some data have been collected, and several studies to investigate genetic character of the upper basin stocks are underway. Until these genetic-origin questions are answered, impacts to the upper basin population and likelihood of recruitment to the lower basin population, and thus potential biological benefits or detriments, are unknown. These factors would have to be investigated before a trap-and-truck operation is initiated.

The goal of the fish passage actions is to provide adult steelhead access to upper basin spawning habitats and provide a means for the progeny of these adults to reach the ocean. The SYRTAC considered four alternative actions to provide fish passage around Bradbury Dam: (1) a fish ladder from the Bradbury Dam Stilling Basin to Lake Cachuma, (2) a fish ladder from Hilton Creek to Lake Cachuma, (3) a bio-engineered fish

passage channel that would pass fish into or around Lake Cachuma, and (4) trap-and-truck operations. Because the first three alternatives all involve passage over Bradbury Dam, they share similar feasibility issues.

Fish Ladder or Passage Channel for Bradbury Dam

There are both biological and technical concerns relating to providing fish passage around Bradbury Dam. These challenges are outlined in the environmental report prepared for implementation of the Plan and BO (Reclamation and COMB 2003, Exhibit No. MU 226(a)) and include: the undesirably warm temperature during portions of the time period for use of the fishway, uncertain genetic heritage of rainbow trout in Lake Cachuma and its tributaries associated with 50 years of stocking non-native trout, large populations of predator species within Lake Cachuma, and the lack of a well-defined outmigration pathway from the upper basin.

Inclusion of a fish ladder was considered when Bradbury Dam was originally designed, but it was not included due to the prohibitive height of the dam and the water requirements.

Biological challenges for providing access around the dam and through Lake Cachuma are considerable. One of the most important considerations is getting the downstream migrating adults (kelt) and smolts downstream. The smolts and kelts would need to travel from the Santa Ynez River roughly 6 miles through Lake Cachuma to Bradbury Dam. The reservoir has populations of piscivorous fish and birds that would prey on young steelhead. It is uncertain whether the downstream migrants could find their way quickly through the reservoir, to the entrance to the fishway. When the reservoir is not spilling, there is typically little current (other than wind-driven currents) in the reservoir. Thermal stratification and high surface temperatures (which occur in some years when steelhead would be expected to migrate downstream) may also present a challenge to downstream migrants navigating the reservoir.

The other option, construction of a bio-engineered fish channel to allow steelhead to pass around the dam and all or a portion of the lake depending on the alignment, was also found to be infeasible. The bio-engineered channel would perform more like a stream channel than a fish ladder and would have similar challenges with downstream migrants. One of the other areas of consideration would be the consequences for the recreational fishery in these areas. CDFG currently manages the lake as a fishery for bass, catfish, and stocked rainbow trout. Lake Cachuma is the largest lake in Santa Barbara County that is available to local fishermen (S. Radom, Santa Barbara County Fish and Game Commission, pers. comm.). The fishery downstream of Bradbury Dam was closed to protect listed steelhead. The presence of steelhead above Bradbury Dam may result in the prohibition of fishing in the lake and in the mainstem and tributaries between Bradbury and Gibraltar dams.

Additional engineering technical challenges are summarized in Reclamation and COMB (2003, Exhibit No. MU 226(a)).

Trap-and-Truck Transport of Steelhead

The SYRTAC continues to investigate the opportunity to provide steelhead access to the upper basin using a trap-and-truck operation. This option would trap-and-truck upstream adult migrants in the lower basin and transport and release them at location(s) in the upper basin, most likely upstream of Gibraltar Dam. The upstream trap-and-truck operation would need to be linked with a downstream trap-and-truck operation designed to capture outmigrating adults and smolts and transport them into the lower basin so they could access the ocean, thus completing their lifecycle. Downstream trap-and-truck, without a corresponding upstream program, was also considered as a potential management action to increase the lower basin population using production from upper basin fish. Although the trap-and-truck approach solves the facility problems associated with fish passage structures and other problems associated with Lake Cachuma (e.g., warm water temperature and predation), the implementation of this action has its own challenges.

