Lower Santa Ynez River

Volume II
Appendices

Fish Management Plan

October 2, 2000

LOWER SANTA YNEZ RIVER
FISH MANAGEMENT PLAN

Volume II
Appendices

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

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A. MANAGEMENT ALTERNATIVES CONSIDERED

B. FLOW-RELATED FISH ENHANCEMENT IN THE SANTA YNEZ RIVER

C. TRIBUTARIES OF THE SANTA YNEZ RIVER BELOW BRADBURY DAM

D. HILTON CREEK ENHANCEMENTS

E. UPPER BASIN ACTIONS FOR THE PROTECTION AND ENHANCEMENT OF SOUTHERN STEELHEAD IN THE SANTA YNEZ RIVER

F. MOLECULAR GENETIC POPULATION STRUCTURE IN RAINBOW TROUT/STEELHEAD (*ONCHORHYNCHUS MYKISS*) FROM THE SANTA YNEZ RIVER 1994-1997

G. REVIEW OF EFFECTS OF WARM WATER TEMPERATURE ON STEELHEAD/RAINBOW TROUT

H. COMMENTS ON THE DRAFT FISH MANAGEMENT PLAN

I. LONG-TERM MONITORING IN THE LOWER SANTA YNEZ RIVER

Conjunctive Use and Flow-Related Enhancement Operations

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MANAGEMENT ALTERNATIVES CONSIDERED

Appendix A

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

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Page

List of Tables .... A-ii

1.0 Potential Management Alternatives Considered by the SYRTAC A-1-1

2.0 Literature Cited A-2-1

3.0 Personal Communications A-3-1

Page

Table 1–1. Management Alternatives Considered for the Mainstem Santa Ynez River below Bradbury Dam....A-1-3

Table 1–1. Management Alternatives Considered for the Mainstem Santa Ynez River below Bradbury Dam -cont'd-....A-1-4

Table 1–2. Management Alternatives Considered for Tributaries below Bradbury Dam....A-1-5

Table 1–3. Management Alternatives Considered for the Mainstem Santa Ynez River and Tributaries above Bradbury Dam....A-1-6

The Santa Ynez River Technical Advisory Committee (SYRTAC) identified a wide range of potential management alternatives to improve conditions for fishery resources, especially rainbow trout/steelhead. These were detailed in the report entitled, *Santa Ynez River Fisheries Management Alternatives*, which was prepared by the SYRTAC on March 11, 1998. Most alternatives focused on the mainstem Santa Ynez River and tributaries below Bradbury Dam, while some addressed actions above Bradbury Dam, mainly providing passage for steelhead to spawning and rearing habitat in the upper basin. The types of measures considered included physical enhancement of stream habitat, measures to manage or increase flows, removal of passage impediments, fish supplementation, fishing regulations in the lower river, and predator removal. Each of the 48 alternatives was described conceptually, along with the expected biological benefits and constraints to successful implementation.

Members of the SYRTAC screened and ranked each alternative. Screening criteria were applied to determine if an action was infeasible or faced clear obstacles to implementation, which eliminated two alternatives from further consideration. A three-tiered ranking process was used to evaluate the remaining alternatives. Of greatest importance was the biological benefits provided for fishery resources. The second ranking stage evaluated likelihood of success and cost variables, and the third ranking stage considered constraints such as access to land, requirements for operations and maintenance, institutional coordination and landowner permission for suggested actions on private land.

Twenty-six promising alternatives were identified in the screening and ranking process. Actions that would improve habitat conditions in the lower Santa Ynez basin for over-summering and juvenile rearing received the highest rankings for biological benefits, especially alternatives that increased flows in the mainstem below Bradbury Dam and in Hilton Creek. The most promising can be grouped into several categories:

1. flow-related measures to improve habitat in the mainstem below Bradbury Dam and Hilton Creek;
2. enhancement of physical habitat in the mainstem and tributaries below Bradbury Dam;
3. removal of passage impediments in the mainstem and tributaries below Bradbury Dam;
4. trap-and-truck measures to provide access to habitat above Lake Cachuma;
5. stock supplementation measures; and
6. reduction of direct mortality from anglers or predators in the lower basin.

All the original alternatives are presented in several tables for the mainstem below Bradbury Dam (Table A-1), tributaries below Bradbury Dam (Table A-2), and the upper basin (Table A-3). The tables indicate which alternatives were included in the Management Plan. In addition, short paragraphs describing those alternatives not covered in more detail in the Plan, are included below. Most of the alternatives recommended in the Management Alternatives Report have been carried forward into the Fish Management Plan. Some actions have been modified. For example, predator removal below Bradbury Dam now will be conducted only in conjunction with fish rescue operations. Other alternatives have been put on hold due to serious institutional obstacles. In particular, transporting adult steelhead around Bradbury Dam to spawning habitat in the upper basin raises problems of moving a listed species to an area outside their defined range. (The National Marine Fisheries Service [NMFS] defined the Southern California Steelhead Evolutionarily Significant Unit [ESU] as the anadromous segments [open to the ocean] of streams from the Santa Maria River south to Malibu Creek. In the Santa Ynez River, rainbow trout/steelhead downstream of Bradbury Dam are protected as an endangered species, but landlocked steelhead above Bradbury Dam are not included in the ESU.)

Finally, a new action has been introduced since the Management Alternatives report was prepared to complement other enhancement measures. This action, public education and outreach, will be especially important, since many actions in the lower basin can only be implemented through voluntary participation by private landowners.

Table 1–1. Management Alternatives Considered for the Mainstem Santa Ynez River below Bradbury Dam

Number	Management Alternative	Priority Action?	Comments
MAINSTEM BELOW BRADBURY DAM			
Flow-related Measures			
1.	Conjunctive use of water rights releases and Fish Reserve Account	Y	Provides year-round rearing habitat
2.	Direct recharge of groundwater using alternate release points along mainstem below Bradbury Dam	N	Institutional concerns, public opposition
3.	Manage flood-control releases	N	Low biological benefits
4.	Additional mainstem flow releases from Fish Reserve Account	Y	Included in conjunctive use of water rights releases and Fish Reserve Account
5.	Surcharge reservoir for Fish Reserve Account	Y	Provides additional water for habitat maintenance
6.	Purchase water and/or water rights for flows in mainstem below Bradbury Dam	N	Water not available for purchase
7.	Recirculate/recycle flows in mainstem below Bradbury Dam	N	Not technically feasible
Habitat Enhancements			
8.	Riparian enhancement along mainstem below Bradbury Dam	N	Lack of landowner interest
9.	Mainstem stream channel modifications below Bradbury Dam	Y	Focus on improving refuge pools for rearing habitat
10.	Instream structures in mainstem below Bradbury Dam (*e.g.*, woody debris, boulders)	Y	Focus on improving refuge pools for rearing and spawning habitat
11.	Place gravel in mainstem below Bradbury Dam	N	Spawning gravels not limiting
12.	Conservation easements along mainstem below Bradbury Dam	N	Lack of landowner interest
Fish Passage			
13.	Passage impediment removal in mainstem below Bradbury Dam	N	Lack of landowner interest
14.	Passage channel at lagoon beach impediment (*i.e.*, breach sandbar)	N	Low biological benefit, adverse effects on other listed species (*i.e.*, tidewater goby)
15.	Fish ladder at Bradbury Dam	N	Not technically feasible, biological concerns
16.	Fish ladder from Hilton Creek to Lake Cachuma	N	Not technically feasible, biological concerns

Table 1–1. Management Alternatives Considered for the Mainstem Santa Ynez River below Bradbury Dam -cont'd-

Number	Management Alternative	Priority Action?	Comments
Fish Passage -cont.d-			
17.	Trap-and-truck adults from mainstem below dam to Lake Cachuma above dam and outmigrants from above to below dam	N	Institutional obstacles in transporting a listed species above Bradbury Dam
18.	Trap-and-truck SYR adults from mainstem below dam to outside SYR drainage	N	Institutional obstacles in transporting a listed species
Predator Removal			
19.	Remove warmwater fish below Bradbury Dam	Y	In conjunction with fish rescue operations in Hilton Creek and select upper mainstem sites
Fishing Regulations			
20.	Fishing moratorium below Bradbury Dam	Y	Already implemented
Fish Supplementation			
21.	Use southern steelhead stocks in hatchery programs to supplement wild population below Bradbury Dam	N	Institutional concerns
22.	Transfer broodstock from the upper basin to the mainstem below Bradbury Dam	N	Institutional obstacles, biological concerns
23.	Streamside incubators along mainstem below Bradbury Dam	N	Low biological benefit, institutional concerns
24.	Spawning channels along mainstem	Y	This concept has been folded into the channel extension for Hilton Creek

Table 1–2. Management Alternatives Considered for Tributaries below Bradbury Dam

Number	Management Alternative	Priority Action?	Comments
TRIBUTARIES BELOW BRADBURY DAM			
Flow-related Measures			
25.	Purchase water/water rights to increase tributary flow below Bradbury Dam	N	Water not available for purchase
26.	Pump/siphon Cachuma water to Hilton Creek	Y	Highly promising
27.	Continuous pump and/or recycle flows in tributaries below Bradbury Dam	N	Not technically feasible
28.	Groundwater wells to augment tributary flow below Bradbury Dam	N	Not technically feasible
Habitat Enhancements			
29.	Instream structures in tributaries below Bradbury Dam	Y	Within conservation easements
30.	Place gravel in tributaries below Bradbury Dam	Y	Within conservation easements
31.	Conservation easements on tributaries below Bradbury Dam	Y	Voluntary participation by the landowner?
32.	Riparian enhancement along tributaries below Bradbury Dam	Y	Within conservation easements
33.	Extend channel of lower Hilton Creek	Y	Creates new spawning and rearing habitat
Fish Passage			
34.	Passage impediment removal in tributaries below Bradbury Dam	Y	Provides access to additional habitat
35.	Trap-and-truck adults from mainstem below dam to tributaries below dam	N	Institutional obstacles, reduced passage problems after implementation of Alt. # 34 (impediment removal)
36.	Trap-and-truck outmigrants at tributaries below Bradbury Dam	N	Downstream passage not limiting, institutional and technical obstacles

Table 1–3. Management Alternatives Considered for the Mainstem Santa Ynez River and Tributaries above Bradbury Dam

Number	Management Alternative	Priority Action?	Comments
MAINSTEM ABOVE BRADBURY DAM			
Flow-related Measures			
37.	Modify flow releases from Gibraltar Dam	N	Limited biological benefit
Physical Habitat Enhancements			
38.	Place gravel in mainstem above Lake Cachuma	N	Limited biological benefit, spawning habitat not limiting
Fish Passage			
39.	Trap-and-truck adults from mainstem below dam to mainstem above Lake Cachuma	N	Access difficulties to the upper basin, biological and institutional concerns in transporting a listed species
40.	Trap-and-truck outmigrants (smolts) from mainstem above Lake Cachuma to estuary	N	Technical and institutional concerns
Predator Control			
41.	Remove warmwater fish from mainstem above Lake Cachuma	N	Limited biological benefit, institutional concerns, infeasible
42.	Remove warmwater fish in Lake Cachuma	N	Limited biological benefit, institutional concerns, infeasible
43.	Remove warmwater fish from Gibraltar Reservoir	N	Limited biological benefit, institutional concerns, infeasible
44.	Remove warmwater fish from Jameson Lake	N	Limited biological benefit, institutional concerns, infeasible
TRIBUTARIES ABOVE BRADBURY DAM			
Fish Passage			
45.	Trap-and-truck adults from mainstem below dam to tributaries above dam	N	Access difficulties to upper basin, biological and institutional concerns in transporting a listed species
46.	Trap-and-truck outmigrants (smolts) from tributaries above Lake Cachuma to estuary	Y	Technical and institutional concerns
Predator Control			
47.	Remove warmwater fish from tributaries above Lake Cachuma	N	Limited biological benefit, institutional concerns, infeasible
Fish Supplementation			
48.	Supplemental rearing facilities on tributaries above Bradbury Dam	N	Institutional concerns, need for supplementation not clear

2. Alternate release points along mainstem below Bradbury Dam

This alternative suggests releasing State Water Project (SWP) water into the Santa Ynez River near the Robinson Bridge (Highway 246 Crossing) and near Rucker Road in lieu of the Below Narrows Account. This might elevate the water table below the Narrows and benefit migrating fish later in the year. SWP water could also be released 2.5 miles downstream of Buellton as part of the Above Narrows Account.

The Department of Fish and Game has expressed concerns that anadromous steelhead may obtain false cues for imprinting if they were exposed to SWP water from the Sacramento-San Joaquin Delta. Furthermore, the public voiced opposition to alternate release points and the use of SWP. Due to the uncertain benefits for rainbow trout/steelhead, institutional concerns and public opposition, this alternative will not be considered further at this time.

3. Manage flood-control releases

This alternative examines the possibility of conducting "pre-releases" of flood-control releases (in advance of expected storm events) from Lake Cachuma to increase or improve the pattern of streamflows for fisheries downstream of Bradbury Dam. The opportunities for manipulating storm-related releases to benefit rainbow trout/steelhead are limited by the unpredictability of the actual occurrence, duration and magnitude of a potential storm event, the flashy hydrology of the upper Santa Ynez watershed, the difficult control of the spillway gates, and the lack of a flood control pool in the Cachuma Project that can be actively managed.

6. Purchase water and/or water rights for flows in mainstem below Bradbury Dam

Purchasing water from existing water rights holders or the outright purchase of their water rights are two means of increasing streamflow. Both methods would be most advantageous in situations where supplemental water would improve instream habitat conditions by either increasing the amount of streamflow at a particular time of year or ensuring that the stream remains a live stream throughout the year (restoring perennial flow).

The complexity of the Santa Ynez River water rights and current land use policies make this alternative likely infeasible. Purchasing additional water rights will not be pursued further at this time.

7. Recirculate/recycle flows in the mainstem below Bradbury Dam

Recirculation of base-level streamflows with a pumping system could be used to improve aquatic habitat within a small portion of the river by maintaining higher flow conditions for a longer part of the dry season.

This alternative, however, faces serious technological challenges, would be expensive to operate and maintain, might result in unacceptable environmental impacts, requires landowner cooperation and would improve only limited lengths of stream. Therefore, it will not be pursued further at this time.

8. Riparian enhancement along mainstem

Riparian enhancement along the mainstem might improve rainbow trout/steelhead habitat through a number of factors (see C.3.2.3.3). Even though many parts of the mainstem are too wide for riparian planting to directly improve habitat by shading, riparian vegetation could provide sufficient shading during low-flow conditions, when the stream follows the bank, and add to the overall health of the system. However, the opportunity for realizing these biological benefits is limited because along those parts of the mainstem best suited for riparian enhancement, landowner cooperation is lacking. This alternative will be put on hold pending landowner approval.

11. Place gravel in mainstem

Addition of gravel may increase the amount of available spawning habitat for rainbow trout/steelhead, and improve rainbow trout/steelhead populations in portions of the mainstem where spawning gravel is the primary limiting factor. However, lack of fry habitat, not spawning habitat, was identified as the overall primary limiting factor in the lower Santa Ynez River, according to the analysis in the Contract Renewal EIR/EIS (ENTRIX 1995). In the areas lacking gravels, hydrological conditions and geomorphic processes indicate that gravels do not tend to accumulate there in the long term. Adding gravel here could impact downstream habitat (*e.g.*, filling of pools).

Due to the uncertain biological benefits, this alternative will not be pursued further at this time.

12. Conservation easements along river channel of mainstem

Conservation easements along the mainstem could be used to improve rainbow trout/steelhead habitat in a number of ways (see 3.3.1), provided that landowners are willing to participate.

The failure to locate interested landowners in priority areas eliminates the option of pursuing this alternative at this time.

13. Passage impediment removal in the mainstem below Bradbury Dam

The removal of physical passage impediments can improve opportunities for rainbow trout/steelhead to migrate upstream and downstream during periods of moderate and low streamflow. Landowner participation is required in order to access the stream and remove impediments.

This alternative is placed on hold, pending further evaluation of passage problems in the mainstem Santa Ynez River and landowner approval in priority reaches.

14. Passage channel at the lagoon impediment (breaching of the sandbar)

Mechanical breaching of the sandbar would allow migrating steelhead to enter or exit the Santa Ynez River when a sandbar closes off the lagoon from the ocean. However, this would only be beneficial during steelhead migration, and when river flows are high enough to provide continuous passage within the stream. Furthermore, breaching the sandbar may have adverse impacts on juvenile steelhead rearing in the lagoon, and on other species, particularly the listed tidewater goby. This fish inhabits the lagoon and the tidally influenced region of the river, and prefers calm conditions which occur when the lagoon is closed (J. Smith, pers. comm.). ESA consultation with the USFWS would be required to implement this action.

At this time, breaching of the sandbar will not be pursued further due to the above mentioned complications.

19. Remove warmwater fish below Bradbury Dam

The removal of non-native warmwater fish, such as largemouth bass, bluegill sunfish, and catfish, from below Bradbury Dam could be beneficial to juvenile steelhead by reducing predation and competition. However, the benefits would be temporary because of recolonization from other areas (the mainstem, Lake Cachuma, and/or the tributaries).

In general, fish control projects have had limited success (Meronek *et al.*, 1996), and in particular, the Long Pool and Stilling Basin have been recolonized by non-natives after a thorough removal in 1997 (Engblom, pers. comm.).

Due to the high likelihood of recolonization, a wholesale removal program would be infeasible on a long-term basis. Furthermore, DFG does not support such an effort (C. Raysbrook, CDFG, pers. comm.). Predator removal is being evaluated on a case-by-case basis in conjunction with fish rescue operations in Hilton Creek and selected upper mainstem sites, and after consultation with SYRTAC, NMFS, DFG, Reclamation and FWS.

20. Fishing moratorium downstream of Bradbury Dam

A year-round fishing moratorium in waters of the Southern California Steelhead ESU has been implemented for two years. This includes the waters below impassible dams, such as Bradbury Dam. Fishing is prohibited on the Santa Ynez River and its tributaries below Bradbury Dam. This reduces disturbance of rainbow trout/steelhead and will complement habitat enhancement efforts to improve population numbers.

21. Wild steelhead hatchery

The rainbow trout/steelhead population of the Santa Ynez River could be directly supplemented by producing fish at a hatchery, using genetically compatible stocks.

In general, CDFG does not support using artificial means to supplement steelhead populations, such as hatchery programs and spawning channels, and rates this as an unacceptable option (C. Raysbrook, CDFG, pers. comm.). According to policies of the CDFG and Fish and Game Commission, artificial supplementation and rearing would only be allowed if current factors that are limiting the population (*e.g.*, passage obstacles, habitat disturbances) are alleviated (D. McEwan, CDFG, pers. comm.).

The current Plan considers the use of a southern steelhead hatchery only for stocking programs in the upper basin, as a means to protect the genetic integrity of native stocks. The need for supplementation in the lower basin is on hold, pending the outcome of habitat improvements.

22. Transfer broodstock from the upper basin to the mainstem below Bradbury Dam

Supplementation of the lower river with adults or eggs from the residualized population of rainbow trout/steelhead upstream of Bradbury Dam could boost production in the lower river.

However, CDFG does not support using artificial means to supplement steelhead populations, such as hatchery programs and spawning channels (C. Raysbrook, CDFG, pers. comm.). According to policies of the CDFG and Fish and Game Commission, artificial supplementation and rearing would only be allowed if current factors that are limiting the population (*e.g.*, passage obstacles, habitat disturbances) are alleviated (D. McEwan, CDFG, pers. comm.).

Based on institutional and biological concerns, this alternative will not be pursued further at this time.

23. Streamside incubators in mainstem below Bradbury Dam

Egg survival of rainbow trout/steelhead might be improved through the use of streamside incubators to maintain ideal conditions for egg growth and survival.

Instream incubation techniques have had varying degrees of success (e.g., Harshbarger and Porter 1982, Bams 1985). Several of the technical and biological factors contributing to the uncertainty of success and low biological benefit of this alternative include the need of high quality water, monitoring and maintenance of the incubators, the potential risk of predation on young steelhead, the cooperation of private landowners, and the potential risk of vandalism.

CDFG does not support using artificial means to supplement steelhead populations, such as hatchery programs and spawning channels (C. Raysbrook, CDFG, pers. comm.). According to policies of the CDFG and Fish and Game Commission, artificial supplementation and rearing would only be allowed if current factors that are limiting the population (*e.g.,* passage obstacles, habitat disturbances) are alleviated (D. McEwan, CDFG, pers. comm.).

Due to the above-mentioned obstacles, this alternative will not be considered further at this time.

25. Purchase water/water rights to increase tributary flows below Bradbury Dam

Purchasing water from existing water rights holders or the outright purchase of their water rights are two means of increasing streamflow. Both methods would be most advantageous in situations where supplemental water would improve instream habitat conditions by either increasing the amount of streamflow at a particular time of year or ensuring that the stream remains a live stream throughout the year (restoring perennial flow).