The trapping of both upstream and downstream steelhead migrants is a difficult undertaking. Trapping upstream migrants presents several challenges. The SYRTAC has been trapping adults in the Lower Santa Ynez River for nine years using Fyke nets. The nets or other collection gear do not function well during high flows, in debris-laden streams, and in broad channels. The SYRTAC has been unable to successfully trap fish in the mainstem. The SYRTAC monitoring program traps adults in selected tributaries (Hilton and Salsipuedes creeks) and is forced to remove the traps from these tributaries at high flows to avoid damage to the traps.

To facilitate capture of steelhead in the Lower Santa Ynez River, a collection facility may need to be constructed. In other rivers, the collection device is often a low weir or dam that impedes passage and concentrates fish sufficiently to guide them into traps or to allow handlers to capture fish. Because flows vary considerably, these structures would need to function across the wide range of flows and be able to handle the high sediment load encountered in the Santa Ynez River (Reclamation and COMB 2003, Exhibit No. MU 226(a)).

Selecting a portion of the river to locate and collect fish is an important factor in the overall success of the program. Two approaches have been considered. These include a trapping station near Bradbury Dam on Reclamation property or one further downstream near one of the locations where the channel constricts (i.e., the Narrows). The site downstream of Bradbury Dam is on Reclamation property and a collection facility could be established. Low numbers of steelhead may be encountered this far up in the basin. Other locations may have access issues. Most of the Santa Ynez River is privately owned and permission to construct and maintain such a facility would need to be obtained from

owners. The SYRTAC has found it challenging to obtain permission from landowners to conduct low-impact surveys on lands adjacent to the river.

After the fish are captured, the next challenge is transporting them to release sites in the upper basin. Captured adults are often transported in aerated tanker trucks. The current roads are unpaved and are frequently impassable during the period when adults are entering the Santa Ynez River. Helicopter transport of fish may be necessary to avoid the road issues. Costs associated with helicopter transport may make the program difficult to sustain.

Captured fish could be released in streams upstream of Gibraltar or Juncal dams. Preliminary results of habitat surveys conducted by the USFS indicate that suitable habitat exists in tributaries in the upper watershed. Once appropriate accessible areas are identified, the best locations to release adults can be determined. Such areas need to have holding habitat and be proximal to suitable spawning and summer-rearing habitat.

To be successful, the upstream trap-and-truck program would need to be accompanied by a downstream trap-and-truck program designed to trap outmigrating adults and smolts and transport them into the lower basin below Bradbury Dam. Trapping young fish has challenges similar to trapping adults. Similar issues regarding placement of collection facilities as discussed for the lower river would apply here as well. High flows and debris loads reduce trap efficiencies, making it difficult to recover young fish. Young steelhead produced in the upper basin from lower river stock may not contribute to production in the lower river, because they may not be recovered and transported around the dams. The difficulties in operating traps and the low trapping efficiencies at higher flows in the Santa Ynez River make it difficult to capture young fish. Additionally, mortalities from the handling required to move fish upstream and downstream would further deplete potential production.

The downstream trapping operation may also capture a substantial number of young fish that are the progeny of nonanadromous rainbow trout. Some of these juveniles translocated downstream of Bradbury Dam may remain resident within the system. These individuals may compete with and/or displace young steelhead already present in the lower river. Consideration of potential release sites in the lower river would be based on several factors, including the need to avoid areas used by lower basin steelhead or areas occupied by predators. Release fish near the estuary may reduce interactions with other steelhead.

The combination of both upstream and downstream migrant trap-and-truck programs would allow some portion of the transported steelhead to complete their lifecycles. Given the limited availability of returning adults and the high probability that many of the progeny would not be recovered, the risk of loss may offset the potential gain of a successful trap-and-truck operation. However, it is unknown whether this would, in the short-term or the long-term, result in a greater biological benefit to the Southern

California steelhead population than implementing the lower-basin enhancement measures without a trap-and-truck program.