The water rights situation in the Santa Ynez River watershed and current land use policies make this alternative unattractive and likely infeasible. Purchasing additional water rights will not be pursued further at this time.

27. Recirculate/recycle flows in live reaches of tributaries

Recirculating base-level streamflows with a pumping system could be used to improve aquatic habitat within a small portion of tributaries with perennial flow by maintaining higher flow conditions for a longer part of the dry season.

This alternative, however, faces serious technological challenges, would be expensive to operate and maintain, might result in unacceptable environmental impacts, requires landowner cooperation, the purchase of additional water rights, and would improve only limited lengths of stream. Therefore, it will not be pursued further at this time.

28. Groundwater wells to augment tributary flow

A series of groundwater wells could be used to augment instream flows and reduce water temperature during critical periods of low flows in perennial tributaries.

Relatively little information exists, however, on groundwater conditions or the potential production of a proposed well field in likely watersheds. Geologic studies generally characterize the consolidated rock aquifers in the Santa Ynez mountains as non-water-bearing, except for fractured sandstone deposits.

Furthermore, the costs for construction, operation, and maintenance of wells, pumps, and conveyance structures are likely to be high. Additional constraints include the accessibility of potential well sites, access to private lands, providing electrical service, maintaining adequate water quality, and potential adverse effects on local hydrology due to pumping.

Due to the technical problems, this alternative will not be pursued further at this time.

35. Trap-and-truck adults from mainstem below Bradbury to tributaries below Bradbury

Trap-and-truck operations can be used to facilitate upstream passage of adult rainbow trout/steelhead around natural or man-made passage barriers in the mainstem to spawning habitat in the tributaries below Bradbury Dam.

Passage impediment removal below Bradbury Dam (Alternative 34) will reduce the need for trap-and-truck operations on the mainstem below the dam. In addition, due to possible mortalities related to trap-and-truck procedures and institutional obstacles, this alternative will not be pursued further at this time.

36. Trap-and-truck outmigrants at tributaries below Bradbury Dam

This alternative can be coupled with another measure to provide upstream passage for adult spawners (Alternative 35), or it can provide downstream passage for residualized steelhead. However, downstream transport of juveniles and adults in other systems has generally been less successful than upstream transport of adults because the typical high streamflows make it more difficult to collect downstream migrants. Furthermore, large numbers of juveniles must be transported in order to produce a discernible effect in the number of returning adults. Finally, downstream passage is not likely to limit fish populations on the tributaries below Bradbury Dam.

Due to the institutional obstacles caused by handling of the listed steelhead involved in this alternative, and the limited biological benefits, this alternative will not be pursued further at this time.

37. Modify flow releases from Gibraltar Dam

Habitat in the mainstem Santa Ynez River between Lake Cachuma and Gibraltar Dam could benefit from water released from Gibraltar Reservoir, utilizing existing water rights releases (Gin Chow releases). Water released from Gibraltar Dam would subsequently be recovered and stored in Lake Cachuma, which would provide fisheries and habitat benefits with a minimum of water supply impact.

Since the alternatives suggesting the transport of steelhead above Lake Cachuma have been put on hold, the need for additional water releases from Gibraltar Reservoir to improve habitat above Cachuma has also been reduced. Furthermore, due to the transit losses between Gibraltar and Cachuma, it is uncertain how much additional water would be contributed to Lake Cachuma to be used for downstream releases. Because of the limited benefits to steelhead, this alternative will not be pursued further at this time.

38. Place gravel in mainstem above Lake Cachuma

Periodic addition of spawning gravel could improve spawning habitat in the mainstem above Lake Cachuma. This measure assumes that the rainbow trout/steelhead population is limited principally by the lack of good quality spawning gravel. To benefit the rainbow trout/steelhead population below Bradbury Dam, successful passage of steelhead (outmigrating juveniles and possibly upstream-migrating adults) around or through Lake Cachuma would be required. Adequate streamflows for spawning, incubation and fry rearing must also be present.

In the areas currently lacking gravel, hydrological conditions and geomorphic processes indicate that gravels do not tend to accumulate there in the long term. Adding gravel here could impact downstream habitat (*e.g.*, filling of pools).

Moreover, previous habitat surveys upstream of Bradbury Dam (ENTRIX 1995) showed that spawning habitat was not limiting. Since the alternatives suggesting the transport of steelhead above Lake Cachuma have been put on hold, and due to the low benefits of placing gravel in the mainstem upstream of the dam, this alternative will not be pursued further at this time.

41. Remove warmwater fish from mainstem above Lake Cachuma

The removal of non-native warmwater fish, such as largemouth bass, bluegill sunfish, and catfish, from the mainstem above Cachuma could benefit native fish. The benefits would be temporary, however, because of recolonization by survivors or warmwater fish from other areas (the mainstem, Lake Cachuma, spill from Gibraltar Reservoir, and/or the tributaries). In general, fish removal programs in other systems have often failed or had only short-term success (Meronek *et al.*, 1996). Furthermore, DFG does not support such an effort (C. Raysbrook, CDFG, pers. comm.). Thus, this alternative will not be pursued at this time.

42. Remove warmwater fish in Lake Cachuma

Non-native warmwater fish, such as largemouth bass, bluegill sunfish, and catfish, can prey on small fish, such as young rainbow trout/steelhead and arroyo chub. The warmwater fish population in Lake Cachuma also acts as a source of predators for the Santa Ynez River upstream and downstream of the lake. Undertaking removal of warmwater fishes from Lake Cachuma would be technically and economically infeasible, due to the large size of the reservoir, the large numbers of fishes, and the importance of the sport fishery for these species. Furthermore, DFG does not support such an effort (C. Raysbrook, CDFG, pers. comm.).

43. Remove warmwater fish in Gibraltar Reservoir

Removal of non-native warmwater fish, such as largemouth bass, bluegill sunfish, and catfish, has been suggested to reduce predation on small native fish. Predator removal occurred through natural means several years ago when Gibraltar Reservoir dried up (1989-1991).

However, DFG does not support such an effort (C. Raysbrook, CDFG, pers. comm.). Undertaking removal of warmwater fishes from Gibraltar Reservoir by means other than reservoir drawdown would likely be technically infeasible. This alternative will not be pursued further at this time.

44. Remove warmwater fish in Jameson Lake

The removal of non-native warmwater fish, such as largemouth bass, bluegill sunfish, and catfish, may reduce the source of predators for the Santa Ynez River upstream and downstream of the lake. However, fish removal programs have often failed or had only short-term success (Meronek *et al.*, 1996). Furthermore, DFG does not support such an effort (C. Raysbrook, CDFG, pers. comm.). Undertaking removal of warmwater fishes from Jameson Lake would likely be technically infeasible and will not be pursued further at this time.

47. Remove warmwater fish from tributaries above Lake Cachuma

The removal of non-native warmwater fish, such as largemouth bass, bluegill sunfish, and catfish, may increase survival of rainbow trout/steelhead and other native species in tributaries above Lake Cachuma. However, fish removal programs have often failed or had only short-term success (Meronek *et al.*, 1996). Recolonization by fish from Cachuma would be expected in accessible areas of these tributaries. Furthermore, DFG does not support such an effort (C. Raysbrook, CDFG, pers. comm.).

The likelihood of recolonization by warmwater fish from Lake Cachuma, low biological benefits, the chance for high incidental environmental impacts and difficult access make this alternative infeasible.

48. Supplemental rearing facilities on tributaries above Bradbury Dam

This alternative would enhance production by providing supplemental rearing opportunities on perennial tributaries upstream of Lake Cachuma, where water is more plentiful. Implementation of this alternative would require consultation with the U.S. Forest Service for construction of facilities on Forest Service land. It would be most promising in years where the number of juveniles exceeds the carrying capacity of the rearing sites below Bradbury Dam. Furthermore, juveniles would have to be trapped below Bradbury Dam, trucked to the rearing sites above the dam, and reared fish (smolts) would have to be returned to reaches below the dam. Due to the difficulties involved with the trap-and-truck method (institutional, technical and biological concerns), as well as the low biological benefit provided and the unclear need for supplementation, this alternative will not be pursued further at this time.

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Return to T.O.C.

FLOW-RELATED FISH ENHANCEMENT IN THE SANTA YNEZ RIVER

Appendix B

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

CONJUNCTIVE USE WORK GROUP

October 2, 2000

Page

List of Tables .... B-iv

List of Figures .... B-vi

1.0 Introduction B-1-1

2.0 Habitat B-2-1

2.1 Mainstem B-2-1

2.1.1 Physical Habitat B-2-1

2.1.2 Reach Descriptions B-2-3

2.1.2.1 Highway 154 .... B-2-3

2.1.2.2 Refugio Reach B-2-4

2.1.2.3 Alisal Reach B-2-6

2.1.2.4 Avenue of the Flags B-2-8

2.1.2.5 Buellton to Lompoc B-2-8

2.1.2.6 Below Lompoc B-2-9

2.1.2.7 Lagoon B-2-9

2.1.3 Dissolved Oxygen Monitoring B-2-10

2.1.4 Steelhead Use of the Mainstem B-2-10

2.2 Hilton Creek B-2-12

2.2.1 Physical Habitat B-2-12

2.2.2 Steelhead Use of Hilton Creek B-2-12

3.0 Description of Actions B-3-1

3.1 Purpose B-3-1

3.2 Lake Cachuma Surcharge B-3-1

3.3 Conjunctive Use of Reservoir Releases and Downstream Water Rights Releases to Meet Mainstem Rearing Target Flows B-3-2

3.3.1 Downstream Water Rights Releases B-3-3

3.3.1.1 Water Rights Releases B-3-3

3.3.1.2 CCWA Deliveries and Releases B-3-6

3.3.1.3 Mainstem Ramping B-3-6

3.3.2 Mainstem Rearing Target Flows B-3-6

3.3.3 Flow Target Compliance Monitoring B-3-12

3.4 Passage Flow Supplementation B-3-12

3.4.1 Fish Passage Account B-3-13

3.4.2 Passage Supplementation Criteria B-3-14

3.4.3 Adaptive Management of the Fish Passage Account B-3-20

3.5 Adaptive Management Account B-3-20

3.6 Interim Operations B-3-21

3.6.1 Surcharge Interim Phases B-3-22

3.6.2 Interim Mainstem Rearing Target Flows B-3-22

3.6.3 Passage Flow Supplementation B-3-26

3.7 Summary of Flow-Related Fish Enhancement Operations B-3-26

4.0 Benefits and Impacts B-4-1

4.1 Analysis Approach B-4-1

4.2 Effects of Flow-Related Enhancement Measures on Rainbow Trout/Steelhead B-4-1

4.2.1 Summary of Effects B-4-1

4.2.2 Effects on Passage B-4-3

4.2.3 Effects on Spawning Habitat B-4-6

4.2.3.1 Methods for Spawning and Rearing Habitat Analysis B-4-6

4.2.3.2 Spawning Results B-4-6

4.2.4 Effects on Rearing Habitat B-4-8

4.2.4.1 Bradbury Dam to Highway 154 .... B-4-8

4.2.4.2 Highway 154 to Refugio Road B-4-10

4.2.4.3 Refugio Road to Alisal Road B-4-10

4.2.5 Effects on Minimum Flows B-4-12

4.2.6 Downstream Water Rights Releases B-4-14

4.3 Effects on Other Species B-4-14

4.3.1 Other Fish in the Santa Ynez River B-4-14

4.3.2 Wildlife B-4-16

4.3.3 Species that Inhabit Lake Cachuma B-4-17

5.0 Recommendations B-5-1

6.0 Literature Cited B-6-1

7.0 Personal Communications B-7-1

		Page
Table 2-1	Reaches in the Lower Mainstem Santa Ynez River	B-2-3
Table 2-2	Habitat Mapping of the Lower Mainstem Santa Ynez River	B-2-4
Table 2-3	Frequency Analysis of Water Temperature Exceedances in the Long Pool at Surface	B-2-5
Table 2-4	Frequency Analysis of Water Temperature Exceedances in the Refugio Reach (3.4 miles Downstream of Bradbury Dam) at Surface	B-2-6
Table 2-5	Frequency Analysis of Water Temperature Exceedances at the Alisal Bridge (9.5 miles Downstream of Bradbury Dam) at Surface	B-2-7
Table 2-6	Frequency Analysis of Water Temperature Exceedances at Buellton (13.6 Miles Downstream of Bradbury Dam) at Bottom	B-2-8
Table 2-7	Relative Abundance of Rainbow Trout/Steelhead in the Lower Santa Ynez River Basin	B-2-11
Table 3-1	Downstream Water Rights Releases[1] under WR 73-37 by Calendar Year	B-3-5
Table 3-2	Downstream Water Rights Releases[1] under WR 89-18 by Calendar Year	B-3-5
Table 3-3	Mainstem Ramping Schedule for Downstream Water Rights Releases	B-3-7
Table 3-4	Summary of Mainstem Target Flow Releases	B-3-9
Table 3-5	Long-Term Releases for Passage Supplementation (Water Years, 1958 to 1998)	B-3-19
Table 3-6	Interim Releases for Passage Supplementation (Water Years 1958 to 1998)	B-3-27
Table 3-7	Summary of Interim and Long-Term Operations for Rearing and Passage Enhancement in the Mainstem	B-3-28

Table 3-8 Allocation of Surcharged Water under the Proposed Implementation Phases B-3-29

Table 4-1 Passage Opportunities in the Santa Ynez River in Years Based on Modeled Fish Passage Account Releases B-4-5

Table 4-2 Flow and Available Spawning Habitat under Different Operation Scenarios B-4-7

Table 4-3 Rearing Habitat between Bradbury Dam and Highway 154 .... B-4-9

Table 4-4 Rearing Habitat between Highway 154 and Refugio Road B-4-11

Table 4-5 Rearing Habitat between Refugio Road and Alisal Road B-4-13

Table 4-6 Minimum Flow by Water Year (cfs) B-4-15

Page

Figure 2-1 Santa Ynez River Basin Downstream of Lake Cachuma B-2-2

Figure 3-1 Modeled Annual Releases to Meet Long-Term Mainstem Rearing Target Flows.. B-3-8

Figure 3-2 Modeled Flow at the Highway 154 Bridge under Long-Term Operations B-3-10

Figure 3-3 Modeled Flow at the Alisal Bridge under Long-Term Operations B-3-11

Figure 3-4 Average Inflow Decay Rates at the Los Laureles and Solvang Streamflow Gages... B-3-15

Figure 3-5 Gaged and Calculated Streamflow at the Solvang Gage with Passage Supplementation Releases B-3-17

Figure 3-6 Example of the 7-Day Passage Supplementation Criteria B-3-18

Figure 3-7 Modeled Flow at the Highway 154 Bridge under the Interim Operations B-3-24

Figure 3-8 Modeled Flow at the Alisal Bridge under the Interim Operations B-3-25

In August 1997, the National Marine Fisheries Service (NMFS) listed anadromous steelhead inhabiting the Southern California Evolutionarily Significant Unit (ESU), including the Santa Ynez River below Bradbury Dam, as an endangered species under the Federal Endangered Species Act. In response to this listing, the operations of the Cachuma Project (Project) were critically reviewed to identify and evaluate potential impacts on steelhead and instream habitats within the lower Santa Ynez River. Using scientific information collected through ongoing fisheries and water quality investigations, in combination with detailed analysis of historic hydrologic patterns and water project operations, modified project operations are proposed to protect steelhead and their habitat in the lower Santa Ynez River.

The U. S. Bureau of Reclamation (Reclamation) operates the Project to deliver water to the Project Member Units. Project operation includes storage and later release of water for downstream water rights as a condition of the Project's State Water Resources Control Board (SWRCB) permit. As a part of the proposed operations, some water within Lake Cachuma (Cachuma Reservoir) will be made available for the purpose of environmental protection and enhancement, including expansion of opportunities for successful passage, reproduction, and rearing of steelhead in the mainstem Santa Ynez River and Hilton Creek. Releases will maintain habitat in lower Hilton Creek, in the Santa Ynez River from Bradbury Dam to Highway 154, and in some years to Alisal Road.

The Conjunctive Use Working Group of the SYRTAC has developed water release measures. The recommendations are based upon an adaptive management strategy that will be able to respond to annual and seasonal variation in hydrologic conditions, water supply availability within the Santa Ynez River basin, and additional opportunities as they arise. The ultimate objective of the proposed actions is to promote the recovery of Santa Ynez River rainbow trout/steelhead consistent with water supply availability, project facilities, and competing demands for limited resources.

The flow-related management actions are designed to:

- protect and improve instream habitat within the mainstem Santa Ynez River;
- create opportunities for successful passage, reproduction and survival of anadromous steelhead trout; and
- avoid adverse effects on other aquatic or riparian biological resources.

The above actions have been developed in conjunction with the Project's need to (1) deliver water supplies, (2) provide for routine maintenance of existing facilities, and (3) maintain groundwater recharge requirements as set forth in water rights order WR 89-18 (downstream water rights).

Reaches of the mainstem and tributaries selected as having priority for habitat protection and improvement were identified based upon: (1) seasonal and annual instream flow patterns, (2) water temperature, and (3) quality and suitability of existing habitat. Priority habitats include Hilton Creek, the mainstem Santa Ynez River between Hilton Creek and the Highway 154 Bridge, the mainstem Santa Ynez River between Bradbury Dam and Hilton Creek and, in wet years and the year following a wet year, the mainstem down to Alisal Bridge (approximately 10.5 miles downstream of the dam).

Implementation of the proposed actions will benefit rainbow trout/steelhead both directly and indirectly by (1) increasing habitat availability and quality and (2) by improving access to good spawning and rearing habitat. The water release measures incorporated in the proposed operations to achieve these results include:

- Conjunctive use of reservoir releases and downstream water rights releases to meet mainstem rearing target flows. Conjunctive use will extend the period of time each year when instream flow improves habitat for steelhead rearing in Hilton Creek and the mainstem river. Modifications to reservoir operations will provide sustained target flows, via Hilton Creek and/or the mainstem Santa Ynez River, of 2.5 or 5 cubic feet per second (cfs) at the Highway 154 Bridge depending on reservoir elevation, or of 10 cfs at Highway 154 in years when the dam spills at least 20,000 acre-feet (AF). In addition, a target flow of 1.5 cfs will be established at Alisal Road in years when the reservoir spills at least 20,000 AF, and the year immediately following such a spill year, when steelhead are present. In critically dry years, when reservoir storage falls below 30,000 AF, periodic releases will be made to improve water quality in the mainstem pool habitat near Bradbury Dam. As a part of the proposed operation, water released for water rights will meet the mainstem target flows for part of the summer in many years. Conjunctive use of reservoir releases and water rights releases to meet rearing target flows will provide substantially more habitat below the dam in the critical late summer months than either current (Water Rights order 89-18 [WR 89-18]) or historic (no storage) conditions.

- Passage flow supplementation to increase the number and duration of passage opportunities in the mainstem Santa Ynez River. A dedicated volume of water will be made available in Lake Cachuma for the purpose of supplementing natural storm events. A Fish Passage Account will be created and allocated 3,200 AF of water in years when the reservoir surcharges to the proposed 3-foot level. The water will be released in subsequent years to increase the receding limb of natural storm hydrographs, thereby providing additional passage days for migrating steelhead.

- The creation of an Adaptive Management Account to provide additional, flow-related benefits to steelhead. The purpose of the Adaptive Management Account is to provide the management team with a dedicated volume of water (500 AF provided in years when the reservoir surcharges to the proposed 3-foot level) to be released based on biological need. The water can be used for passage flow supplementation and/or additional habitat maintenance releases into the mainstem or Hilton Creek.

- Releases made through the Hilton Creek Supplemental Water Supply System (detailed in the Hilton Creek Technical Appendix). Releases made to support mainstem habitat (*i.e*., target flows) will be made via the Hilton Creek system. The delivered water will meet specific temperature and dissolved oxygen criteria to benefit rainbow trout/steelhead. The watering system has been designed to take cool water from 60+ feet below the surface of Lake Cachuma and deliver this water to one or more of the following locations:

  (1) upper Hilton Creek release point near Reclamation property boundary, approximately 2,980 feet upstream of the Santa Ynez River;

  (2) lower Hilton Creek release point just above the chute pool, approximately 1,380 feet upstream of the river; and/or

  (3) the Stilling Basin (mainstem) release point below Bradbury Dam.

The 3-foot surcharge will support the flow-related enhancement actions summarized above: the reservoir releases for rearing target flows and the Passage and Adaptive Management accounts. It is anticipated that up to four years may be required to complete environmental review to implement the proposed 3-foot surcharge. Environmental review is already complete for an interim level surcharge of 1.8 feet. Modifications to the flashboards of the Bradbury Dam radial gates can be completed next year to allow the 1.8 foot surcharge and accommodate the 3-foot surcharge. Thus, interim rearing target flows and an interim allocation to the Fish Passage Account are included in the recommended actions.

The actions proposed here will provide opportunities for steelhead numbers in the Santa Ynez River to expand. The measures will provide a substantial net benefit compared to existing and historic conditions by increasing the amount of available habitat, increasing the quality of existing habitat, and by increasing the number of days that steelhead can migrate in the mainstem.

Rainbow trout/steelhead occur throughout the Santa Ynez River basin and its tributaries where conditions are favorable for their persistence. A description of the steelhead habitat conditions in the mainstem Santa Ynez River and Hilton Creek, a tributary to the river, is provided below. Hilton Creek is the only tributary included in this discussion because it is the only creek that will be enhanced by releases. Hilton Creek is situated immediately downstream of Bradbury Dam and therefore provided a unique opportunity for flow-related enhancement.

2.1 MAINSTEM

2.1.1 PHYSICAL HABITAT

Anadromous steelhead are currently limited to the mainstem Santa Ynez River and the accessible portion of its tributaries below Bradbury Dam (Figure 2-1). Historically, the reach of the Santa Ynez River downstream of Bradbury Dam either dried up in the summer or supported very low streamflow levels (Shapovolov 1944). Young steelhead remain in freshwater for a year or more, and summer habitat in warm climates is often in short supply. Steelhead also require cool water temperatures. Summer conditions in Santa Ynez valley can warmwater temperatures above levels suitable for young steelhead.

Prior to 1953, when the dam was constructed, steelhead likely used the mainstem below Bradbury Dam primarily for passage to more favorable spawning and rearing areas that now lie above Bradbury Dam (but below Gibraltar Dam, which was the upstream limit of migration beginning in the 1920's, when it was constructed) (Shapovalov 1944). The area below the current location of Bradbury Dam, except for a spring-fed segment near Solvang, typically went dry in the summer and therefore was not suitable spawning or rearing habitat (Shapovalov 1944). Shapovalov (1944) reports rescuing rainbow trout/steelhead from the area of the mainstem above the current location of Bradbury Dam.

Since 1953, steelhead have been restricted to the mainstem Santa Ynez River and its tributaries below Bradbury Dam. This 48-mile reach of river is characterized by a longitudinal gradient of differing habitat types. Several reaches have been delineated based on geomorphology, as well as opportunities for management (Table 2-1). The primary characteristics describing each reach include channel structure, substrate, cover and water temperature conditions. A description of the mainstem reaches follows, discussing the attributes of these reaches and their suitability for rainbow trout and steelhead.

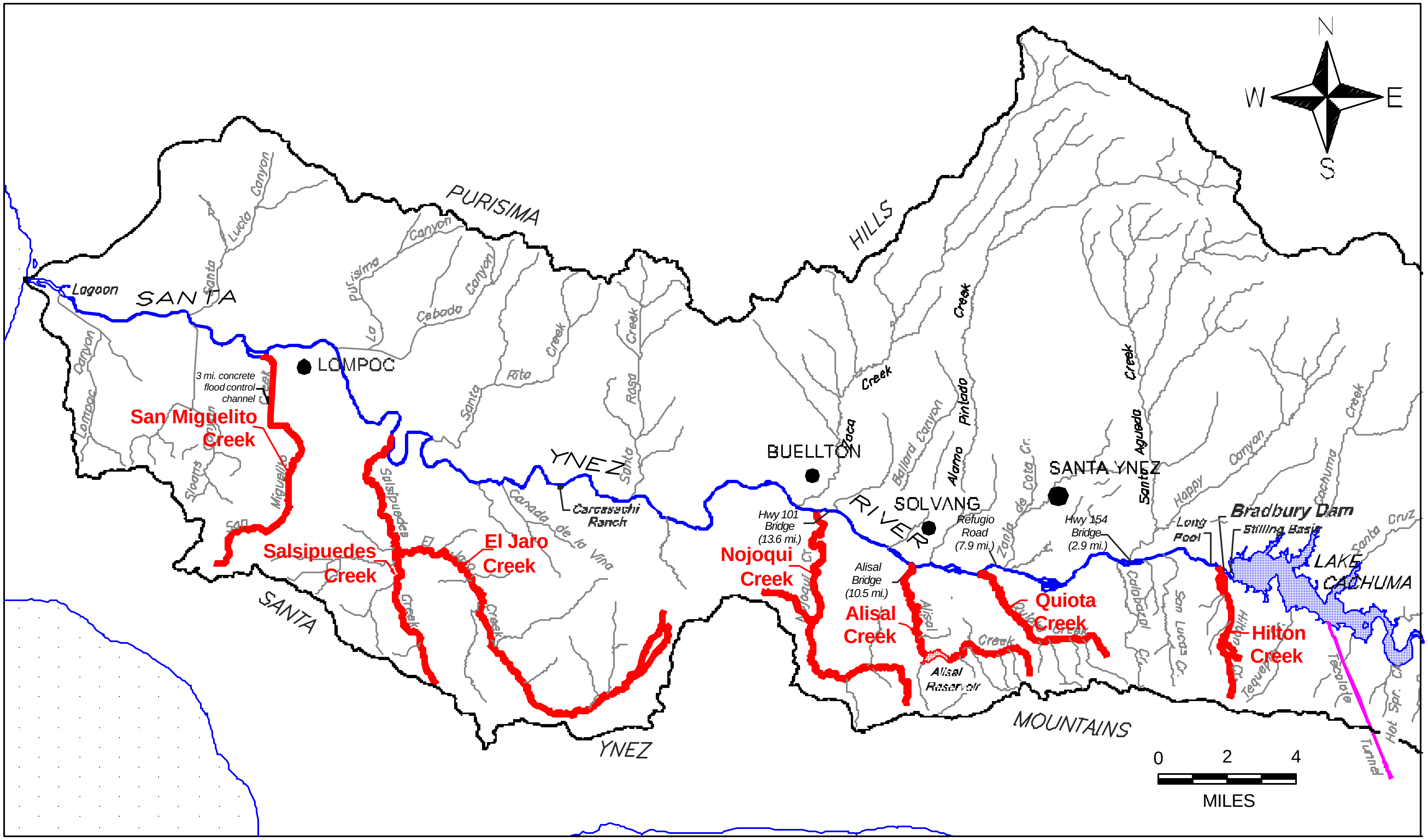

Figure 2-1 Santa Ynez River Basin Downstream of Lake Cachuma

Table 2-1 Reaches in the Lower Mainstem Santa Ynez River

Reach Name	Landmarks	Reach Length (miles)	Miles below Bradbury Dam
Highway 154	Bradbury Dam down to Highway 154 Bridge	2.9	0 - 2.9
Refugio	Highway 154 Bridge down to Refugio Road	5.0	2.9 - 7.9
Alisal	Refugio Road down to Alisal Bridge in Solvang	2.6	7.9 - 10.5
Avenue of the Flags	Alisal Bridge in Solvang down to Avenue of the Flags Bridge in Buellton	3.1	10.5 - 13.6
Buellton to Lompoc	Buellton to Highway 1 Bridge in Lompoc (includes Weister and Cargasachi study sites)	23.9	13.6 - 37.5
Below Lompoc	Highway 1 Bridge in Lompoc to lagoon	8.3	37.5 - 45.8
Lagoon	Above old 35th Street Bridge to mouth of river	2.5	45.8 - 48.3

2.1.2 Reach Descriptions

2.1.2.1 Highway 154

The Highway 154 Reach extends 2.9 miles from Bradbury Dam to the Highway 154 Bridge. The Highway 154 Reach has a more confined channel than reaches further downstream, as well as better riparian cover in general. Property access issues have limited studies in this reach to Reclamation property, which extends approximately a ¼ mile between the Stilling Basin just below Bradbury Dam to the Reclamation property boundary. Habitat mapping in March 1994 showed that this reach was dominated by pool habitat (75% by length) (Table 2-2). Most of the pools in this reach (76% of total pool length) had a maximum depth of less than 3 feet. Runs accounted for 19% of the total length, and riffles and dry channel made up 3% each. Several large and deep perennial pools are present on Reclamation property, including the Stilling Basin and the Long Pool.

Substrate consisted primarily of cobble near Bradbury Dam with increasing proportions of sand and gravel downstream. This is typical of stream reaches just below dams because sediment-starved water from the reservoir picks up small substrate and carries it downstream. Habitat mapping surveys in 1994 noted that spawning-sized gravels were of extremely limited availability within the wetted channel between Refugio Road and Bradbury Dam (ENTRIX 1995a). High-flow events in 1995 and 1998 have since resulted in additional gravels being moved into the system from Hilton Creek and other tributaries (SYRTAC data).

Table 2-2 Habitat Mapping of the Lower Mainstem Santa Ynez River

		Highway 154 Reach[1]		**Refugio Reach**[2]		**Alisal Reach**[2]	
		Length	%	Length	%	Length	%
Habitat Type	Pool	12,481	75	2,937	33	1,346	9
	Run	468	19	2,800	32	4,184	29
	Glide	*	*	1,494	17	3,859	27
	Riffle	3,088	3	1,543	18	4,991	35
	Dry Channel	554	3	*	*	*	*
	Total Length	16,591		8,774		14,380	
Survey Date		March 25, 1994		July 28, 1997		July 23, 1997	
Release from Cachuma		0 cfs[3]		92 cfs		93 cfs	
Flow		42 cfs at Solvang		86 cfs at site		72 cfs at site	

[1] ENTRIX 1995a
[2] SYRTAC 1999a
[3] Estimated flow below Hilton Creek was 4 to 6 cfs.
* Not designated. Glides are grouped with runs.

From a fisheries perspective, riparian vegetation in most areas of the lower Santa Ynez River is not well developed, and does not provide significant shading for aquatic habitats. The Highway 154 Reach has moderate canopy coverage, better than canopy cover in reaches further downstream.

Instream aquatic vegetation, mainly algae, forms in the Highway 154 Reach typically in pools. Large amounts of aquatic algae have been observed growing up from the bottom in all years since 1994. During the early part of the summer this reach appears to have less algal growth than more downstream reaches. However, by the late summer, algae becomes abundant.

Temperature monitoring and modeling results indicate that this reach of the mainstem Santa Ynez River is the only portion of the river where water temperatures remain within the tolerance limits of steelhead. Monitoring over several years reveals that generally there are only a few days in July and August where mean daily water temperatures exceed 22°C and maximum daily water temperatures exceed 25°C (Table 2-3). Several localized areas of upwelling cool water were noted in the Long Pool, which may help account for these cool water temperatures and which may also provide temperature refugia when water temperatures reach stressful levels.

2.1.2.2 Refugio Reach

The Refugio Reach is 5 miles long, extending from the Highway 154 Bridge (about 2.9 miles downstream from Bradbury) down to the Refugio Bridge (about 7.9 miles downstream from

Table 2-3 Frequency Analysis of Water Temperature Exceedances in the Long Pool at Surface

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	Average Daily >22°C	Maximum Daily >25°C	Maximum Monthly (°C)	Maximum Monthly (°F)
1995						
June	15	0	N/A	0	17.3	63.1
July	31	***11***	N/A	0	22.3	72.1
August	31	***10***	N/A	0	21.6	70.9
September	30	0	N/A	0	20.8	69.4
October	31	0	N/A	0	18.5	65.3
1996						
April	28	4	0	0	22.5	72.5
May	31	N/A	0	N/A	--	
June	30	N/A	1	N/A	--	
July	31	***18***	***17***	1	25.1	77.2
August	31	0	0	0	18.1	64.6
September	30	0	0	0	17.6	63.7
October	31	0	0	0	19.4	66.9
1997						
April	30	0	0	0	19.3	66.7
May	31	***10***	0	0	23.4	74.1
June	30	***13***	0	0	23.2	73.8
July	21	***10***	0	0	23.2	73.8
August	31	0	0	0	17.5	63.5
September	30	0	0	0	17.5	63.5
October	31	0	0	0	18	64.4

Bold/Italics: 25-74% of the monitored days exceeded criterion
Bold: 75% or more of the monitored days exceeded criterion
N/A: Unavailable
Source: SYRTAC 1997, 1998, and other SYRTAC data

Bradbury). Flows in this area often become intermittent or non- existent during the summer. Based on a large subsample of this reach, the habitat composition (percent of total length) was 33% pools, 32% runs, 17% glides, and 18% riffles (SYRTAC 1999a) (Table 2-2).

The substrate is a mix of small cobble, gravel, and fine sediment. The 1994 habitat surveys noted that spawning-sized gravels were of extremely limited availability within the wetted channel between Refugio Road and Bradbury Dam. High-flow events in 1995 and 1998 have resulted in additional gravel recruitment to this area's tributary streams. Instream cover is moderate in pools. Riparian vegetation is not well developed, and canopy coverage is low. This reach has the most extensive growths of algae compared with the other mainstem reaches.

Temperatures often exceeded 20°C daily average in summer 1995 and August 1996, but rarely exceeded a 22°C daily average (Table 2-4). A daily maximum temperature of 25°C was generally exceeded on a few days in 1995 and 1996, but was not exceeded in 1997. Temperature modeling studies suggest that temperatures in this reach could likely not be maintained on a reliable basis during most years even at flows of up to 20 cfs. In relatively cool, wet years, it may be possible to maintain suitable temperatures in some or all of this reach. Upwelling of cool groundwater, which occurs in a few habitat units, can provide a thermal refuge for fish in the summer (SYRTAC 1997, 1998, 2000).

Table 2-4 Frequency Analysis of Water Temperature Exceedances in the Refugio Reach (3.4 miles Downstream of Bradbury Dam) at Surface

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	Average Daily >22°C	Maximum Daily >25°C	Maximum Monthly (°C)	Maximum Monthly (°F)
1995						
June	16	***4***	0	0	23.9	75.0
July	31	**26**	5	6	26.4	79.5
August	31	**29**	**9**	***9***	26.5	79.7
September	30	**25**	0	1	25.0	77.0
October	31	1	0	0	24.1	75.4
1996						
July	12	2	0	1	24.7	76.5
August	31	**23**	2	***8***	27.2	81.0
September	30	***9***	0	***9***	26.6	79.9
October	31	***8***	0	6	25.4	77.7
1997						
April	30	0	N/A	0		
May	0	0	N/A	0	Dry	
June	0	0	0	0	Dry	
July	14	0	0	0	23.0	73.4
August	15	***6***	0	0	24.9	76.8
September	30	7	0	0	23.8	74.8
October	31	0	0	0	22.2	72.0

Bold/Italics: 25-74% of the monitored days exceeded criterion
Bold: 75% or more of the monitored days exceeded criterion
N/A: Data not available
Source: SYRTAC 1997, 1998, and other SYRTAC data

2.1.2.3 Alisal Reach

The Alisal Reach extends about 2.6 miles from the Refugio Road Bridge (7.9 miles downstream from Bradbury) to the Alisal Road Bridge in Solvang (approximately 10.5 miles downstream from Bradbury). Quiota and Alisal creeks join the mainstem Santa Ynez River in this reach. Flows generally become non-existent during the summer and fall months except in very wet years. The habitat composition of this reach (percent of total length) is 35% riffles, 29% runs, 27% glides, and only 9% pools (Table 2-2) (SYRTAC 1999).

The substrate is small cobble, gravel, and fine sediments. As with the Refugio Reach, riparian vegetation is not well developed, and canopy coverage is poor. Floating mats of algae can be extensive in the summer. In July 1995, algal mats covered an average of 60% of the aquatic habitat surface area in Alisal Reach. Although algal mats declined or disappeared during the winter of 1995 to 1996, they were again extensive by early summer 1996. In August 1996, following initiation of downstream water rights releases from Bradbury Dam, algae were not observed in any of the habitats where snorkel surveys were conducted. In June 1997, algal mats were again prevalent in monitored pools (25% to 70% cover).

The Alisal Reach is the downstream most extent to which steelhead have been observed on a regular basis in the mainstem. Generally a few adults may be found in the thermal refugia in this portion of the river, but numbers are typically sparse.

Temperature monitoring in 1995 through 1997 shows that mean daily temperatures in this reach generally exceeded 20°C in all years from June through September and often exceeded 22°C in July or August (Table 2-5). Maximum daily temperatures exceeded 25°C in more than 75% of days in August in 1996 and 1997. Temperature modeling results indicate that temperatures suitable for steelhead cannot be maintained in this portion of the river on a reliable basis, even with flow releases of up to 20 cfs (Woodward-Clyde Consultants *et al.,* 1995, SYRTAC 1997). Upwelling of cool groundwater, which occurs in a few habitat units, can provide a thermal refuge for fish in the summer (SYRTAC 1997).

Table 2-5 Frequency Analysis of Water Temperature Exceedances at the Alisal Bridge (9.5 miles Downstream of Bradbury Dam) at Surface

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	Average Daily >22°C	Maximum Daily >25°C	Maximum Monthly (°C)	Maximum Monthly (°F)
1995						
July	7	**7**	**6**	7	26.4	79.5
August	31	**31**	7	7	26.3	79.3
September	30	***9***	0	0	22.8	73.0
October	31	***5***	0	0	22.0	71.6
1996						
May	28	***7***	0	2	25.6	78.1
June	30	**28**	2	***17***	28.0	82.4
July	31	**31**	***23***	**30**	28.2	82.8
August	31	**30**	***11***	**30**	28.0	82.4
September	30	**30**	7	***22***	27.5	81.5
October	31	***15***	0	9	26.3	79.3
1997						
April	30	3	0	2	25.1	77.2
May	6	***2***	5	***2***	25.8	78.4
June	30	***19***	7	***8***	26.6	79.9
July	31	**30**	***8***	***16***	26.5	79.7
August	31	**31**	27	**27**	27.9	82.2
September	30	**30**	9	***15***	27.7	81.9
October	31	6	N/A	2	25.8	78.4

Bold/Italics 25-74% of the monitored days exceeded criterion
Bold 75% or more of the monitored days exceeded criterion
N/A: Not available Source: SYRTAC 1997, 1998, and other SYRTAC data

2.1.2.4 Avenue of the Flags

The Avenue of the Flags Reach extends 3.1 miles, from Alisal Road Bridge down to the Avenue of the Flags Bridge in Buellton (about 13.6 miles downstream from Bradbury). The habitat is almost exclusively run. Substrate here is typically sand and gravel. This reach is essentially devoid of canopy cover (SYRTAC 1998). Water temperatures at Buellton are potentially adverse or lethal for steelhead, with nearly all summer days exceeding 20°C, many days exceeding 22°C average daily in July through September, and a significant proportion of days exceeding 25°C daily maximum in July and August (Table 2-6).

Table 2-6 Frequency Analysis of Water Temperature Exceedances at Buellton (13.6 Miles Downstream of Bradbury Dam) at Bottom

MONTH	NO. DAYS MONITORED	FREQUENCY (DAYS)				
		Average Daily >20°C	**Average Daily >22°C**	**Maximum Daily >25°C**	**Maximum Monthly (°C)**	**Maximum Monthly (°F)**
1995						
May	28	0	0	0	24.1	75.4
June	30	16	6	***10***	27.3	81.1
July	31	31	10	***14***	26.4	79.5
August	31	16	2	1	25.0	77.0
September	30	0	0	0	21.6	70.9
October	31	0	0	0	22.4	72.3
1996						
April	30	5	N/A	0	24.8	76.6
May	27	0	0	0	20.6	69.1
June	30	**23**	0	0	22.6	72.7
July	31	**30**	14	***10***	27.6	81.7
August	31	**30**	16	**29**	28.1	82.6
September	30	**30**	5	2	25.0	77.0
October	31	***14***	0	0	22.4	72.3
1997						
May	24	0	0	0	22.3	72.1
June	30	**24**	0	0	22.6	72.7
July	31	**28**	7	0	24.3	75.7
August	31	**31**	**26**	***12***	26.6	79.9
September	30	**30**	***15***	0	24.8	76.6
October	31	6	0	0	22.9	73.2

Bold/Italics 25-74% of the monitored days exceeded criterion
Bold 75% or more of the monitored days exceeded criterion
N/A Data not available
Source: SYRTAC 1997, 1998, and other SYRTAC data

2.1.2.5 Buellton to Lompoc

The mainstem between Buellton and Lompoc (about 37.5 miles downstream from Bradbury at the Highway 1 Bridge) extends 23.9 miles and includes the Weister Reach (about 16 miles downstream from Bradbury) and the Cargasachi Reach (a 1.5-mile reach about 24 miles downstream from Bradbury). Upstream of Lompoc, near the confluence with Salsipuedes Creek (about 30 miles downstream from the dam), the channel is broad and braided, with little shading. In the 1995 survey, runs are the dominant habitat type, with some riffles and few pools (SYRTAC 1997). Substrate is mainly sand and small gravel. Canopy cover and instream cover is minimal. Coverage from algal mats in July 1995 was lower compared to the Refugio and Alisal reaches. In early summer 1996, algal mats were extensive in the Cargasachi Reach, but were absent in August following initiation of downstream water rights releases.