5.0 OTHER AQUATIC SPECIES THAT WILL BE AFFECTED BY ACTIONS IN THE PLAN

Steelhead are among the most sensitive of the species in the Santa Ynez River watershed. Actions that benefit steelhead will thus benefit other aquatic species. Species that use riparian habitat would realize positive benefits from implementation of the Plan.

5.1 Tidewater Goby

The tidewater goby is a federally-listed, endangered species. It is abundant in the Santa Ynez lagoon and the tidally influenced river reach. Tidewater gobies are bottom dwellers and are typically found in low-velocity habitats out of the main current.

Proposed mainstem-rearing target flows will not affect flow to the lagoon, and therefore are not likely to affect tidewater goby or other lagoon species.

Fish Passage Account releases will flow through the lagoon. Additional flows to the lagoon have the potential to increase currents in the mainstem and thus have the potential to increase the risk of flushing tidewater goby out of the lagoon. However, these releases will be made on the receding limb of a storm hydrograph. Therefore, they are not likely to increase peak flows and will not increase the risk to tidewater goby.

5.2 Additional Aquatic Species

Of the 25 species of fish in the Santa Ynez River, 10 are native: 4 in fresh water (Southern California steelhead, threespine stickleback, Pacific lamprey, and prickly sculpin) and 6 in the Santa Ynez River estuary (including tidewater goby). The native fish community is likely to benefit from increased fish habitat in Hilton Creek and the mainstem near Bradbury Dam. In addition, perennial flows in the reaches just downstream of Bradbury Dam will likely increase riparian growth and thereby enhance available habitat for these native fish communities.

The Arroyo chub, a California species of special concern, is introduced to the Santa Ynez River. Arroyo chub tolerate a widely fluctuating environment and can survive high temperatures and low DO levels. However, monitoring studies have shown that they are not observed in pools inhabited by large predators such as bass. Arroyo chub are likely to benefit from mainstem pool enhancement, and habitat enhancement actions in conservation easements in tributary habitat.

Passage-flow releases will mimic natural storm events, and therefore are not expected to adversely impact native fish species. Passage-flow supplementation will benefit the Pacific lamprey population in the Santa Ynez River. Lamprey, like steelhead, depend on sufficient streamflow to open the mouth of the lagoon to the ocean and to provide

adequate streamflow for migration. Passage-flow releases will occur during the lamprey migration period and will therefore increase the number of passage opportunities.

Although fish rescue operations may temporarily affect native fish species due to stress of handling and capture, native fishes will be released back into their habitat once predators have been removed. The predator-removal activities in the mainstem pool habitats are more likely to benefit native fishes. It is unclear how long such benefits will accrue to particular habitats because not all predatory fish will be removed and new predatory fish may migrate into the treated habitat.

5.3 Non-native Predators

A number of species of non-native predators have been documented in the Santa Ynez watershed, including warmwater fish species (e.g., centrarchids such as largemouth and smallmouth bass, sunfish, and crappie and bullfrogs). These non-native species prey on native fish and amphibians. Other non-native species can compete with native species. Furthermore, non-native carp have feeding behaviors that can contribute to high turbidity and uprooted plants, negatively affecting habitat for other aquatic species.

Conjunctive use of mainstem-rearing target flow releases and downstream water rights releases will benefit non-native species by increasing habitat in the late summer and early fall. An increase in the availability of pool habitat in the mainstem or tributaries may also benefit these non-native species. This would result in an increased risk of predation on native fish and amphibians. Although predator removal may temporarily decrease the risk of predation in pools, persistent populations elsewhere will serve as source populations for recolonization.

This may be partially offset in the reaches near Bradbury Dam (above State Highway 154) by the release of cool (18ºC) water that would favor the coldwater fish community (including rainbow trout/steelhead) over the non-native warmwater community (e.g., centrarchids, carp, and catfish). Furthermore, centrarchids are generally negatively affected by high-velocity flows that may result from both passage-flow supplementation and downstream water rights releases. These releases may transport these fish downstream to potentially less suitable summer habitat.