2.1.2.6 Below Lompoc

This reach extends about 8.3 miles from the Highway 1 Bridge in Lompoc (37.5 miles downstream of Bradbury Dam) down to the lagoon. Habitat surveys in March 1994 of the two miles below the Lompoc Wastewater Treatment Facility found the reach dominated by deep pools formed by numerous beaver ponds (50% of length) (ENTRIX 1995a). Runs were also extensive, accounting for 37% of the reach, while shallow pools (maximum depth less than 3 feet deep) and riffles accounted for 12% and 1%, respectively.

Downstream of Bailey Avenue in Lompoc, progressively greater concentrations of riparian vegetation occur, including extensive growths of willows, both along the sides and within the river channel. The growth of willows and other vegetation in this area is supported by freshwater (treated effluent) releases to the channel from the Lompoc Wastewater Treatment Facility. Substrate in the area is typically sand and fine silt.

2.1.2.7 Lagoon

The lagoon is located at the mouth of the Santa Ynez River, about 9 miles west-northwest of the town of Lompoc, California. The lagoon typically forms as flows decline after the winter runoff period when the mouth of the river is filled with sand deposited by both the river and by the strong longitudinal drift of sand from north to south along the shoreline. High winter river flows are capable of opening an outlet. Low summer flows are typically insufficient to keep the outlet open, although inflow from the Lompoc treatment facility and wave action can breach this barrier (Engblom, pers. comm.).

The lagoon is about 13,000 feet long, with an average width of about 300 feet. Near the beach, it is substantially wider than at the upstream end. The average water depth is about 4 feet, and the water surface elevation during the July 1994 sampling period, with the mouth closed, was almost 5 feet MSL. The volume of water stored in the closed lagoon is approximately 300 AF. The lagoon supports the growth of emergent aquatic vegetation along the margins, but the majority of the lagoon is open water. Substrate in the lagoon typically consists of sand and silt.

The lagoon represents a unique habitat characterized by saltwater/freshwater mixing. Water quality within the lagoon, particularly salinity, has a major influence on the distribution of fish and macroinvertebrates inhabiting this area of the system. Vertical gradients in water temperature, dissolved oxygen, and salinity were observed within deeper areas of the lagoon during periods when the lagoon mouth was closed. Vertical stratification in water quality parameters varied substantially between locations and survey periods. Dissolved oxygen concentrations were generally greater than 5 mg/l in the upper three quarters of the water column during months when stratification within the lagoon had developed. The lower one quarter of the water column had dissolved oxygen levels less than 4 mg/l, with concentrations less than 1 mg/l within 1 foot of the bottom at most locations.

Average daily and maximum daily water temperatures within the lagoon during the summer were usually lower than water temperatures measured at upstream monitoring locations, with the exception of locations immediately downstream of Bradbury Dam (SYRTAC 1997). Surface and bottom temperatures frequently exceeded 20°C average daily but never exceeded 25°C from May to September (SYRTAC 1997).

Salinity levels within the lagoon followed a consistent longitudinal pattern, with salinity near brackish/full strength seawater at Ocean Park, decreasing to freshwater at the upstream location. Salinity level varied at each site between months, reflecting seasonal variation in the balance between freshwater inflow and tidal influence. Higher salinity concentrations were observed at high tide at all three sites monitored, particularly when the Lagoon mouth was open.

2.1.3 DISSOLVED OXYGEN MONITORING

Dissolved oxygen concentrations are an important component of habitat for steelhead and rainbow trout. Among the most profound influences on dissolved oxygen concentrations are algal concentrations and mixing. Algal concentrations have been observed to be high in all reaches of the mainstem from late spring to early fall. Large diel fluctuations in dissolved oxygen concentrations have been linked to high algal concentrations in studies conducted by the SYRTAC (1997, 1998). In these studies, dissolved oxygen concentrations were monitored in mainstem pools at times when algae was and was not present (SYRTAC 1997, 1998). Dissolved oxygen levels were good during the day (>5 mg/l), regardless of algal cover. Pre-dawn surveys found that concentrations were acceptable when algae was not present (usually about 6 to 9 mg/l); however, when algae was present, dissolved oxygen concentrations in some pools dropped to as low as 1 to 3 mg/l. Dissolved oxygen concentrations this low would be expected to result in stress and possible mortality to steelhead. Steelhead are likely to respond by seeking out microhabitats having more oxygen, such as a riffle, where the water is better aerated. Observations indicate that large accumulations of algae are removed from pools when WR 89-18 releases are made. These releases flush the algae out of the pools, resulting in better dissolved oxygen concentrations.

2.1.4 STEELHEAD USE OF THE MAINSTEM

SYRTAC studies conducted from 1993 to 2000 have documented rainbow trout/steelhead in the mainstem Santa Ynez River downstream of Lake Cachuma (Table 2-7). These studies have occurred during wet and average periods, therefore, results probably do not reflect distribution and relative abundance in dry years.

Table 2-7 Relative Abundance of Rainbow Trout/Steelhead in the Lower Santa Ynez River Basin

		Young-of-the-year				
Mainstem Reach	**Miles below Bradbury**	1995 Wet	1996 Average	1997 Average	1998 Wet	1999 Average
Highway 154 Reach	0-0.5	3-36	0	0	239	5
Refugio Reach	3.4-7.9	0	0	0	686	0
Alisal Reach	8-10.5	0	0	0	244	0
Avenue of the Flags Reach	14	0	0	0	0	0
Weister Ranch Reach	16	0	0	0	0	0
Santa Rosa Park Reach	20	0	0	0	0	0
Cargasaschi Reach	24	0	0	0	0	0

		Juveniles				
Mainstem Reach	**Miles below Bradbury**	1995 Wet	1996 Average	1997 Average	1998 Wet	1999 Average
Highway 154 Reach	0-0.5	10-31	3	23	5	6
Refugio Reach	3.4-7.9	1-8	0	0	5	8
Alisal Reach	8-10.5	1-14	0	0	0	48
Avenue of the Flags Reach	14	0	0	0	0	0
Weister Ranch Reach	16	0	0	0	0	0
Santa Rosa Park Reach	20	0	0	0	0	0
Cargasaschi Reach	24	0	0	0	0	0

		Adults				
Mainstem Reach	**Miles below Bradbury**	1995 Wet	1996 Average	1997 Average	1998 Wet	1999 Average
Highway 154 Reach	0-0.5	52-84	23	5	48	44
Refugio Reach	3.4-7.9	4-43	1-15	0	29	1
Alisal Reach	8-10.5	20-38	8-42	1	24	6
Avenue of the Flags Reach	14	1	0	0	0	NS
Weister Ranch Reach	16		0	0	0	NS
Santa Rosa Park Reach	20	0	0	0	15	NS
Cargasaschi Reach	24	0	0	0	0	NS

WY Water Year (October 1-September 30)
NS Not sampled
P Not sampled by snorkeling survey, but presence observed from bank.
Hyphenated values represent the range of fish numbers observed when multiple surveys were conducted.
Data are not standardized to a particular unit (*e.g.* length of stream) although the methods for data collection are.
Data from snorkel surveys in summer and fall, 1995-1999 (SYRTAC 1997, 1998, 2000; Engblom pers. comm.).

Spawning activity has been observed in the mainstem directly downstream of Bradbury Dam in nearly every year of the SYRTAC studies (SYRTAC 1997, 1998, 2000), but no redds were reported in 1997 (SYRTAC 1998). While no spawning has been observed downstream of the Highway 154 Reach, redds have been observed in the Refugio Reach in 1999 and in the Alisal Reach in 2000 (SYRTAC 2000, other data). In addition, young-of-the-year have been documented in the Refugio and Alisal reaches in 1995 and 1998, both very wet years.

2.2 HILTON CREEK

Hilton Creek is a small, intermittent stream located immediately downstream of Bradbury Dam. In general, steelhead are known to migrate to the uppermost accessible reaches in a river seeking spawning habitat. Adults migrating up the Santa Ynez River are blocked by Bradbury Dam and must find spawning habitat downstream of the dam. Hilton Creek currently provides the most upstream, tributary spawning habitat available to anadromous fish in the lower Santa Ynez basin. It is included here because proposed flow-related enhancement releases will be discharged into Hilton Creek through the supplemental watering system. Please refer to *Appendix C, Tributaries of the Santa Ynez River below Bradbury Dam* and *Appendix D, Hilton Creek Enhancement* for a more detailed description of Hilton Creek and the supplemental facility.

2.2.1 PHYSICAL HABITAT

The watershed of Hilton Creek is estimated at approximately 4 square miles, and approximately 2,980 feet of the creek is on Reclamation property, including the confluence with the Santa Ynez River. The lower reach of Hilton Creek (downstream of the Highway 154 crossing) is high gradient and well confined. The channel is shaded by riparian vegetation and the walls of the incised channel. Habitat mapping in 1998 classified the stream below the chute pool (located approximately 1,380 feet upstream of the confluence) as 58% run, 27% riffle/cascade, and 15% pool (SYRTAC 2000). Surveys upstream of the chute pool to the Reclamation property boundary (1,553 feet total) documented 34% run, 61% riffle/cascade, and 5% pool (SYRTAC 2000). Most pools had suitable spawning habitat at their tails.

Thermograph data, coupled with observations throughout the year, indicate that water temperatures are generally suitable for over-summering steelhead, although temperatures may occasionally reach stressful levels for a few days in some years. Water temperatures are lowest at the upper Reclamation property boundary, with gradual warming occurring towards the mouth of the creek. Dissolved oxygen concentrations are suitable for rainbow trout/steelhead (>5 mg/l) when water is flowing in the creek. Channel disturbance and water quality problems appear to be minimal. Hilton Creek clears quickly even after several days of rain.

2.2.2 STEELHEAD USE OF HILTON CREEK

Hilton Creek is inhabited by rainbow trout/steelhead up to the chute pool (1,380 feet upstream of its confluence with the Santa Ynez River). Prickly sculpin are found to about 800 feet upstream from the mainstem and no introduced warmwater species, such as bass, bullhead or sunfish, are found in Hilton Creek.

Adult passage to upper Hilton Creek is hampered first by a cascade and bedrock chute (just upstream of the chute pool) and then completely blocked at a culvert at the Highway 154 crossing (about 4,200 feet upstream from the confluence). Spawning is generally more common in the upper sections of the accessible reach. No spawning or young-of-the-year have been observed above the cascade to the Reclamation property boundary (about 2,980 feet upstream from the mainstem). Anecdotal reports indicate that trout were historically present in upper Hilton Creek above the Highway 154 Culvert prior to the Refugio Fire in 1955.

Adult rainbow trout/steelhead have been documented migrating into Hilton Creek in all years that observations have been made, but numbers were low in years with low winter runoff. Production has been especially good during high runoff years such as 1995 and 1998, when many adults enter the creek. Adults migrating into Hilton Creek are often large and could be anadromous steelhead from the ocean (particularly in wet years), rainbow trout that spilled over from Lake Cachuma, or fish that are resident in the river, its tributaries or the lagoon (SYRTAC 1997). Because the stream goes dry during the summer, young-of-the-year cannot complete rearing in lower Hilton Creek under natural conditions (SYRTAC 1997, 1998, 2000). The fish are either stranded or must enter the mainstem where they are exposed to predatory bass and catfish. Fish rescue operations saved over 220 young-of-the-year and 5 adults in 1995 and 831 young-of-the-year (up to 100 mm) and 3 adults in 1998, the two years when rescues have been performed.

3.1 PURPOSE

The flow-related fish enhancement measures described in this appendix were created to improve fish passage to the mainstem and tributaries near Bradbury Dam and provide additional rearing habitat in this area. Releases have been designed to provide continuous flows in Hilton Creek and the mainstem of the Santa Ynez River between the mouth of Hilton Creek and the Highway 154 Bridge in almost all years. Flow will also be maintained at Alisal Road in spill years and the year following a spill year. Releases may also be made into the Stilling Basin, likely to occur in wet years, to improve habitat in the short reach between the dam and the mouth of Hilton Creek. Finally, releases will be made into the mainstem to provide additional passage opportunities for migrating steelhead. This section describes how releases will be made to enhance the fishery in the lower Santa Ynez River.

3.2 LAKE CACHUMA SURCHARGE

The storage capacity in Lake Cachuma can be increased by installing higher flashboards on the spillway radial gates at Bradbury Dam that will allow surcharging of the reservoir. The additional water stored will support the flow-related enhancement measures. Currently, Reclamation can surcharge Lake Cachuma to 0.75 feet above the reservoir full level at elevation 750 feet. A 0.75 foot surcharge yields approximately 2,300 AF of additional storage in Lake Cachuma in years when the reservoir spills. About 5,500 AF of storage is provided by a 1.8 foot surcharge. A surcharge of 3 feet would provide conservation storage of about 9,200 AF over that available at the 750 foot elevation. Operations modeling for the 1918 to 1993 period of record indicates that the 3-foot surcharge, proposed here for long-term operations, would likely occur in 24 out of the 76 years (32% of years).

For the higher levels of surcharge to occur (1.8 and 3 feet), environmental review must be completed, flashboards for the existing spillway gates must be modified, and there must be an opportunity to surcharge the reservoir. Reclamation has already determined that it is feasible, from an engineering perspective, to make the appropriate spillway gate modifications for either the 1.8 or 3-foot surcharge (Reclamation 1998). Surcharging the reservoir to 1.8 feet was evaluated in the EIR/EIS for the Cachuma Reservoir Contract Renewal (Woodward-Clyde Consultants 1995) and determined to have no significant impact. Surcharging the reservoir to a level higher than 1.8 feet (*i.e*., elevation 753 feet) will require disclosure of potential effects on the human environment, including temporary flooding of some county park facilities, and effects on sensitive resources such as oak trees (NEPA compliance). Evaluation of potential effects on the human environment, under NEPA, for the proposed 3-foot surcharge will be evaluated by Reclamation. CEQA review will be accomplished by the EIR currently in process by the SWRCB. It is anticipated that construction of the flashboard modifications required to allow the 1.8 foot surcharge will be completed next year. These modified flashboards will also accommodate the 3 foot surcharge once environmental review is complete.

The long-term operations described below will begin once the reservoir has surcharged to the proposed 3-foot level for the first time, thus storing an additional 9,200 AF of water to support the actions. Reclamation has proposed operations changes to benefit steelhead and their habitat in the interim period prior to implementation of the proposed 3-foot surcharge. Reclamation anticipates that the environmental review and construction required to implement the proposed 3-foot surcharge will be in place by 2004 with the implementation of long-term operations expected in 2005, should sufficient rain occur to allow for surcharge in this year.

Sections 3.3 through 3.5 present the long-term releases proposed for fish enhancement (long-term operations). Section 3.6 presents those actions that will be taken in the interim prior to surcharging the reservoir to the 3-foot level required for implementation of the long-term operations. In addition to the flow-related enhancement measures, a number of conservation measures will be implemented as described in Appendices C and D, and a long-term monitoring program will also be included to assist in the adaptive management and evaluation of the program (Appendix I).

3.3 CONJUNCTIVE USE OF RESERVOIR RELEASES AND DOWNSTREAM WATER RIGHTS RELEASES TO MEET MAINSTEM REARING TARGET FLOWS

The objective of conjunctive operations is to extend the period of time each year when instream flows improve fisheries habitat for over-summering and juvenile rearing within the mainstem river and Hilton Creek. As a part of the Project operations, water will be made available within Lake Cachuma for the purpose of environmental protection and enhancement of habitat downstream of Bradbury Dam. Mainstem target flow levels have been designed to reflect annual and inter-annual variations in hydrologic conditions.

First priority for flow enhancement will be given to Hilton Creek and the reach from the Hilton Creek confluence to Highway 154. The second priority will be the area between Bradbury Dam and the Hilton Creek confluence, including the Stilling Basin and Long Pool, and third priority is given to the mainstem downstream from Highway 154 to the Solvang area. These priorities have been established based on the quality of existing habitat, the results of extensive water temperature monitoring and modeling, and the likelihood for successful protection and improvement of steelhead use. Temperature monitoring and modeling suggest that improved temperature conditions will not extend beyond the Highway 154 Bridge.

Target flows will be established in the mainstem and will vary in order to provide greater biological benefit. In years of higher flow, the mouth of the estuary will open, and steelhead will be able to migrate up the mainstem to spawn. Under the proposed target flows, more water is provided in these years which are expected to be highly productive. In years of lower flow, the mouth may not open, and migration up the mainstem may not be possible; but fish holding over from previous years must be sustained. Lower target flows are set to provide habitat maintenance flows for these rearing fish. By having a variable mainstem target flow, more water is available when it will support the most steelhead.

During winter runoff seasons, natural flow from tributaries generally provides instream flow in the mainstem of the Santa Ynez River. In wet years, instream flows continue into early summer. In addition, spills from Lake Cachuma tend to enhance and prolong the instream flows in the mainstem in wet years. Water rights releases are made during the spring, summer, and/or fall of most average and dry years. Additional reservoir releases will augment natural flow and water rights releases to meet rearing target flows that have been set at two locations in the mainstem. Releases to meet the target flows will be managed to extend the period of time when instream flows improve fisheries habitat for oversummering and juvenile rearing. Targets will be set at the Highway 154 Bridge in all but the driest of years and at the Alisal Road Bridge in spill years and the year following a spill year.

In general, managed releases provide opportunities for improved maintenance of fisheries habitat over longer periods of time than have occurred in the past several decades. These releases can be made from the Bradbury Dam outlet and/or via the Hilton Creek supplemental water supply facility. Benefits can include an increased amount of aquatic habitat, improved dissolved oxygen conditions from flushing of accumulated algae, and generally reduced water temperatures in habitat close to Bradbury Dam. Conjunctive operation of reservoir releases and water rights releases to meet mainstem rearing target flows will be made to improve habitat conditions *year-round* in all but the driest (2%) of years. The releases will build the rainbow trout/steelhead population during wet years, while maintaining the rainbow trout/steelhead population and other fishery resources in dry years.

3.3.1 DOWNSTREAM WATER RIGHTS RELEASES

Releases are made from Bradbury Dam to meet downstream water rights requirements (WR 89-18). These releases are typically made during the late spring and/or summer and early fall, using flow patterns designed to recharge the groundwater basin between Bradbury Dam and the Lompoc Narrows and the Lompoc groundwater basin. Mainstem rearing flow targets will be met and surpassed during water rights releases. The majority of the flow will be released through the Bradbury Dam outlet works, although a small portion may go via the Hilton Creek system. The conjunctive operation will occur through coordination among Reclamation, the Adaptive Management Committee, and Santa Ynez River Water Conservation District (SYRWCD), which has committed to participate in conjunctive use operations.

3.3.1.1 Water Rights Releases

SWRCB Order WR 73-37, as amended in Order WR 89-18, established requirements for the release of water from Lake Cachuma intended to offset the impacts of the Cachuma Project upon downstream water right holders. These releases from Lake Cachuma are structured on two water storage accounts in Lake Cachuma, one for the area above the Lompoc Narrows (Above Narrows, ANA) and one for the area below the Narrows (BNA).

The credits to the two accounts are determined based on the impairment in the amount of natural replenishment from the Santa Ynez River to the groundwater basins downstream of Bradbury Dam caused by the operation of Lake Cachuma. The ANA credits are calculated based on surface water observations and groundwater depletion in the above Narrows basin. The BNA credits are calculated based on constructive flows at the Narrows and constructive percolation from the Santa Ynez River in the Lompoc basin.

The amendments to WR 73-37, as ordered under WR 89-18, significantly increased the below Narrows releases for the Lompoc area, resulting in an operation benefiting both the above and below Narrows areas. Therefore, historical releases under WR 73-37 cannot represent the present release regime under WR 89-18. Table 3-1 and Table 3-2 show the historic releases at Bradbury Dam for the above and below Narrows areas under WR 73-37 and WR 89-18, respectively.

Downstream releases are typically not made in wet years because the groundwater basins are replenished by precipitation and runoff in the Santa Ynez River. In dry years, there are generally two or three periods of releases to provide water to the users in the above Narrows area. In normal years and in some dry years, depending on hydrologic conditions and availability of water in the ANA and BNA, combined releases are made to replenish the groundwater basins in the above and below Narrows areas. Downstream water rights releases are made when the Santa Ynez River bed is dry and water levels in the groundwater basins have receded so that there is at least 10,000 AF of dewatered storage available in the above Narrows basin. The duration and rate (including initial rate) of releases varies depending on whether water is released for the purpose of recharging only the above Narrows area or both the above and below Narrows areas together. For example, combined releases for the above and below Narrows areas may begin at the rate of 135 cfs to 150 cfs and are maintained at a steady rate for about 12 to 15 days before they are gradually decreased to lower flow rates. During the initial period of 12 to 15 days, the flow moves at a rate of less than 3 miles per day. As the recharge rate decreases in the river bed, the release rate is also gradually reduced depending on groundwater levels. In essence, the release rates are maintained at such rates that water would disappear in the lower reaches of the Santa Ynez River channel. Thus, water rights releases do not create a continuous channel to the ocean nor are releases made when continuous flow exists. The reduced releases could extend two to three months and then are gradually ramped down to match scheduled releases to meet mainstem target flows.

Table 3-1 Downstream Water Rights Releases[1] under WR 73-37 by Calendar Year

Calendar Year	ANA Release	BNA Release	Total Release
1974	1,353	0	1,353
1975	1,152	0	1,152
1976	4,237	0	4,237
1977	2,299	0	2,299
1978	56	0	56
1979	1,200	0	1,200
1980	0	0	0
1981	4,175	0	4,175
1982	6,655	755	7,410
1983	0	0	0
1984	3,162	0	3,162
1985	5,686	0	5,686
1986	5,317	1,780	7,097
1987	3,887	0	3,887
1988	5,050	1,283	6,333

[1](Acre Feet)

Table 3-2 Downstream Water Rights Releases[1] under WR 89-18 by Calendar Year

Calendar Year	ANA Release	BNA Release	Total Release
1989	5,192	0	5,192
1990	4,792	0	4,792
1991	7,745	3,638	11,383
1992	4,930	3,287	8,217
1993	0	0	0
1994	6,727	4,012	10,739
1995	0	0	0
1996	7,319	3,459	10,778
1997	9,522	3,438	12,960
1998	0	0	0
1999	0	0	0

[1] (Acre Feet)

Releases for the above Narrows areas are made for shorter durations and lower initial rates compared to the combined releases described above, but they follow the same principles.

3.3.1.2 CCWA Deliveries and Releases

In 1997, deliveries of water from the State Water Project (SWP) were started to the Santa Ynez River Water Conservation District, Improvement District Number 1 (ID #1) and Lake Cachuma. As part of the project, the pipeline that formerly delivered the Cachuma Project entitlement to ID #1 was purchased and improved by the Central Coast Water Authority (CCWA) to convey SWP water in through the outlet works in the dam and into the reservoir. This water is available for later conveyance to the South Coast. ID #1 will receive treated SWP water in exchange for ID #1's Cachuma Project entitlement.

The CCWA pumping facility has a maximum capacity of 22 cfs. When a downstream release coincides with a SWP water delivery, and the releases is greater than the 10 cfs design capacity of the Hilton Creek system, SWP water will be blended in the outlet works with Lake Cachuma water and released to the river. For fisheries purposes, CCWA has agreed to guarantee a released water temperature of less than 18°C when SWP water is to be released into the river downstream of the dam. In addition, the SWP water will not comprise more than half of the water to be released into the river. CCWA water will not be released into the Santa Ynez River when there is continuous flow from the dam to the ocean during the months of December through June (NMFS 2000). This provision will prevent smolts that could migrate to the ocean from potentially imprinting on non-Santa Ynez River basin water. Because downstream water rights releases are made only when there is discontinuous flow in the Santa Ynez River mainstem, the provision will have no impact on water rights releases.

3.3.1.3 Mainstem Ramping

Operation of water rights releases will be managed to avoid stranding of rainbow trout/steelhead and other fish species. Since 1994, water rights releases have been ramped down voluntarily at the termination of the WR 89-18 releases in accordance with recommendations of the Biological Subcommittee of the SYRTAC. This practice will be continued under the proposed operations using the ramping schedule outlined in Table 3-3. A schedule for ramping flows upward is unnecessary as the travel time of water in the river will attenuate the rate of increase as described above.

3.3.2 MAINSTEM REARING TARGET FLOWS

Target flows for rainbow trout/steelhead rearing and over-summering will be established at two locations: at the Highway 154 Bridge and at the Alisal Bridge (Figure 2-1). Releases up to the system capacity (designed for 10 cfs) will be made from the Hilton Creek supplemental watering system to meet these targets. The supplemental system has the ability to make these

Table 3-3 Mainstem Ramping Schedule for Downstream Water Rights Releases

Release Rate (cfs)	Maximum Ramping Increment (cfs)	Minimum Ramping Frequency
> 90	25	4 hours
90 to 30	10	4 hours
30 to 10	5	4 hours
10 to 5	2.5	4 hours
5 to 3.5	1.5	4 hours
3.5 to 2.5	1	4 hours

releases to both Hilton Creek and/or the Stilling Basin based upon the criteria described in the Hilton Creek Appendix (Appendix D). In years when the lake spills (when the storage in Lake Cachuma is above 120,000 AF) and the spill amount exceeds 20,000 AF, a target flow of 10 cfs at the Highway 154 Bridge will be set. When the lake does not spill, or the spill amount is less than 20,000 AF, and the storage in Lake Cachuma exceeds 120,000 AF, then a target flow of 5 cfs will be maintained. When lake storage recedes below 120,000 AF, the target flow at the Highway 154 Bridge will be 2.5 cfs. When reservoir storage determines the target flow, storage will be assessed at the beginning of each month and the target flow set accordingly. In critical drought years (Lake Cachuma storage ≤30,000 AF), periodic releases from Bradbury Dam will be made to improve water quality in the Stilling Basin and the Long Pool. Thirty AF per month will be reserved to provide refreshing flows. In these years, Reclamation will consult with NMFS to determine what actions will be taken to protect steelhead in lower Hilton Creek and the mainstem reaches (NMFS 2000). These flow targets are summarized in Table 3-4.

In addition to the Highway 154 Bridge targets, flow targets will be established at the Alisal Bridge. In years when the Lake Cachuma spill amount exceeds 20,000 AF and steelhead are present in the Alisal Reach, a target flow of 1.5 cfs will be maintained at the Alisal Bridge. A 1.5 cfs target will also be maintained at this location in the year immediately following a spill year (a year with the spill amount exceeding 20,000 AF) if steelhead are present in the Alisal Reach.

Figure 3-1 shows what the annual releases would have been to meet the established mainstem target flows based on Santa Ynez River model runs from 1918 to 1993. The model analysis shows that the average release for habitat maintenance would have been approximately 2,290 AF under the proposed operations.

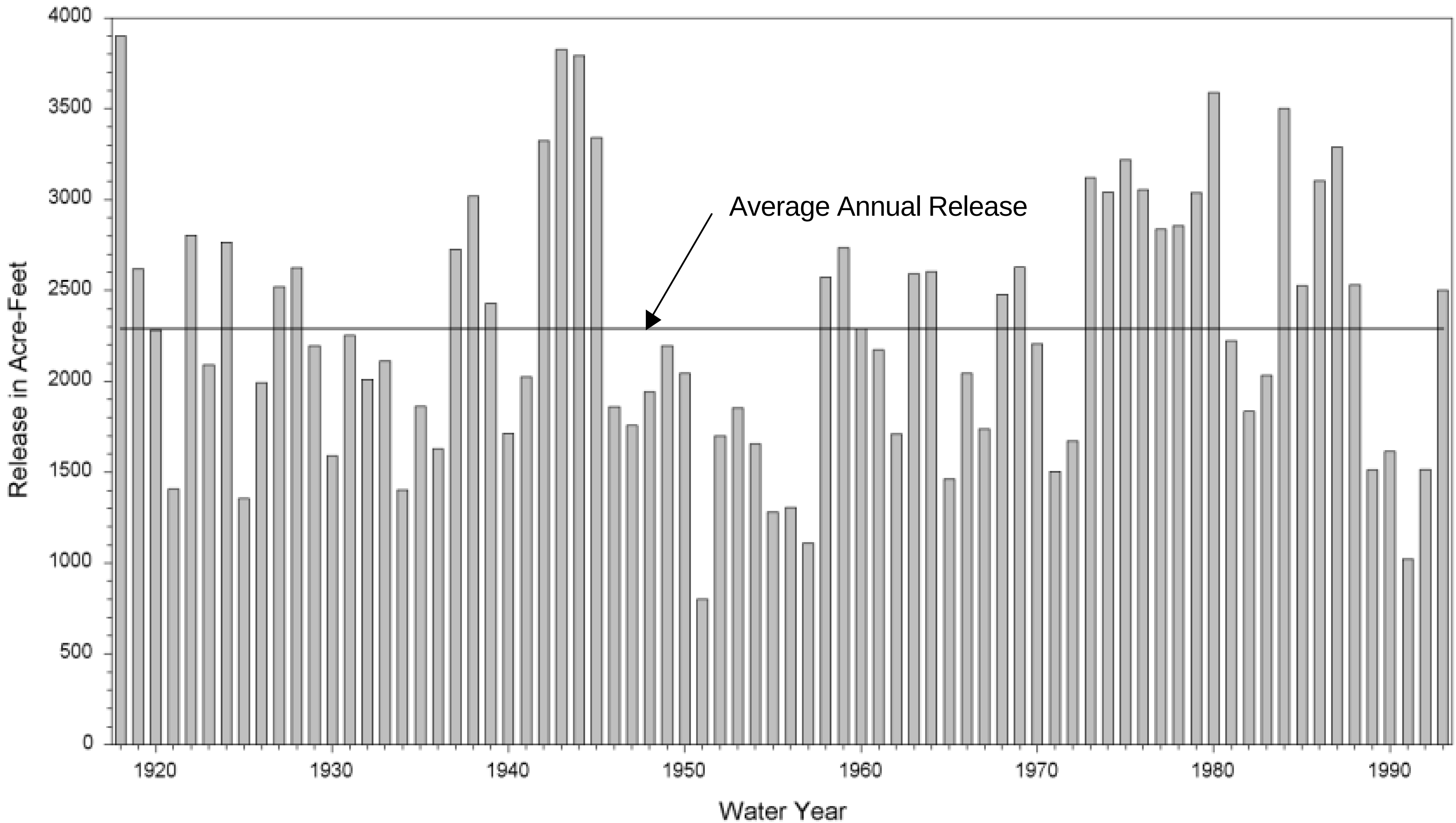

Figure 3-1 Modeled Annual Releases to Meet Long-Term Mainstem Rearing Target Flows

Table 3-4 Summary of Mainstem Target Flow Releases

Lake Cachuma Storage	Reservoir Spill?	Target Flow	Target Site
> 120,000 AF	Spill > 20,000 AF	10 cfs	Highway 154 Bridge
> 120,000 AF	Spill > 20,000 AF	1.5 cfs*	Alisal Road Bridge
> 120,000 AF	Spill < 20,000 AF or No Spill	5 cfs	Highway 154 Bridge
< 120,000 AF	No Spill	2.5 cfs	Highway 154 Bridge
< 30,000 AF	No Spill	Periodic release; ≤ 30 AF per month	Stilling Basin and Long Pool
> 30,000 AF	Spill < 20,000 AF or No Spill	1.5 cfs*	Alisal Road Bridge**

*When rainbow trout/steelhead are present in the Alisal Reach.
**This target will be met only in the year following a >20,000 AF spill year.

The target flows design provides for rearing flows at the Highway 154 Bridge in all but the driest 2% of years. In these dry years, mainstem habitat will be refreshed instead of a continual flow target being met. Analysis of historical hydrology using the Santa Ynez River Hydrological Model (SYRHM) monthly data indicates that it will be possible to meet the target flows under most conditions. Figure 3-2 shows the daily exceedance flow for the Santa Ynez River at Highway 154 based on simulations of the SYRHM from 1918 to 1993. Flow at Highway 154 would exceed 2.5 cfs about 98% of the time, 5 cfs about 77% of the time, and 10 cfs about 39% of the time. Some of the flow targeted for Highway 154 persists downstream as far as the Alisal Reach during most years (Figure 3-3). Flow at the Alisal Bridge, according to the model, would exceed 1.5 cfs approximately 75% of the time.

In order not to impact State Water Project deliveries, the Hilton Creek supplemental watering system will be used to make the reservoir releases necessary to meet the mainstem rearing target flows. Based on the designed capacity of the Hilton Creek supplemental watering system to deliver 10 cfs, the model shows that the 10 cfs target at Highway 154 was not met in its entirety in 34 out of the 185 months that the 10 cfs target would have been in place. However, the model demonstrates that in those months where the 10 cfs target was not met, there would have been at least 8.5 cfs at Highway 154. The model showed that the other targets would have been met in all years based on historical watershed conditions. The existing infrastructure of the Hilton Creek facility (the gravity fed portion of the system) is being repaired to increase the capacity which is currently below the anticipated 10 cfs level. Additional portions of the facility, the pump and flexible intake, will be added in the next few years.

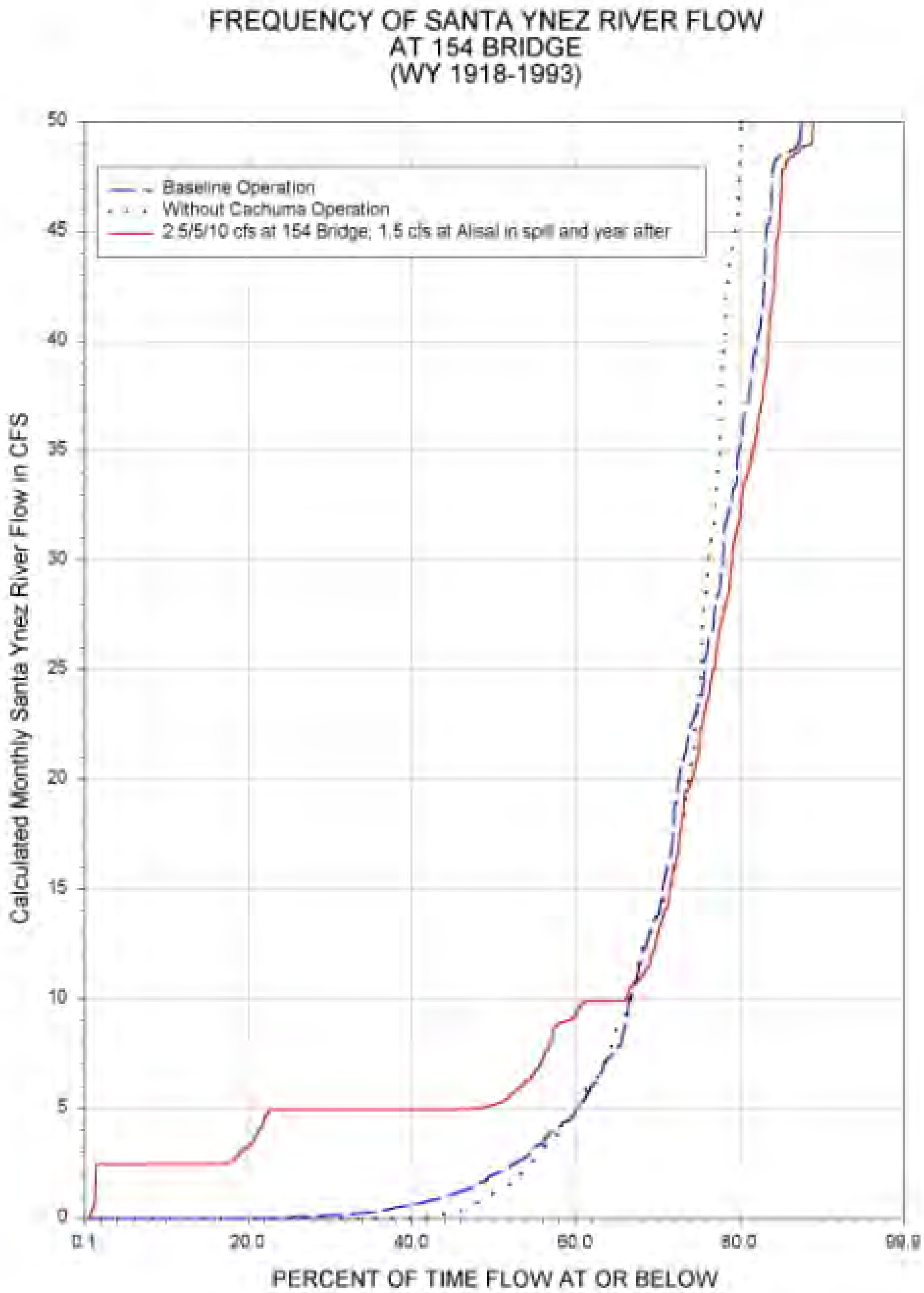

Figure 3-2 Modeled Flow at the Highway 154 Bridge under Long-Term Operations

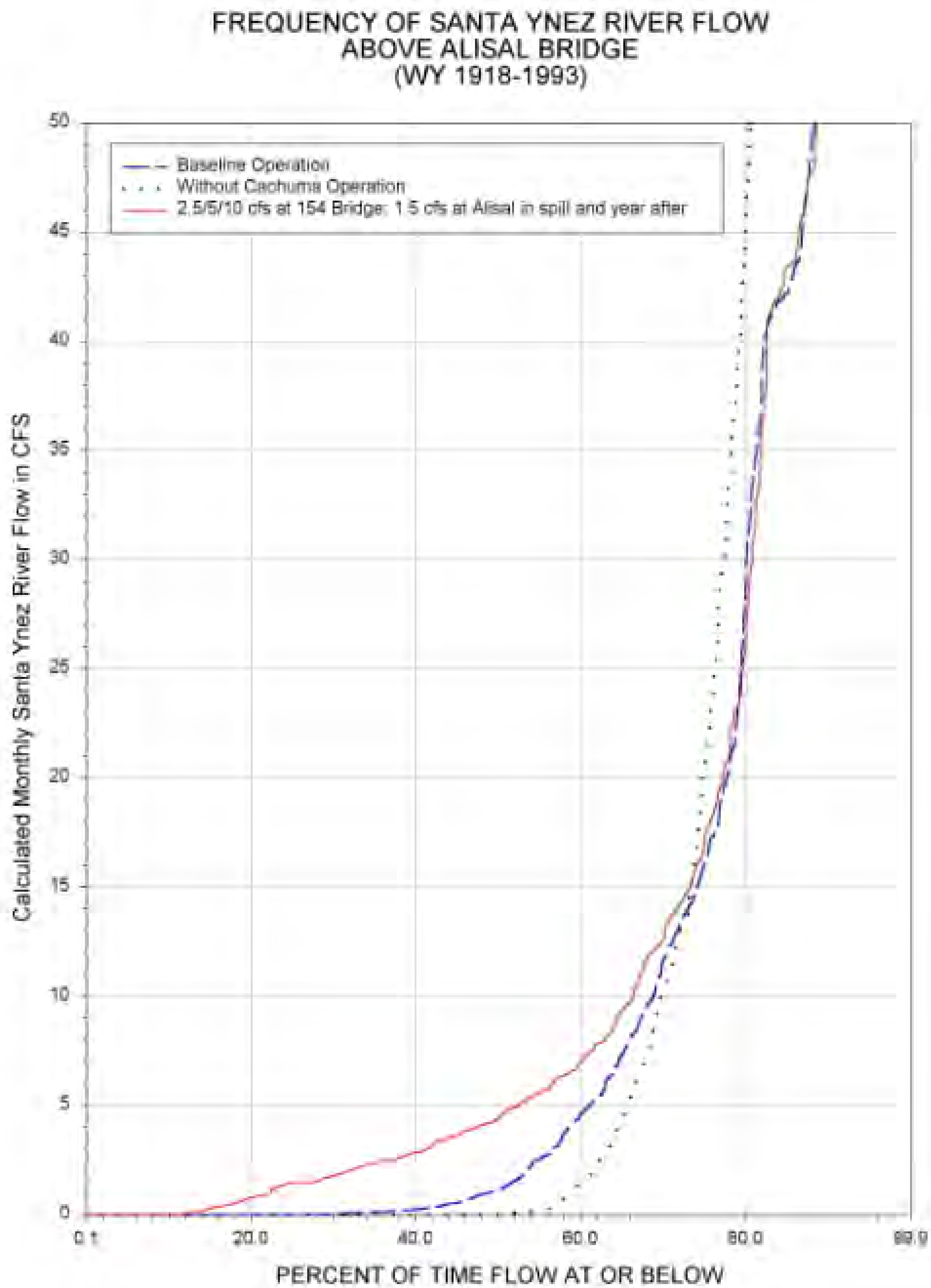

Figure 3-3 Modeled Flow at the Alisal Bridge under Long-Term Operations

3.3.3 Flow Target Compliance Monitoring

Habitat maintenance flow targets have been established at the Highway 154 Bridge, where there was formerly a U. S. Geological Survey (USGS) gaging station. Currently, a number of options for monitoring the Highway 154 target flow compliance are being explored. The Member Units are in discussion with CalTrans, which has an easement at the Highway 154 Bridge, to allow access for gage installation and monitoring. Until the gage is in place, monitoring of the flow level at the Highway 154 Bridge will occur weekly when flows have receded to the target flow levels using a standard methodology. In addition, a staff gage or other marking devise may be used once weekly monitoring for no less than one rearing season has occurred to establish the relationship between the marker and flow. Flows in the Alisal Reach will likely be monitored by the USGS Solvang gage. Modifications to this gage will be necessary to improve its ability to monitor low flows. If the residual pool depth must be maintained in the interim period in the Refugio and Alisal Reaches, a staff gage installed these pools. The water surface elevation will be monitored weekly.