6.0 SUCCESS CRITERIA AND ADAPTIVE MANAGEMENT

The data provided by the monitoring program will benefit public-trust resources by generating the information necessary to assess the success of the Plan and adaptively manage the implementation of the Plan.

6.1 Success Criteria

The Plan recommends a series of projects, each with specific goals and measurable objectives. Overall, the success of the Plan will be measured through improved habitat quality and long-term trends in fish use of the lower basin habitat. Habitat quality

measures include assessments of spawning habitat, rearing habitat, quantity and quality of riparian habitat, and increases in year-round flow. Fish use will be measured through migrant trapping, redd surveys, and snorkel surveys.

There are two levels of evaluation criteria for the actions proposed in the Plan. The first level is to determine that the action has been successfully implemented. Specific implementation evaluation guidelines are proposed for each action. For example, water temperature monitoring at several locations in Hilton Creek and the mainstem will determine whether water released into Hilton Creek is meeting the established criteria. For tributary passage enhancement projects, an evaluation of both the success of the structure in meeting the design goals (e.g., flow depth and flow velocity) and in passing fish will occur.

The second level of evaluation criteria is a wider interpretation of Plan implementation. Long-term data will be collected to evaluate trends in habitat quantity and quality and fish use. If steelhead and other public-trust resources are provided with more high-quality habitat, a long-term trend of increasing fish use is anticipated. Data is collected each year by the Project Biologist to assess fish habitat and fish use. This data will be evaluated yearly, and as a long-term data set, to identify trends in both habitat and use. This information will be used to evaluate the overall success of the Plan and to identify recommended changes to the Plan through the adaptive management program.

6.2 Adaptive Management Program

6.2.1 Definition of Adaptive Management

Since its conception in the 1970s as a resource management technique (Holling 1978), adaptive management has been defined in various ways. Generally, adaptive management is a structured process of "learning by doing" (Walters 1997). The overall goal of adaptive management is to develop an optimal management capacity (Johnson 1999), with the understanding that new uncertainties will emerge regardless of the type of management used (Gunderson 1999). Active learning is the process in which uncertainty is removed (Gunderson 1999). For Cachuma Project operations, the adaptive management program is based on these concepts (Holling 1978, Walters 1986 & 1997, Gunderson 1999, Johnson 1999, British Columbia Forest Service 2000), and is defined as: the continual learning process in which management policies and actions are systematically improved upon in the face of uncertainty by learning from the outcomes of operational programs. This process involves six basic steps (Holling 1978, Walters 1997, British Columbia Forest Service 2000): assessing the problem, designing "experiments" to be tested in the field, implementing the management actions, monitoring the results of the implemented actions, evaluating the monitoring/implementation results, and adjusting the management recommendations based on the evaluation.

6.2.2 Purpose

An adaptive management strategy will allow the Plan to adapt to changing conditions and new information developed through ongoing studies to take advantage of conservation opportunities that may arise. The adaptive management structure was included in the Plan to provide a framework for future decisions based on an evaluation of the Plan's actions.

One of the long-term goals of the Plan is the protection and recovery of Southern California steelhead in the Lower Santa Ynez River. Recovery of an endangered species is a process that may take decades, and long-term data trends are required to manage that recovery process. Implementation of the Plan will begin the restoration process. The adaptive management program will help to keep the restoration process on track over the long-term.

Monitoring data will also be used on a short-term basis to evaluate actions in the Plan, such as particular restoration actions or fish-passage releases. Based on these evaluations, recommendations will be made for future projects or changes in protocols.

6.2.3 Framework

Adaptive management will occur within a framework set forth in the Plan and the most recent (December 2001) fisheries MOU (Figure 4). The current process builds on the successful framework used during the initial study and Plan development phases of this effort, including a technical team, a management team, and opportunities for public involvement.