3.4 Passage Flow Supplementation

Upstream migration is an important event in the steelhead lifecycle. Steelhead, like the other anadromous salmonids, are born in freshwater and live there for generally one or two years before migrating to the sea. While at sea, they grow to sexual maturity and then return to the stream in which they were born to spawn. If passage from the ocean to their spawning grounds is prevented, steelhead cannot complete their lifecycle and spawn the next generation. When this happens steelhead may spawn in another stream or wait for another year to spawn. Unlike salmon who die after spawning, steelhead are capable of spawning several times (in different years) under the right conditions (Shapovalov and Taft 1954). Prior to steelhead migrating upstream in the river itself, they must first be able to enter the river from the ocean. The mouth of the Santa Ynez River is frequently closed by the presence of a sandbar. This bar forms during the summer when flows are low and wave energy is also low. It is breached in the winter by a combination of higher river flows and greater wave energy. Winter runoff from Salsipuedes Creek appears to be sufficient to breach the bar before enough flow is available in the mainstem. The purpose of the passage flow supplementation is to improve the opportunity for steelhead to migrate from the Santa Ynez lagoon to the mainstem and tributaries upstream of Alisal Road.

The proposed operations provide frequent passage opportunities for migrating steelhead in wet years (spill years). In these years, tributary and mainstem habitat is accessible and of good quality. In dry years, there is a limited number of passage opportunities. Low flows in the tributaries can limit access to tributary habitat, and this habitat is of lower quality in these years. In other years, passage opportunities may be limited while tributary habitats are suitable for occupancy. An experimental program for supplementing existing storm flow has been develop and is described below. The passage flow supplementation plan proposed here promotes good passage conditions in years after steelhead have likely been highly productive in the system. Reclamation and years after steelhead have likely been highly productive in the system.

Reclamation and the Cachuma Member Units will work with NMFS to further refine this program to maximize the positive benefits of the passage releases.

3.4.1 Fish Passage Account

For the purpose of supplementing passage flows, a Fish Passage Account will be created in Cachuma Reservoir. The Fish Passage Account will be filled in years when the reservoir surcharges, and released in subsequent years to enhance passage opportunities by augmenting storm flows. The Fish Passage Account will be allocated 3,200 AF of water from the 3-foot surcharge (see Section 3.6 for interim allocations). The Fish Passage Account water will be released starting in the year after the reservoir surcharges to 3 feet, and in subsequent years until there is no more water in the Fish Passage Account.

Fish Passage Account water stored in Lake Cachuma will not diminish by evaporation or seepage losses. Any unused portion of the Fish Passage Account will be carried over to following years until the reservoir surcharges again. In the event of a spill, the Fish Passage Account will be deemed to spill, and the account will be reset to a new allocation of 3,200 AF. If only a partial surcharge is possible (not the complete volume between 1.8 and 3 feet [the first 5,500 AF from the 1.8 foot surcharge supports reservoir releases for rearing target flows]), then the Fish Passage Account would receive the surcharge amount in excess of the 1.8-foot surcharge, plus any carryover in the account with the total not to exceed 3,200 AF. Simulations with the SYRHM indicate that when the reservoir spills, the surcharge space is always completely filled; although, in theory, a partial surcharge is possible.

There is limited data on mainstem fish migration in the Santa Ynez River system and a incomplete record of tributary migration monitoring. The record is incomplete because of difficulty in installing and maintaining mainstem traps and because of the need to remove traps during high flow periods. The SYRTAC migrant trapping program has, however, been able to identify the period when fish are migrating in the system. Specific details, such as the travel time of migrating fish, can not be determined from the existing data. In addition, trapping data is limited to the fairly wet climatic period that the SYRTAC studies have been conducted in. Because some uncertainty regarding the movement patterns of migrating steelhead remains, and because the protocol described below is experiemental, the passage flow supplementation proposal will be adaptively managed. The Adaptive Management Committee (see Section 3.4.3) will be responsible for managing the Fish Passage Account releases. To provide resources for evaluation of the program by the Adaptive Management Committee, the existing tributary migrant trapping program will continue, and an additional trap will be installed in the Refugio Reach to monitor mainstem migrants (see Appendix I for more detail on the monitoring program). The Fish Passage Account releases will be based on the following passage supplementation regime, although modifications may be made based on further biological data, dam operational requirements, fish use, prior hydrologic events, and other relevant factors.

3.4.2 PASSAGE SUPPLEMENTATION CRITERIA

Releases for fish passage supplementation will be made in years following a surcharge year until all of the water in the Fish Passage Account has been released. Releases will be made to augment storms in January through May (passage period). For the purpose of fish passage supplementation, a storm is defined as flows of 25 cfs or more at Solvang (see discussion below). The first storm in January will not be supplemented as it is considered to be a recharge storm and will prime the lower watershed for future releases. All storms in the passage period will be supplemented unless specific conditions are met (see below). No passage flow supplementation will occur until the sandbar has been breached by natural events. The sandbar will be visually inspected each week during the migration season to determine its status, and a water level recorder will be installed in the lagoon to monitor ponding conditions.

For the purpose of fish passage supplementation, a storm is defined as flows of 25 cfs or more occurring at Solvang (monitored at the Alisal USGS gage). The 25 cfs criteria was selected for three reasons. First, 25 cfs provides passage flow in the Alisal Reach, and passage at these critical riffles should indicate that passage is provided over critical riffles upstream to the dam (SYRTAC 1999b). Second, a flow of 25 cfs at Solvang indicates that the tributaries upstream of Solvang (*e.g.,* Quiota and Hilton creeks) are flowing and will provide steelhead access to these habitats. Finally, 92% of the time when there is a flow of 25 cfs or more at the Solvang gage, there is at least 15 cfs flowing in the Santa Ynez River upstream of the confluence with Salsipuedes Creek, indicating there is continuity of flow throughout the mainstem. Passage over the critical riffle at the Lompoc Narrows is achieved 92% of the time that there is 25 cfs at Solvang, indicating passage flows for adult steelhead exist upstream to Bradbury Dam.

The passage flow supplementation will take the form of enhancing the storm hydrograph at Solvang. A decay function for the hydrograph recession at the Los Laureles gage above Cachuma Reservoir has been calculated. Figure 3-4 compares the average storm recession hydrograph for the Los Laureles and Solvang gages. The Solvang gage recedes at a faster rate than the Los Laureles gage primarily because the Solvang gage measures flow from a smaller watershed in the absence of spills at Bradbury Dam. The decay rates begin to diverge at about 150 cfs. The Los Laureles decay function from 150 cfs to 25 cfs takes approximately 14 days. Fourteen days was considered to be a reasonable, continuous passage event for migrating fish. The combination of the divergence, the 14 days of passage flows, and the operational maximum release from the Bradbury Dam outlet works, also 150 cfs, determined the flow trigger for the fish passage releases.

Flow supplementation will begin when the unsupplemented storm hydrograph at Solvang recedes from its peak to 150 cfs. From 150 cfs to 25 cfs, releases will be made from the Fish Passage Account such that the combination of natural flow and passage releases mimic the Los Laureles decay curve at Solvang. From 25 cfs to baseflow, releases will be made based on the mainstem ramping rate (Table 3-4 above). Figure 3-5 shows how basin input and Fish

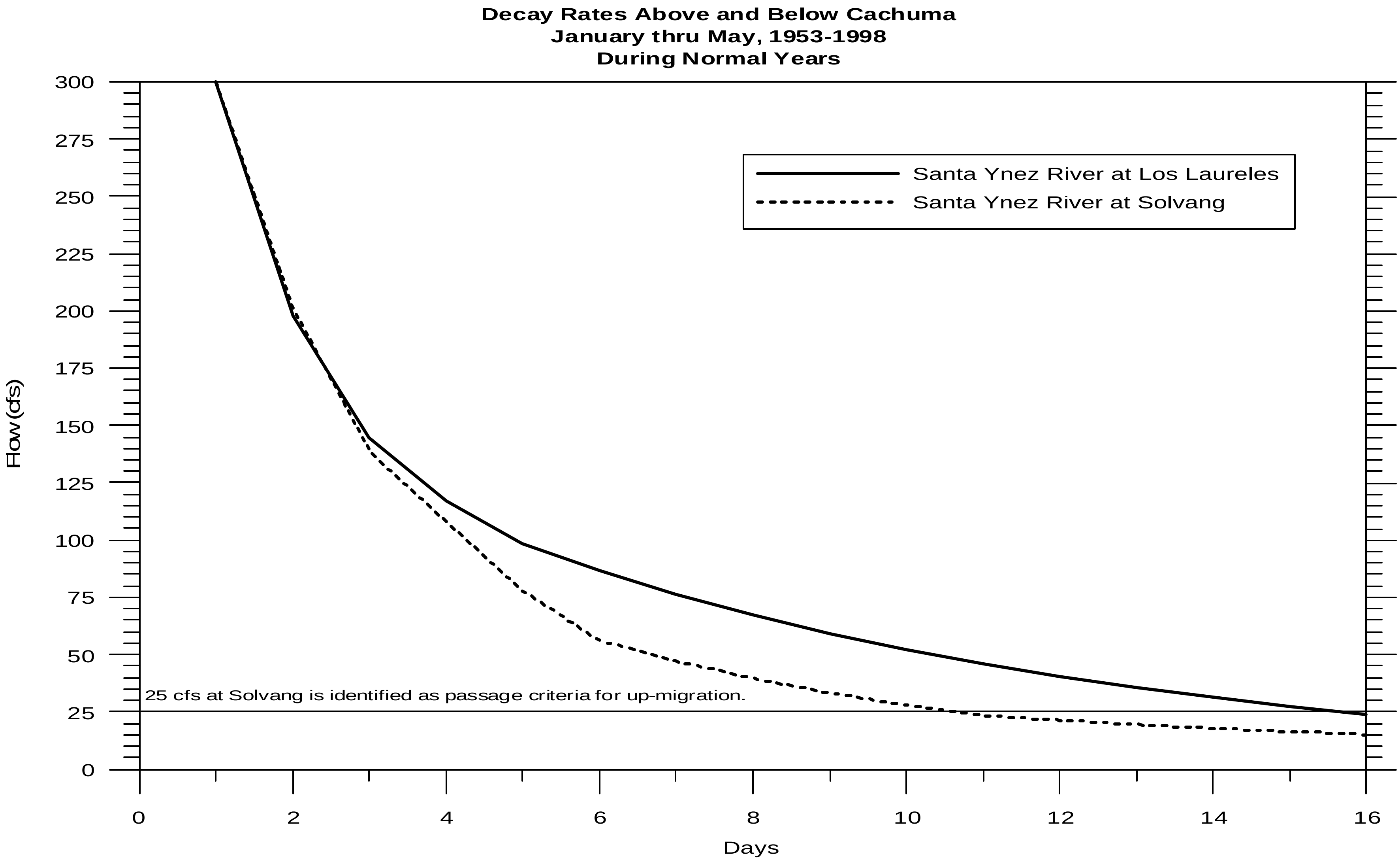

Figure 3-4 Average Inflow Decay Rates at the Los Laureles and Solvang Streamflow Gages

Passage Account releases would combine to provide additional passage days under this flow supplementation scenario (Example #1). In the event that storm peaks at Solvang are less than 150 cfs but greater than 25 cfs, releases will be made from Bradbury Dam to supplement not only the decay curve of the storm hydrograph, but also the peak storm discharge. Thus, up to the outlet works capacity of 150 cfs will be released to boost the peak storm discharge to 150 cfs at Solvang, and then the Los Laureles decay function will be applied as Example #2. Releases for fish passage supplementation will come from the outlet works at Bradbury Dam, although a portion of the releases (≤ 10 cfs) may come through the Hilton Creek supplemental watering system. When several storms come together, there is typically a number of passage opportunities such that supplementing all these storms is not warranted. In the Santa Ynez River watershed, there may be several storm peaks with brief hydrograph recessions in between. When storm flows between these peaks do not recede to 150 cfs, these peaks are all considered to be the same storm event. In this case, passage flow supplementation will occur when flows finally recede to 150 cfs. In other cases, a storm event may trigger the start of the target period for passage releases by reaching 150 cfs, and supplementation will occur such that flows will decay over 14 days to 25 cfs. If a second storm peaks within 7 days following the conclusion of the 14 day target period, the second storm will not be supplemented (Figure 3-6). This criteria establishes a 21 day window in which supplementation of a second storm will not occur. The window begins when the passage flow target period (14 days) is triggered by reaching 150 cfs and continues for 7 days after the end of the target period. If the passage flow target period begins for a storm, but is not completed because a second storm occurs, then the second storm will not be supplemented as it has occurred within a 21-day window. The purpose of this criteria is to conserve Fish Passage Account water for later supplementation, which can extend the biological benefit of the Fish Passage Account into future months and years.

The quantity and frequency of passage releases under the proposal were calculated using USGS gaged daily flows at Solvang for 40 years post-Cachuma construction (1958 to 1998). Flows required to provide passage supplementation for individual storm events are estimated to range from 300 to 1,800 AF. Passage releases would occur starting in the year after the Fish Passage Account is filled by a surcharge event up to, on average, two to three years after the surcharge, but could occur up to eight years after the surcharge event. Table 3-5 tabulates the releases for supplementation of passage by year and shows how the operation of the Fish Passage Account (3,200 AF) would be implemented. In those years when the Fish Passage Account is released in a single year, it is generally because there were a number of small storms whose peaks were boosted and then the recession curve applied.

All storms in the passage period will be supplemented unless (1) flows at Solvang reach 25 cfs within 7 days from a prior fish passage target period (the second storm will not be supplemented), (2) the Adaptive Management Committee determines that there is a greater biological benefit to not supplement a particular storm, or (3) there is no water left in the Fish Passage Account.

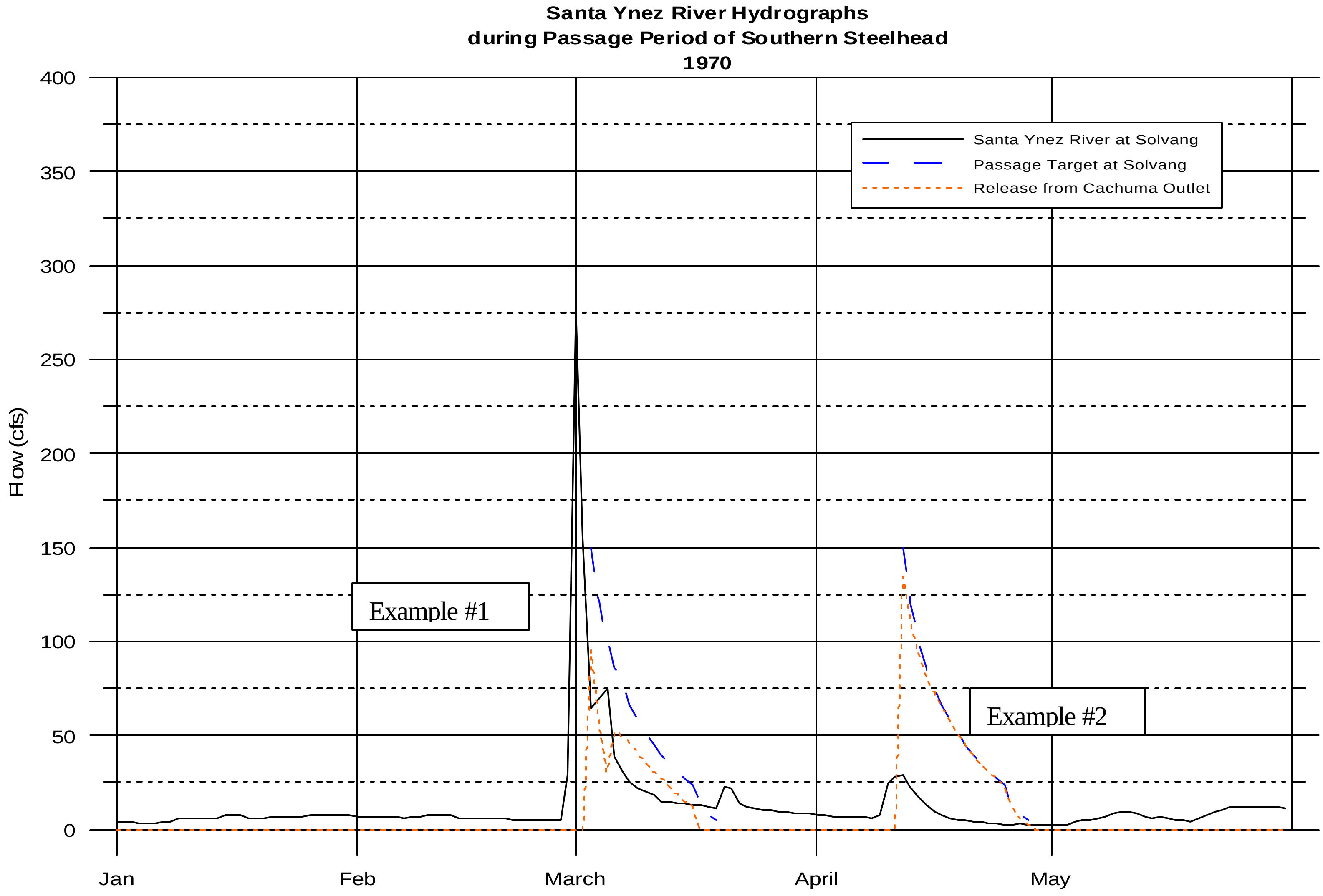

Figure 3-5 Gaged and Calculated Streamflow at the Solvang Gage with Passage Supplementation Releases

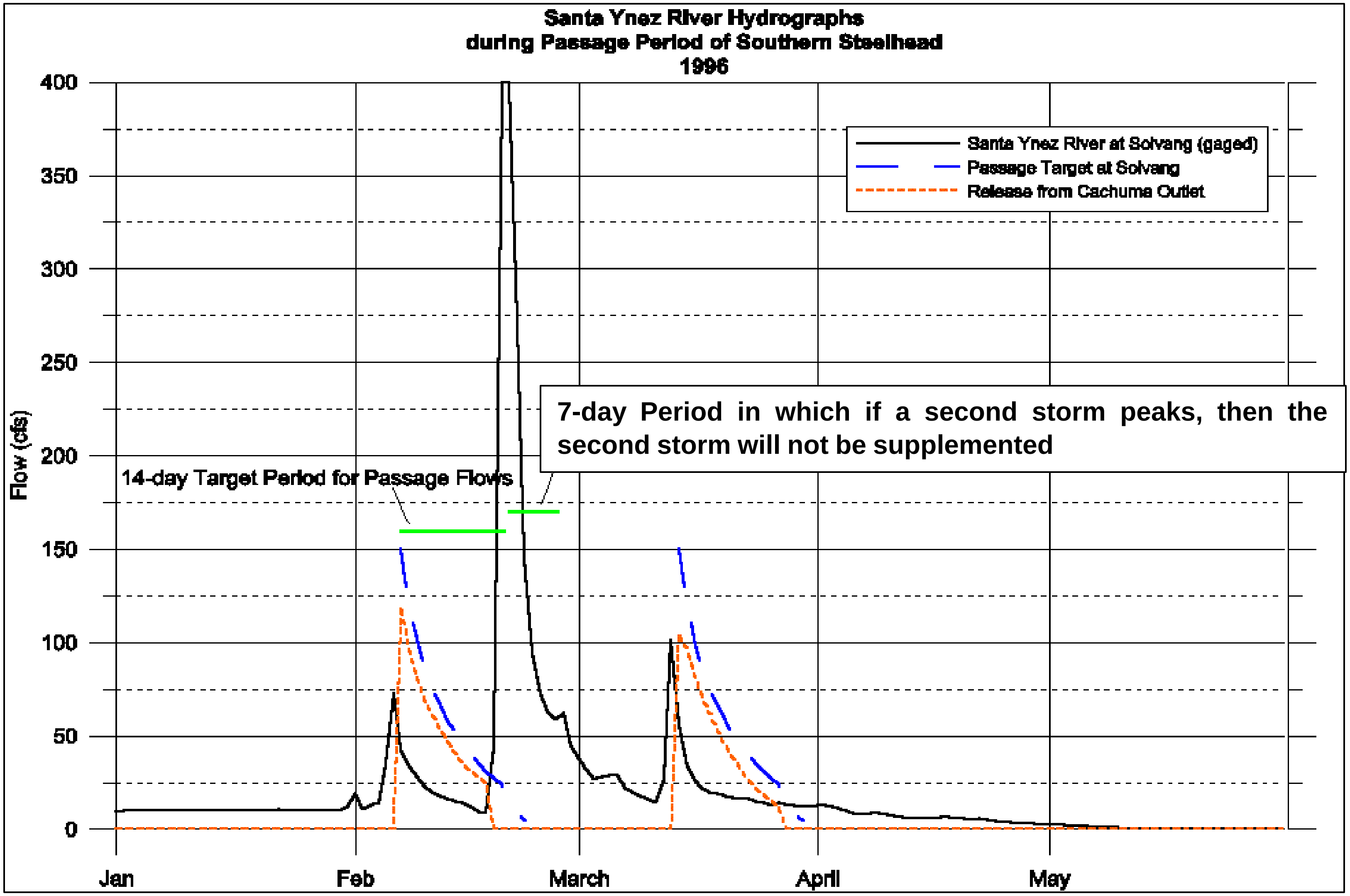

Figure 3-6 Example of the 7-Day Passage Supplementation Criteria

Table 3-5 Long-Term Releases for Passage Supplementation (Water Years, 1958 to 1998)

YEAR	Allocation to Fish Passage Account	Years from Surcharge	Releases from Fish Passage Account	End-of-Year Fish Passage Account Balance
1958	3,200		0	3,200
1959		1	740	2,460
1960		2	2,460	0
1961		3	0	0
1962	3,200		0	3,200
1963		1	3,200	0
1964		2	0	0
1965		3	0	0
1966		4	0	0
1967	3,200		0	3,200
1968		1	3,200	0
1969	3,200		0	3,200
1970		1	2,813	387
1971		2	387	0
1972		3	0	0
1973	3,200		0	3,200
1974	3,200		0	3,200
1975	3,200		909	3,200
1976		1	1,811	1,389
1977		2	0	1,389
1978	3,200		0	3,200
1979	3,200		0	3,200
1980	3,200		0	3,200
1981		1	1,170	2,030
1982		2	1,298	732
1983	3,200		0	3,200
1984	3,200		0	3,200
1985		1	0	3,200
1986		2	957	2,243
1987		3	0	2,243
1988		4	1,670	573
1989		5	0	573
1990		6	0	573
1991		7	573	0
1992		8	0	0
1993	3,200		0	3,200
1994		1	2,759	441
1995	3,200		0	3,200
1996		1	2,716	484
1997		2	484	0
1998	3,200		0	3,200

3.4.3 ADAPTIVE MANAGEMENT OF THE FISH PASSAGE ACCOUNT

The protocol set forth above will be used to supplement passage flows and will be monitored closely to provide information to the Adaptive Management Committee. Operating criteria have to be put in place for monitoring peak storm flows at Solvang and concurrent releases at Bradbury Dam for the purpose of implementing the passage flow supplementation.