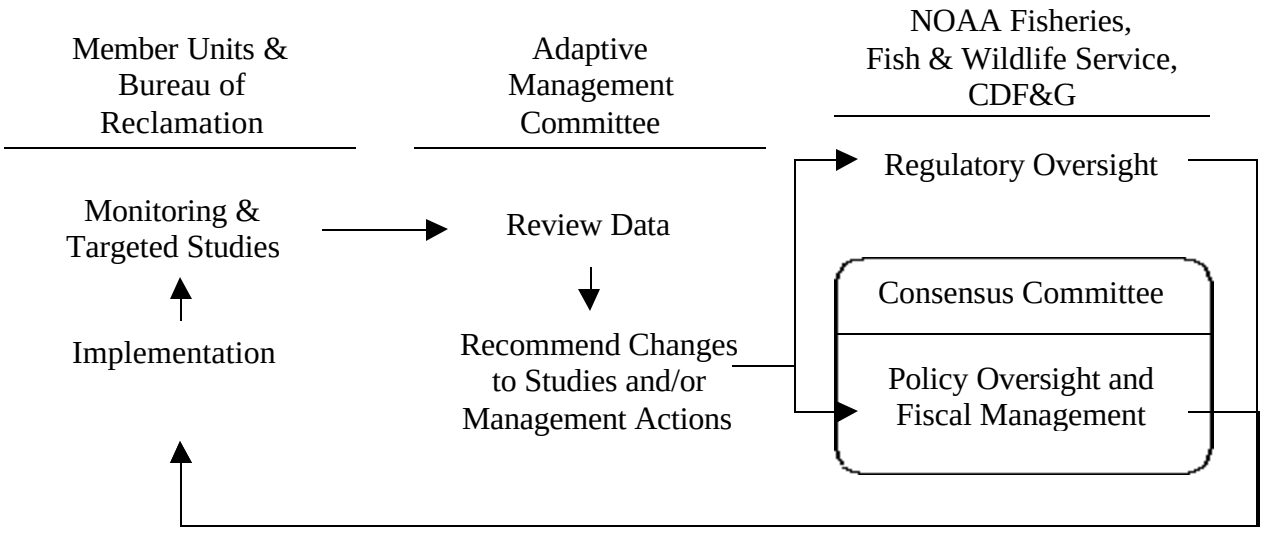


Figure 4. Schematic Diagram of the Cachuma Project Adaptive Management Process

The Plan calls for the establishment of an Adaptive Management Committee, which is tasked with exploring new opportunities, modifying the existing programs as necessary, and presenting their recommendations to the Consensus Committee and NOAA Fisheries. The Consensus Committee has the ability to make management decisions and commit resources to implement the actions outlined in the Plan. The BO requires that NOAA Fisheries approve decisions that could be reasonably expected to affect steelhead prior to implementation. Finally, the SYRTAC will continue to provide a forum for public input into the process.

The Adaptive Management Committee includes one representative from each of the following agencies or organizations: Reclamation, NOAA Fisheries, CDFG, CCRB, SYRWCD, ID#1, USFWS, and the City of Lompoc. This committee structure represents considerable expertise that is qualified to implement the Plan, oversee development of programs required under the BO, oversee implementation of the long-term monitoring plan, and make recommendations to the Consensus Committee.

6.2.4 Application of Adaptive Management

The purpose of the adaptive management process is broad. However, three core areas form the focus of Adaptive Management Committee activities. These core areas comprise the Adaptive Management Program and include environmental water accounts, target flows for rearing, and habitat protection and enhancement, as described below.

Environmental Water Accounts

The Plan calls for two environmental water accounts to be created, the Fish Passage Account and the Adaptive Management Account. The Adaptive Management Committee is responsible for overseeing the releases from these two accounts, monitoring the results of the releases, and recommending changes to the release protocols to increase the benefit to steelhead.

Initial release protocols for the Fish Passage Account are set forth in the Plan, although further analysis of potential release regimes was requested in the BO. The Adaptive Management Committee is currently working to address a term and condition within the BO that calls for decreasing the frequency of fish-passage supplementation in dry years, when the benefit of such supplementation may be reduced (Cachuma Project Adaptive Management Committee, Hydrologic Work Group 2003). Further, during development of the existing fish-passage supplementation protocol, fisheries biologists acknowledged that releases of this nature to enhance fish-passage opportunities were experimental. Therefore, a focus of the Adaptive Management Committee will be to review the results of monitoring studies specifically designed to provide guidance on whether the fish-passage supplementation program is successfully increasing fish passage in the mainstem river.

The long-term monitoring program includes fish surveys in both mainstem and tributary habitats where access is available. Information will be used by the Adaptive

Management Committee to determine whether (1) passage supplementation releases are providing additional benefit, and (2) how releases might be modified to increase this benefit. Hydrological characteristics of the lagoon will be tracked to provide information necessary for the application of passage supplementation releases. Based on the results of these multiyear studies, further changes to the release protocols may be made through the adaptive management program.

The Adaptive Management Account was created to provide some flexibility in the availability of water to meet habitat needs that vary between years. For instance, currently, the target flow releases result in base flow in Hilton Creek, and natural runoff provides higher, wet-season flows. If additional releases into Hilton Creek are needed to provide passage in a below-normal year, the Adaptive Management Account could be used. Similarly, if numbers are increasing in Hilton Creek and more habitat space is needed, the Adaptive Management Account could be used. The desire to be able to respond to these types of variable conditions led to the creation of the Adaptive Management Account.

The Project Biologist and Adaptive Management Committee will work together to identify situations where additional releases could increase the biological benefit to steelhead. Releases can be made to improve passage, spawning, or rearing habitat in Hilton Creek and the mainstem.

Release Locations for Rearing Flows

The Plan sets forth the target flow level designed to maintain suitable rearing habitat within Hilton Creek and the mainstem reaches near Bradbury Dam. The Adaptive Management Committee is charged with determining how the water released to meet the target flow level is distributed among the three release points of the Hilton Creek Supplemental Watering Facility. Because the area watered varies, to some degree, among the release points, so too does the potential biological benefit. Therefore, the Adaptive Management Committee will determine the split of released water based on the data provided by the ongoing monitoring program. Further, in the longer term, monitoring data will be used to determine whether the mainstem-rearing target flow program is benefiting the steelhead population and what, if any, adjustments to the mainstem-rearing target flow program may be recommended.

Habitat Protection and Enhancements

The SYRTAC has collected detailed data on the mainstem and tributaries, where accessible, and has identified a suite of potential actions appropriate for each reach. Actions include passage barrier removal/improvement, habitat protection, and habitat enhancement. Prioritization of these actions provides the current framework for the Plan. The adaptive management program provides the framework for determining whether the tributary enhancement measures successfully achieve their individual goals (e.g., was passage improved by a particular project), whether the suite of tributary enhancements has successfully fostered recovery in a particular tributary, and whether additional

measures should be undertaken to further enhance conditions for steelhead. Because so much of the watershed is privately owned, structural habitat enhancement depends on voluntary landowner participation. Therefore, enhancement opportunities will be implemented as opportunities become available. The public education and outreach component of the Plan is essential to generating the access necessary for both monitoring and restoration activities.

The many ongoing studies collect data in the mainstem and tributaries that support the decisions of the Adaptive Management Committee. Further, specific studies are undertaken for each enhancement project to determine whether the specific project was a success. In this way, the Adaptive Management Committee can further learn which methods of restoration are successful and which methods are less successful. Synthesizing the results of individual project and tributary/mainstem monitoring will provide the Adaptive Management Committee with a broad view as to which enhancements have improved conditions for steelhead and allow for an assessment of what, if any, future actions are needed.