Based on the results of these experimental releases, the Adaptive Management Committee will manage the Fish Passage Account releases to increase the biological benefit to steelhead. Initially, all storms will be supplemented as described above. As data are gathered on passage releases, fish movement within the system, and steelhead migration in general, modifications to the release scenario might be made. Such modifications may include changing the trigger flow level, changing the definition of a storm, and selecting to boost storm peaks that are less than 150 cfs to different levels.

Releases in the month of May might also be modified as more downmigrant information is developed. These modifications will likely be similar to those used to extend the water supply availability and might also include extending the tailout for longer periods of time. The decay rate strategy will continue to be applied unless there is data to suggest a more effective release strategy for passage flow supplementation. The Adaptive Management Committee will work with NMFS to refine the fish passage supplementation protocol to (1) shift releases away from dry years and (2) review storm flow decay curves and other methods for providing increased migration ability (NMFS 2000).

Early in the year, water in the Fish Passage Account will be used to supplement every storm meeting the requirements. For releases in late April and in May, however, the committee may begin to consider the storage in Cachuma Reservoir, and the likelihood of a surcharge in the following year, the balance of the Fish Passage Account, the current and prior passage opportunities, and expected baseflow recession levels in deciding whether further supplementation is warranted.

In addition, the Adaptive Management Committee will work with NMFS to develop a strategy to refine this passage supplementation protocol to (1) reduce the number of dry years in which supplementation occurs, to (2) review the use of the mean Los Laureles decay curve as the desired flow shape at Solvang, and (3) to study other methods for providing additional passage opportunities (the strategy must be presented to NMFS by March 11, 2001; NMFS 2000). Once NMFS and the Adaptive Management Committee have agreed to the refinement strategy, it will be implemented.

3.5 ADAPTIVE MANAGEMENT ACCOUNT

The Santa Ynez River system is still under study and new information about many of the operations proposed in this document will be gathered over the course of implementing and monitoring these measures. Many components of the proposed operations will be managed by the Adaptive Management Committee. This committee will be comprised of a representative from Reclamation, the Cachuma Conservation Release Board, ID #1, the Santa Ynez River Water Conservation District, NMFS and DFG.

Potential scenarios are foreseeable where small amounts of additional water could provide a substantial biological benefit in this adaptive management program. In order to capitalize on these occurrences, an Adaptive Management Account will be established. The Account will contain water that the Adaptive Management Committee can use to provide additional benefits to steelhead and their habitat.

The Adaptive Management Account will be filled in years when the reservoir surcharges to the proposed 3-foot level. Of the additional 9,200 AF provided by the proposed 3-foot surcharge, 5,500 AF supports reservoir releases for the rearing target flows and 3,200 AF is allocated to the Fish Passage Account. The remaining surcharged water (500 AF) will be allocated to the Adaptive Management Account. This account will be maintained using the same guidelines as the Fish Passage Account. The Adaptive Management Account will not experience evaporation or seepage losses; the unused portion will be carried over to the next year; and in the event of a spill, the Adaptive Management Account will be deemed to spill, and the account will receive a new allocation from the surcharged water.

The Adaptive Management Account will be used at the discretion of the Adaptive Management Committee to increase the biological benefit to steelhead and their habitat as opportunities arise. The account water can be used to increase releases for mainstem rearing, provide additional flows to Hilton Creek, or to provide additional water for passage flow supplementation. For instance, perhaps the last storm of the season was the first week in May, and that storm used the remaining water in the Fish Passage Account. However, monitoring data from trapping is demonstrating that a number of smolts are attempting to outmigrate but are having difficulty because of low flows in the mainstem. Water from the Adaptive Management Account could be released to provide additional flow for these fish.

3.6 INTERIM OPERATIONS

Reclamation and the Cachuma Member Units are proposing to surcharge Lake Cachuma and use the surcharged water to provide habitat and fish passage enhancement in the lower Santa Ynez River. Implementation of the surcharge requires environmental review and compliance, and construction of flashboards to enable a surcharge. Because implementation of additional surcharge requires facility modifications, interim operations have been developed to provide increased habitat and passage opportunities until long-term operations are in place (*i.e.*, the 3-foot surcharge water is available).

Interim actions identified to protect and enhance habitat conditions for steelhead within the lower Santa Ynez River have been developed based on results of scientific investigations performed by the SYRTAC in combination with extensive hydrologic modeling to evaluate the feasibility and water supply impacts associated with various alternative interim actions. Field fisheries investigations have identified factors such as elevated summer water temperature in affecting habitat quality and availability, particularly for summer steelhead rearing. The investigations have also identified the best available habitat for juvenile steelhead rearing at the reach of the lower Santa Ynez River between Bradbury Dam and Highway 154, and within tributaries such as Hilton Creek. The interim plan of action is designed to protect and enhance these high-value habitat areas using resources and modifications to existing operations under the direct authority of Reclamation and the Member Units with support of the Santa Ynez River water users and the SYRTAC.

The proposed interim plan builds on the fishery actions already implemented within the Santa Ynez River to provide the greatest benefits possible to steelhead on a short-term basis within the constraints of reservoir facilities, hydrologic variability within Santa Ynez River watershed, and water supply operations. The fundamental objective of the proposed program of interim actions outlined below, in combination with the fishery actions taken to date, is to protect the Santa Ynez River steelhead. Once the proposed 3-foot surcharge is complete, the additional facilities and operational flexibility provided through the long-term plan will substantially improve instream flow conditions for various life stages of steelhead.

3.6.1 SURCHARGE INTERIM PHASES

Two interim phases of operations will occur prior to implementation of the long-term operations. The first set of interim operations has already been partially implemented, and will be fully implemented on the release of the Biological Opinion and this Plan. The first phase of operations uses the existing surcharge of 0.75 feet. Phase I will continue until the flashboards on the Bradbury Dam radial spillway gates are modified too allow the 1.8 foot surcharge and accommodate the 3 foot surcharge, and there is sufficient rainfall to surcharge the reservoir to the 1.8 foot level. The second phase of interim operations begins when 1.8 feet of surcharge water is available; and it concludes when the proposed 3-foot surcharge is approved, and there has been sufficient rainfall to surcharge the reservoir to the 3-foot level.

Flashboard construction on the Bradbury Dam spillway gates is scheduled for 2001. As stated above, environmental review for implementation of the 1.8 foot surcharge has been completed (Woodward-Clyde Consultants 1995). Implementation of the proposed 3-foot surcharge may require additional actions to be identified through project design and environmental review. It is anticipated that a few years may be required to complete the environmental compliance necessary for implementation of the proposed 3-foot surcharge (environmental compliance anticipated by 2004).

3.6.2 INTERIM MAINSTEM REARING TARGET FLOWS

During interim operations, rearing target flows will be established in the Santa Ynez River for the purpose of improving mainstem rearing habitat. These target flows will be structured to provide year-round rearing in the Highway 154 Reach of the Santa Ynez River. The same rearing target flows will be in effect during both phases of the interim operations (0.75 and 1.8- foot surcharges). Additional water provided by the 1.8 foot surcharge under Phase 2 of the interim operations (1.8-foot surcharge) will be allocated to passage flow supplementation.

Interim target flows will be established at the Highway 154 Bridge. The flow targets will depend on the water year type and the storage in Lake Cachuma on the first of each month. Reservoir releases through the Hilton Creek supplemental watering system will be made to meet the flow targets. In years when the lake spills (when the storage in Lake Cachuma is above 120,000 AF) and the spill amount exceeds 20,000 AF, a target flow of 5 cfs at the Highway 154 Bridge will be maintained. When the lake does not spill, or the spill amount is less than 20,000 AF, and the storage in Lake Cachuma exceeds 120,000 AF, a target flow of 2.5 cfs will be maintained. When lake storage recedes below 120,000 AF, the target flow at the Highway 154 Bridge will be 1.5 cfs. Periodic releases from Bradbury Dam will be made to improve water quality in the Stilling Basin and the Long Pool in critical drought years (storage in Lake Cachuma <30,000 AF). Thirty AF per month will be reserved to provide these refreshing flows.

In addition, when the reservoir spills at least 20,000 AF or the year following such a spill, the residual pool depth will be maintained in refuge pools in the Refugio and Alisal reaches when steelhead are present. The residual pool depth is defined as the difference between the elevation of the deepest point in the pool and the elevation of the lowest point of the crest (outlet depth) that forms the pool’s hydraulic control. Maintenance of the residual pool depth is designed to provide habitat space for the rainbow trout/steelhead inhabiting these habitats and also to improve water quality. There are a number of uncertainties regarding this action, therefore monitoring and evaluation of the action and the maintained habitat will be a focus of the Adaptive Management Committee. Residual pool depth maintenance will be required until the first year the 3 foot surcharge is achieved and all the passage barrier/impediment modifications are completed (NMFS 2000).

Analysis of historical hydrology indicates it will be possible to meet target flows under most conditions. Figure 3-7 shows the daily exceedance flow for the Santa Ynez River at Highway 154 based on simulations of the Santa Ynez River model from 1918 to 1993. Flow at Highway 154 would exceed 1.5 cfs about 98% of the time, 2.5 cfs about 81% of the time, and 5 cfs about 49% of the time. Some of this flow persists downstream to the Alisal Bridge in most years (Figure 3-8). The flow can be subsurface and often wells up at the downstream end of some riffle bars.

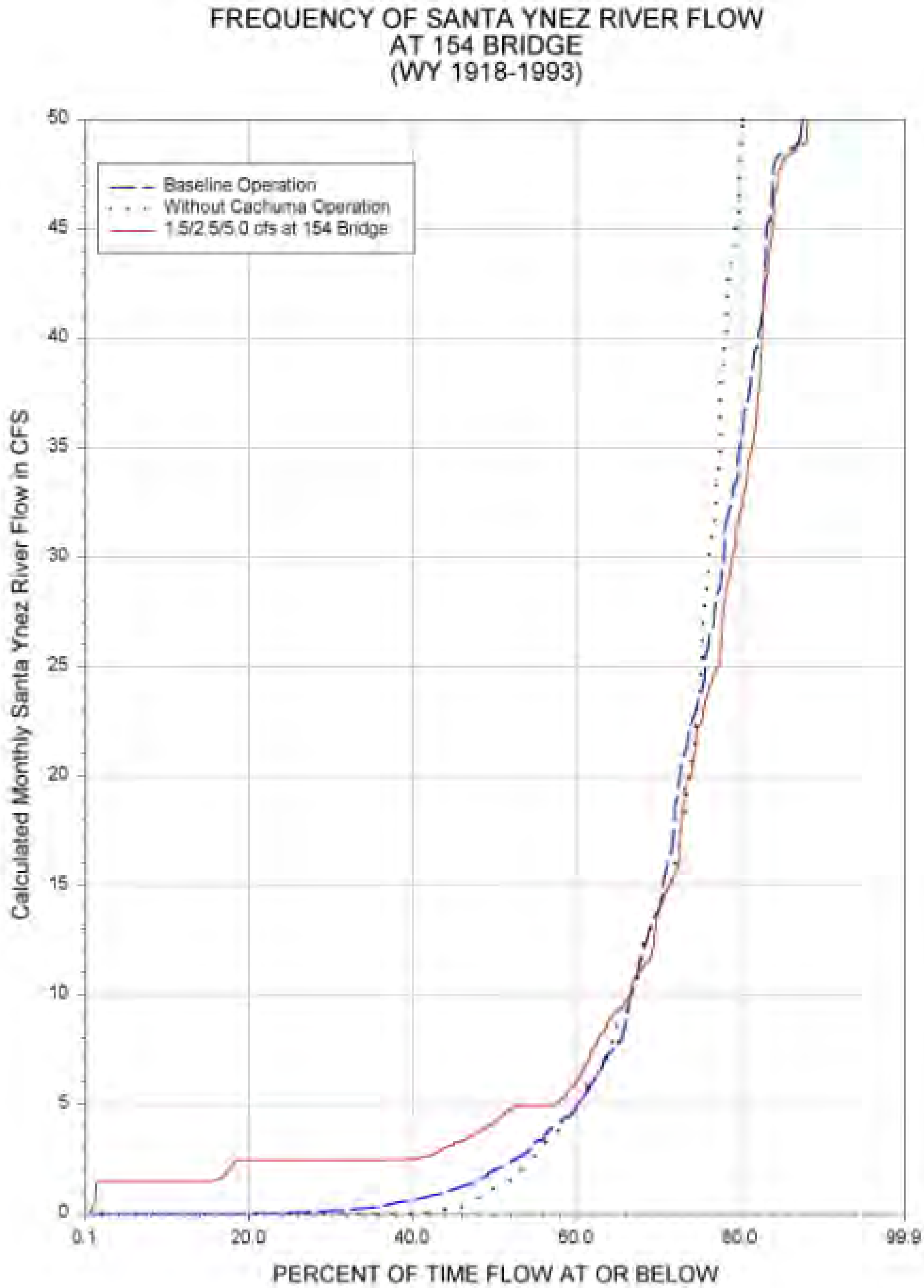

Figure 3-7 Modeled Flow at the Highway 154 Bridge under the Interim Operations

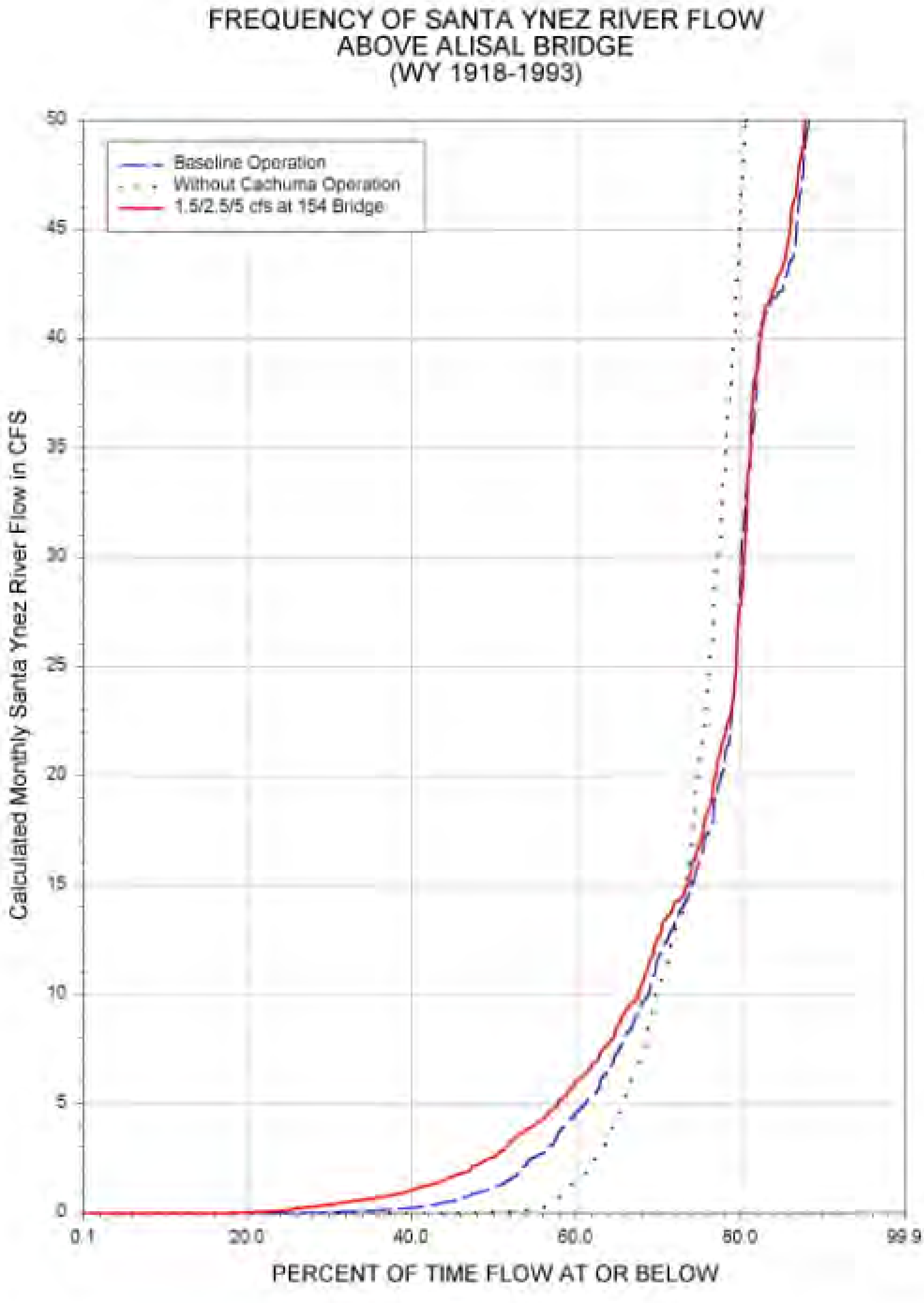

Figure 3-8 Modeled Flow at the Alisal Bridge under the Interim Operations

3.6.3 PASSAGE FLOW SUPPLEMENTATION

Passage flow supplementation will begin under the second phase of the interim operations, once the reservoir has surcharged to 1.8 feet. A portion of the additional water provided by the 1.8 foot surcharge, 2,500 AF, will be allocated to the Fish Passage Account. Water will be released from the Fish Passage Account in years following the 1.8 surcharge event in accordance with the criteria described for long-term operations in Section 3.4.

The quantity and frequency of passage releases under Phase 2 of the interim operations (1.8 feet of surcharge) were calculated using USGS gaged daily streamflows at Solvang for the 40 years of post-Cachuma construction (1958 to 1998). Passage releases under the interim scenario would occur generally one to two years after a year in which the reservoir is surcharged. Table 3-6 tabulates the releases for supplementation of passage by year and shows how releases from the Fish Passage Account would be implemented under this interim proposal. Interim passage releases will be adaptively managed, and the scenario may be adjusted to provide greater benefit to steelhead as described in Section 3.4.3.

3.7 SUMMARY OF FLOW-RELATED FISH ENHANCEMENT OPERATIONS

The long-term operations proposed in Sections 3.3 through 3.5 above will be phased in as additional water resources become available from the surcharge of Lake Cachuma (see Section 3.2). Three different surcharge levels (0.75, 1.8, and 3 foot levels) are proposed over the course of the phase-in period. The interim and long-term flow-related enhancement measures depend on the status of surcharge implementation. Table 3-7 summarizes the three types of flow-related enhancement measures proposed in this document: (1) conjunctive use of reservoir releases and downstream water rights to maintain mainstem rearing target flows, (2) fish passage supplementation, and (3) adaptive management supplementation (rearing or passage). Table 3-8 summarizes the allocation of water provided by the three different surcharge levels proposed for Lake Cachuma to each of these flow-related enhancement measures.