Monitoring Program

The monitoring program has been discussed as an integral component of each of the three core areas of the Adaptive Management Program presented above. However, the monitoring program itself is also a tool targeted for adaptive management. The suite of monitoring programs established in the Plan has three goals: (1) to provide trend information on the status of the steelhead population and their habitat in the Lower Santa Ynez River to determine whether the overall goal of the Plan is met, (2) to test the assumptions upon which certain Plan actions were based, and (3) to determine whether specific Plan actions are successful. The Adaptive Management Committee will establish a subcommittee that will develop monitoring and evaluation criteria and hypotheses that will allow these goals to be tested. As the actions in the Plan are changed through implementation and evaluation of the three core areas just discussed, so too must the monitoring program adapt to accommodate those changes. Further, as the ability to access various areas within the lower basin shifts, changes to the methods and monitoring sites may be necessary. Therefore, the monitoring program will be evaluated and modified, as necessary, to ensure that the program is providing the data necessary for the successful management of the Plan as a whole.

7.0 "GOOD CONDITION" CRITERIA

One of the questions often asked regarding a water supply project's effect on fish populations is "are the fish downstream from the dam in 'good condition'?"

The term "good condition" comes from CDFG Code in Section 5937, which states:

> The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to

> pass over, around, or through the dam, to keep in good condition any fish that may be planted or exist below the dam.

The term "good condition" is not defined in the CDFG Code. Several definitions have been used in the past, including Wong's definition in the Mono Lake, Mono County SWRCB hearing (Wong 1993) and Moyle et al.'s (1998) definition developed for the 1996 Putah Creek trial (Solano and Yolo counties), which built on Wong's definition.

Darrell Wong, a CDFG biologist, defined "good condition" as

> The instream flows necessary to keep fish in good condition include those which will maintain a self-sustaining population of desirably sized adult…fish which are in good physical condition…The fish populations should contain good numbers of different age classes; and habitats for these age classes should not be limiting…The ecological health of a stream will determine if the fish…are to be kept in good condition.

From this definition, we extracted the following characteristics to measure good condition: (1) multiple age classes (i.e., evidence of reproduction), (2) a viable population size, and (3) healthy individuals (Moyle et al. 1998). For the ecological health of the stream, we looked to community structure and geographic distribution to evaluate the ecological health.

Moyle et al. (1998) based their definition of "good condition" on Wong's definition: "to mean there had to be healthy individual fish in healthy populations that were part of healthy biotic communities." We established criteria to determine whether a population met this definition at three levels: individual, population, and community. At an individual level, a healthy fish is "one that obviously looks good to a human observer, is not stunted, and will take appropriate evasive action when a predator or angler approaches" (Moyle et al. 1998). At a population level, criteria include: (1) extensive habitat should be available for all life-history stages and (2) all life-history stages and their required habitats should have a broad enough distribution within the creek to sustain the species indefinitely (barring stream-long catastrophes). Finally, a fish community in good health in California is (1) dominated by co-evolved species, (2) predictable in structure as indicated by limited niche overlap among the species and by multiple trophic levels, (3) resilient in recovering from extreme events, (4) persistent in species membership through time, and (5) replicated geographically (Moyle et al. 1998).

The criterion of healthy individuals is met, based on the Cachuma Project Biologist's snorkel survey data since 1993. Fish captured in the trapping operations and those observed during snorkel surveys are disease-free, exhibit appropriate size, and are able to exhibit predator avoidance reactions. Steelhead also are completing their life-history in the Santa Ynez River. Although observed numbers are low, multiple age classes are present and there is evidence of reproduction, emergence, rearing, smolting, and

returning adults (SYRTAC 1997, Exhibit No. MU 34; 1998b, Exhibit No. MU 27; 2000c, Exhibit No. MU 31; SYRTAC unpublished data).

Completion of the Plan actions would meet the habitat criteria under the population level established by Moyle et al. (1998). The Plan focuses on providing access to, and improving, habitat in the Lower Santa Ynez River. Extensive habitat for all life-history stages did not exist before implementation of the Plan (e.g., instream flow release, passage augmentation, and barrier removal). The Plan actions will enhance access to 18 miles of habitat, create or provide access to 7 miles of oversummering habitat, and improve habitat quality in 10 miles of the mainstem. These actions will improve spawning and rearing habitat and passage conditions in the Lower Santa Ynez River mainstem and its tributaries.

Additional productive habitat has already expanded the living area for steelhead and other aquatic resources in the lower Hilton Creek and in the Highway 154 management reach. Riparian growth along the channels of the Santa Ynez River and lower Hilton Creek benefit a variety of fish and wildlife species. Impediment removals in Salsipuedes Creek have extended the flow range at which steelhead and lamprey can access this watershed. More habitat will be accessible to anadromous fish when the Quiota Creek passage obstructions are removed next year. Extensive habitat will exist for all life-history stages of the native fish community after the Plan actions are completed, thus providing the foundation for the maintenance of healthy populations.

Before any of the actions in the Plan were implemented, steelhead were not "geographically dispersed;" they were found primarily in Salsipuedes Creek. Instream flow releases have increased the geographical distribution of fish in the Lower Santa Ynez River. Fish can use Hilton Creek and the Highway 154 management reach year-round. Additional summer habitat is present in the refuge pools in Refugio Reach. After passage impediments are removed, additional tributary areas will be available to the anadromous populations, further increasing the geographic distribution and reducing the vulnerability to catastrophic events. Currently, anadromous fish use portions of the south-side tributaries from Salsipuedes Creek to Hilton Creek, and the mainstem above Alisal. Other native fish are more broadly dispersed and occupy habitat no longer accessible to anadromous fish. Since the Plan has been implemented, anadromous fish distribution has increased. As the Plan actions continue to be implemented, additional habitat will become available to anadromous fish, allowing further increase in geographic distribution. The native fish community will continue to be "geographically dispersed" in this watershed, and steelhead will remain dispersed in the ESU in this and other watersheds along the south coast.

One of the limiting factors in the Santa Ynez River and other south coast rivers is the lack of reproduction capacity in the population. The spawning population is too small to provide for rapid recovery. Providing good habitat conditions, however, is a critical first step in increasing population levels in the Santa Ynez River.

The fish populations in the Santa Ynez River fail to meet the criteria for "good condition" at the community level. The preponderance of non-native fish in the mainstem river is high. Of the 22 species found in the riverine habitats, only 4 are native. Of the native fish, two have depressed populations (steelhead and Pacific lamprey). Non-native species (e.g., bass and catfish) prey on juvenile steelhead; introduced Arroyo chub can compete with steelhead (Richards and Stoltz 1986). Due to some niche overlap between steelhead and these species, modification of habitat characteristics (e.g., releasing more flow) will not control the exotic species. Further, removal of introduced species is difficult and rarely successful in the long term. Removal efforts in the Lower Santa Ynez River are further complicated by a source population in Lake Cachuma and the lack of access to mainstem habitat. Because of the influence of introduced species, it is unlikely that the community criteria will be met in the mainstem. As the steelhead and lamprey populations increase, the community composition will shift to a healthier structure.

With the continued execution of the Plan, the native fish community can meet most of the criteria developed by Moyle et al. (1998). Fish will continue to meet the "good condition" criteria at the individual level. Continued progress toward "good condition" at the population level will be achieved. Extensive habitat over a broad geographic distribution will be available to native species. The native fishes contribution to the community structure will be improved, but probably will not achieve dominance over the non-native species.

8.0 CONCLUSION

The actions outlined in the Plan provide a substantial biological benefit for steelhead and other public-trust resources in the Lower Santa Ynez River. These actions provide a high biological benefit and have a high potential for success. The adaptive management program included in the Plan has been created to address the variability within the system and the fact that our knowledge of steelhead behavior in the Lower Santa Ynez River is incomplete.

It is my opinion that at this time the Plan should continue to be executed and adaptively managed based on the results of the monitoring program and new information, as it becomes available. Implementing all of the Plan's actions, including the continuing development of new actions and the adaptive management program, will provide a significant benefit to aquatic habitat in the Lower Santa Ynez River basin. This is a necessary component of the effort to protect, and enhance, the endangered Southern California steelhead and restore the native fish community to "good condition."

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