Table 3-6 Interim Releases for Passage Supplementation (Water Years 1958 to 1998)

YEAR	Allocation to Fish Passage Account	Years from Surcharge	Releases from Fish Passage Account	End-of-Year Fish Passage Account Balance
1958	2,500		0	2,500
1959		1	740	1,760
1960		2	1,760	0
1961		3	0	0
1962	2,500		0	2,500
1963		1	2,500	0
1964		2	0	0
1965		3	0	0
1966		4	0	0
1967	2,500		0	2,500
1968		1	2,500	0
1969	2,500		0	2,500
1970		1	2,500	0
1971		2	0	0
1972		3	0	0
1973	2,500		0	2,500
1974	2,500		0	2,500
1975	2,500		909	2,500
1976		1	1,811	689
1977		2	0	689
1978	2,500		0	2,500
1979	2,500		0	2,500
1980	2,500		0	2,500
1981		1	1,170	1,330
1982		2	1,330	0
1983	2,500		0	2,500
1984	2,500		0	2,500
1985		1	0	2,500
1986		2	957	1,543
1987		3	0	1,543
1988		4	1,543	0
1989		5	0	0
1990		6	0	0
1991		7	0	0
1992		8	0	0
1993	2,500		0	2,500
1994		1	2,500	0
1995	2,500		0	2,500
1996		1	2,500	0
1997		2	0	0
1998	2,500		0	2,500

Table 3-7 Summary of Interim and Long-Term Operations for Rearing and Passage Enhancement in the Mainstem

Project Operations Phase	Fish Enhancement Releases for Mainstem Rearing and Passage
Interim Phase I 0.75-Foot Surcharge	**Rearing** *Highway 154 Flow Targets* • 5 cfs flow target at Highway 154 in years when the lake spills at least 20,000 AF • 2.5 cfs flow target at Highway 154 in years when the lake does not spill but storage exceeds 120,000 AF or when the lake spills less than 20,000 AF • 1.5 cfs flow target at Highway 154 in years when lake storage recedes below 120,000 AF but greater than 30,000 AF • Releases to refresh the Long Pool and the Stilling Basin may be made (limited to 30 AF per month or as needed)
Interim Phase II 1.8-Foot Surcharge	**Rearing** *Highway 154 Flow Targets* • 5 cfs flow target at Highway 154 in years when the lake spills at least 20,000 AF • 2.5 cfs flow target at Highway 154 in years when the lake does not spill but storage exceeds 120,000 AF or when the lake spills less than 20,000 AF • 1.5 cfs flow target at Highway 154 in years when lake storage recedes below 120,000 AF but greater than 30,000 AF • Releases to refresh the Long Pool and the Stilling Basin may be made (limited to 30 AF per month or as needed) **Passage** • 2,500 AF allocation to the Fish Passage Account in surcharge years
Long-Term Operations 3-Foot Surcharge	**Rearing** *Highway 154 Flow Targets* • 10 cfs flow target at Highway 154 in years when the lake spills at least 20,000 AF • 5 cfs flow target at Highway 154 in years when the lake does not spill but storage exceeds 120,000 AF or when the lake spills less than 20,000 AF • 2.5 cfs flow target at Highway 154 in years when lake storage recedes below 120,000 AF but greater than 30,000 AF • Releases to refresh the Long Pool and the Stilling Basin may be made (limited to 30 AF per month or as needed) *Alisal Bridge Flow Targets* • 1.5 cfs flow target at the Alisal Bridge in years when the lake spills at least 20,000 AF and steelhead are present in the Alisal Reach • 1.5 cfs flow target at the Alisal Bridge in the year immediately following a year when the lake spills at least 20,000 AF and steelhead are present in the Alisal Reach **Passage** • 3,200 AF allocation to the Fish Passage Account in surcharge years **Adaptive Management Account** • 500 AF allocation to the Adaptive Management Account in surcharge years

Table 3-8 Allocation of Surcharged Water under the Proposed Implementation Phases

Surcharge Level	Account/Use	Surcharge Allocation (AF)	Total Amount in Surcharge Years (AF)
0.75 foot (Interim Phase I)	Mainstem Rearing Target Flow Releases*	2,300	2,300
1.8 foot (Interim Phase II)	Mainstem Rearing Target Flow Releases*	3,000	5,500
	Fish Passage Account	2,500	
3.0 foot (Long-Term)	Mainstem Rearing Target Flow Releases*	5,500	9,200
	Fish Passage Account	3,200	
	Adaptive Management Account	500	

*There is no account for the mainstem rearing target flows. The allocation in surcharge years will support the reservoir releases needed to maintain the target flows year-round (except in the driest years), however additional water will be released as needed to meet the targeted flow level. These releases replace the Fish Reserve Account as established in the MOU and WR 94-5.

4.1 ANALYSIS APPROACH

This section evaluates the potential effects of releases made under the proposed project operations relative to the baseline operations on steelhead passage opportunities, mainstem steelhead spawning and rearing habitat, and other aquatic resources. The steelhead evaluation includes the reaches of the Santa Ynez River downstream of Bradbury Dam (the upstream limit of steelhead) that may support steelhead. This analysis also looks at the streamflow conditions that would have been present at these locations if Bradbury Dam did not store water and if all inflow was passed through the reservoir. The analysis is based on the flows that would be present at specified locations along the river during wet, normal, and dry water year types. The three water year types are represented by the 20%, 50% and 80% exceedance flows under the three operating conditions: Historic, Baseline, and Proposed.

- The "Historic" condition represents the habitat conditions prior to the construction of Bradbury Dam (*i.e.*, inflow passed through the reservoir).
- "Baseline" Operations represent the operation of the project as directed in SWRCB Decision WR 89-18. There is no Fish Reserve Account. The project diverts and stores water and makes deliveries to the Member Units and releases to satisfy the requirements of downstream users.
- The "Proposed" Operations include modification to the project to include the flow releases for the maintenance and enhancement of aquatic habitats and species downstream of the reservoir: conjunctive use of reservoir and downstream water rights releases to meet mainstem rearing target flows and Fish Passage Account releases. Adaptive Management Account releases cannot be directly quantified, as it is not known how this water will be used; therefore, these are not included in this analysis. Similarly, the provision to maintain residual pool depth in the Refugio and Alisal Reaches during the interim period is not included in the analysis. Proposed Operations include both Interim Operations (0.75 and 1.8-foot surcharge, where applicable) and Long-Term Operations.

4.2 EFFECTS OF FLOW-RELATED ENHANCEMENT MEASURES ON RAINBOW TROUT/STEELHEAD

4.2.1 SUMMARY OF EFFECTS

The effects of the Proposed Operations on steelhead were evaluated with respect to the potential effects on three lifestages: passage, mainstem spawning and mainstem rearing.

- **Passage –** In general, the Proposed Operations improve passage opportunities relative to the Baseline Operations (Section 4.2.2). The Historic Condition provides more passage opportunities than either the Proposed or Baseline Operations because water is not stored behind Bradbury Dam but flows directly to the sea. In just those years when passage flow supplementation would have occurred, the Proposed Operations (both interim and long-term) substantially increase the number of passage days over Baseline Operations; although, the number of passage days under the Proposed Operations is still lower than the Historical number of passage days.

- **Spawning Habitat -** The Proposed Operations provide substantially more mainstem spawning habitat in all three reaches between Bradbury Dam and Alisal Road in normal and dry years than the Baseline Operations (Section 4.2.3). The Historic Condition provides more spawning habitat in wet and normal years than the Proposed Operations, but less habitat in dry years, especially in the Refugio and Alisal reaches.

- **Rearing Habitat -** The Proposed Operations result in a substantial amount of additional rearing habitat (Section 4.2.4) being available relative to the Baseline Operation during all seasons in dry and normal years, and in July through December in wet years. In the first half of a wet year, the Proposed Operation provides a similar amount of rearing habitat to the Baseline Operation. These results were common to all three reaches. 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. This was particularly true of the Alisal Reach, where the proportion of pool habitat was lower than in the more upstream reaches.

The additional rearing habitat provided by the Proposed Operations relative to the Baseline Operations, in combination with the persistence of this habitat throughout the year even under dry conditions, provides a substantial benefit to steelhead over both Baseline Operations and Historic Conditions. Young-of-the-year rearing habitat was identified as a major limiting factor in the contract renewal EIS/EIR (Woodward-Clyde Consultants *et al*., 1995). Proposed Operations provide many times the amount of rearing habitat and provide it year round even in the typically dry months of July through November. In addition, the Proposed Operations provide additional passage opportunities and more spawning habitat than the Baseline Operations. Because of this, the Proposed Operations are judged to provide a greater net benefit to steelhead over Baseline Operations.

Although the Historic Condition provides more passage opportunities, greater spawning habitat (except in dry years), and more rearing habitat in the early part of the year, these benefits are likely lost in the latter portion of the year when rearing habitat is reduced below the level provided under the Proposed Operations. During the first part of the year, temperatures are relatively cool and, therefore, the metabolism of rainbow trout/steelhead is slower. These fish tend to reside in pools during the winter months when feeding is reduced, therefore habitat needs are less. In the April through June period, juvenile fish may be smolting and moving downstream to the ocean when flows permit. Young-of-the-year fish, where present (they are emerging from the gravels during this time), are small and require less space. As the fish grow, they require more space, which may lead to a habitat bottleneck in the late summer or early fall when the amount of space required by each fish increases and the amount of space available decreases. Historic observations found that the mainstem river routinely dried in the summer downstream of Gibraltar Dam (except for a small, spring-fed reach around Solvang) (Shapovalov 1944). The greater availability of rearing habitat in the late summer and early fall likely provides a substantial benefit to steelhead relative to the Historic Condition in this portion of the river.

The perennial flows in the river under the Proposed Operations would likely result in the increased growth of willows and other riparian plant species. The increased growth of riparian plants would likely provide additional cover for steelhead and thus increase the carrying capacity of the river. The increased riparian growth may also shade the stream and help promote cooler water temperatures and reduce evaporation. Increased riparian growth may remove water from the stream through increased rates of evapotranspiration, but this is not likely to be of a magnitude that would adversely affect the steelhead population. Increased riparian vegetation may also require periodic maintenance which could result in some disturbance to the rearing habitat. Best management practices would be followed to avoid adverse effects to steelhead.

4.2.2 Effects on Passage

The passage evaluation is based on the results of the passage study performed by the SYRTAC (1999b) and additional analyses (SYRTAC data). The analysis uses a minimum passage criterion of 8 feet of contiguous channel width with a depth of .6 feet. This criterion was selected based on the passage analysis performed by the SYRTAC (1999b) and observation of flows at which adult rainbow trout/steelhead were observed in Salsipuedes Creek during the 1999 migration season. A number of critical riffles were selected for study to determine minimum passage flow levels. Riffles were selected for evaluation because they represent the shallowest habitat type and thus would most likely represent low-flow passage barriers. The critical riffles were located in four areas (from downstream to upstream they are Lompoc Narrows, Cargasachi Reach, Alisal Reach, and Refugio Reach [SYRTAC 1999b]), and the flow that met minimum passage criterion was determined.

The minimum passage flow for the Alisal Reach (25 cfs) was used as an indicator of the availability of passage flows from Bradbury Dam to the ocean based on the critical riffle study (SYRTAC 1999b) and additional flow analysis. The 25 cfs criteria was selected for three reasons. First, 25 cfs provides passage flow over critical riffles in both the Alisal Reach and the more upstream Refugio Reach (SYRTAC 1999b). Second, 92% of the time when there is a flow of 25 cfs or more at the Solvang USGS gage (in the Alisal Reach), there is at least 15 cfs flowing in the Santa Ynez River upstream of the confluence with Salsipuedes Creek (*i.e.,* the Cargasachi Reach). Finally, passage flows at the critical riffles in the Lompoc Narrows are achieved 92% of the time that there is 25 cfs at Solvang based on USGS gaged data post

Cachuma construction (1953-1999). Taken together, these analyses support the assumption that 25 cfs at Alisal results in passage from the ocean to Bradbury Dam.

Prior to steelhead migrating upstream in the river itself, they must first be able to enter the river from the ocean. As discussed previously, the mouth of the Santa Ynez River is frequently closed by the presence of a sandbar. This bar forms during the summer when flows and wave energy are low. It is breached in the winter by a combination of higher river flows and greater wave energy (although either of these elements may be able to breach the bar by themselves). Little information is available regarding the frequency with which the bar is broken or what flows might be required to accomplish this. Flow from Salsipuedes Creek appears to be sufficient to breach the bar before sufficient flow is available in the mainstream. The bar has occasionally been opened manually, but this is not a regular practice due to concerns for the endangered tidewater goby inhabiting the lagoon. The passage analysis that follows presumes that steelhead have already gained access to the river.

The number of passage days provided, based on daily flows as modeled by the SYRHM (1942 to 1993) for the months of January through April, was calculated. This analysis tabulated the number of passage days, defined as a flow of 25 cfs or greater at Solvang (Alisal Reach), for each year under the Historical condition and Baseline and Proposed Operations. For the Proposed Operations, both the long-term (3,200 AF) and interim (2,500 AF) Fish Passage Account allocations were analyzed. For normal and dry years modeled, the Proposed Operations (both account allocations) provide more passage days than Baseline Operations. In wet years, the Proposed and Baseline Operations would provide similar passage opportunities. Historical conditions, however, still provide, on average, roughly 40% more passage days than either the Baseline or Proposed Operations. Although the Proposed and Baseline Operations do provide many passage opportunities for migrating steelhead, especially in wet years. The Adaptive Management Committee will work with NMFS to refine the passage supplementation protocol to reduce the number of dry years when supplementation occurs.

Supplementation occurs in years following surcharge years (typically wet years) and therefore provides additional passage opportunities in predominantly non-wet years. Table 4-1 presents the passage opportunities in those years when passage flow supplementation would have occurred under the Proposed Operations based on analysis of the SYRHM (1942 to 1993). The passage flow releases under the Proposed Operations would have provided 166% more passage opportunities than Baseline Operations in the slightly less than a third of years in which supplementation would have occurred. An additional third of the years are historically wet years, suggesting that steelhead will have at least fourteen days of passage in roughly two-thirds of the years. For the 14 years when passage flow releases would have been made, historically there were still more passage days than under the Proposed Operations overall. However, Historical conditions would have only provided at least 14 days of passage per year in eight out of the fourteen years.

Table 4-1 Passage Opportunities in the Santa Ynez River in Years Based on Modeled Fish Passage Account Releases

		Without Cachuma Operations (Historical)		Baseline Operations		Long-Term Passage Proposal (3.0' Surcharge, 3,200 AF)			Interim Passage Proposal (1.8' Surcharge, 2,500 AF)		
Year	**Hydrologic Year Type[1]**	**# of Passage Days[2]**	**Indicator of ³ 14 days**	**# of Passage Days[2]**	**Indicator of ³ 14 days**	**# of Passage Days[2]**	**Add'l Days from Baseline**	**Indicator of ³ 14 days**	**# of Passage Days[2]**	**Add'l Days from Baseline**	**Indicator of ³ 14 days**
1949	dry	1		1		15	14	X	15	14	X
1950	dry	1		0		14	14	X	8	8	
1953	normal	51	X	3		17	14	X	18	15	X
1954	normal	53	X	7		26	19	X	20	13	X
1959	normal	47	X	2		15	13	X	15	13	X
1960	dry	0		1		15	14	X	12	11	
1968	dry	24	X	1		15	14	X	15	14	X
1970	normal	72	X	11		16	5	X	15	4	X
1975	normal	89	X	68	X	74	6	X	75	7	X
1976	dry	2		1		16	15	X	16	15	X
1981	normal	64	X	10		22	12	X	21	11	X
1982	normal	35	X	6		19	13	X	18	12	X
1987	dry	0		0		16	16	X	15	15	X
1988	dry	12		0		15	15	X	9	9	
Average		32		8		21	13		19	12	
Sum		451		111		295			272		
Number of years with ³ 14 days of passage			8 57%		1 7%			14 100%			11 79%

[1]A 'wet' year is the third of the years analyzed with the greatest inflow into Lake Cachuma, 'normal' years were the middle third of years, and 'dry' years were the third of years with the lowest inflow into Lake Cachuma using USGS Los Laureles gage data.

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

4.2.3 EFFECTS ON SPAWNING HABITAT

4.2.3.1 Methods for Spawning and Rearing Habitat Analysis

The spawning habitat analysis (in this section) and rearing habitat analysis (in the next section) are both based on the habitat studies performed by the SYRTAC (1999a, Section 2.1). These analyses focus on the upper part of the mainstem from Alisal Bridge to Bradbury Dam because the river below the Alisal Reach does not appear to support rainbow trout/steelhead. Despite many snorkel surveys since 1995 (SYRTAC 1997, 1998, 2000), only one rainbow trout/steelhead has been observed below this reach. This adult fish was found below Buellton in a pool at Santa Rosa Park in 1998, an extremely wet year (SYRTAC data).

For purposes of this analysis, the average top width versus flow relationship was generated by weighting the top width of each habitat type by its relative proportion in each reach. The average top width was converted to acres of habitat by multiplying the average top width by the length of habitat in each reach. For the spawning analysis, usable habitat was limited to riffles and runs. In the rearing habitat analysis, it was assumed that only pool habitats remained when flow was zero and all other habitat types provided no habitat. This likely results in an overestimate of habitat under zero flow conditions, as the pools likely shrink by an unknown amount both in length and width, and an unknown number of pools likely dry up completely. Regardless of this overestimate, the analysis does provide a basis for making a comparison between the Baseline and Proposed Operations, as both are evaluated under the same assumptions.

Flow exceedance curves were developed from the daily flows generated from the Santa Ynez River model for three locations: (1) below the confluence of Hilton Creek (representing the Highway 154 Reach), (2) at Highway 154 (representing the Refugio Reach), and (3) at Alisal Bridge (representing the Alisal Reach) based on model simulations including a 52-year period of record (1941 to 1993). Four seasons were used in the rearing habitat analysis: (1) January 1 through March 31, (2) April 1 through June 30, (3) July 1 through September 30, and (4) October 1 through December 31. For the spawning analysis, only the January through April period was used. The model included both Fish Passage Account releases, reservoir releases to meet mainstem rearing target flows, and downstream water rights releases.

4.2.3.2 Spawning Results

The relative availability of spawning habitat among the three operational scenarios is similar in the three reaches (Table 4-2). In general, both Interim phases have similar spawning habitat. Long-Term Operations have slightly more spawning habitat than Interim Operations in normal and dry years because target flows are maintained through conjunctive use releases and passage flow supplementation releases are made in these years. Long-Term Operations provide more habitat in dry years than the Historic (17% to 655% in the upper two reaches respectively) or Baseline Operations (1,562% more in the upper reach). Neither the Historic Conditions

Table 4-2 Flow and Available Spawning Habitat under Different Operation Scenarios

Condition	Dry Years 80% exceedance[1]			Normal Years 50% exceedance[1]			Wet Years 20% exceedance[1]		
	Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)	Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)	Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)
Bradbury Dam to Highway 154									
Historic	1.6	4.1	17	20.1	6.2	-10	164.1[3]	8.0	-18
Baseline	0.2	0.3	1562	1.0	2.6	115	44.7	6.6	0
Long Term	3.4	4.8	-	5.6	5.6	-	50.2	6.6	-
Int: 0.75	2.5	4.5	-	3.3	4.8	-	45.7	6.6	-
Int: 1.8	2.6	4.6	-	3.3	4.8	-	49.1	6.6	-
Highway 154 to Refugio Road									
Historic	0.3	0.4	655	18.9	4.0	-16	167.1[3]	5.2	-12
Baseline	0.0	0.0	+++[4]	0.9	1.7	94	51.3	4.6	0
Long Term	3.1	3.3	-	5.0	3.4	-	58.2	4.6	-
Int: 0.75	2.4	3.2	-	2.9	3.3	-	51.3	4.6	-
Int: 1.8	2.4	3.2	-	3.0	3.3	-	59.6	4.6	-
Refugio Road to Alisal Bridge									
Historic	0.0	0.0	+++[4]	15.9	8.5	-16	174.9[3]	12	-11
Baseline	0.0	0.0	+++[4]	1.3	5.3	36	66.8	10.5	2
Long Term	1.4	5.7	-	4.6	7.2	-	76.5	10.7	-
Int: 0.75	0.3	0.9	-	2.9	6.7	-	69.9	10.5	-
Int: 1.8	0.3	0.9	-	3.1	6.8	-	74.9	10.6	-

[1]Dry years are represented by an 80% exceedance for all years in the model (for example, under Historic conditions from the Dam to HWY 154, 80% of the time flows are greater than 1.6 cfs); Normal years are represented by a 50% exceedance and Wet years by a 20% exceedance.
[2]Based on change in habitat area relative to the Long-Term Operations
[3]Estimated habitat; flows exceed predictive reliability of habitat-flow relationship
[4]Percentage increase could not be calculated because there was no available habitat for this condition

or Baseline Operations provide spawning habitat in the Alisal Reach in dry years. Nor do the Baseline Operations provide spawning habitat in dry years in the Refugio Reach. Long-Term Operations provide between 36% and 115% more spawning habitat than the Baseline Operations in normal years, and similar amounts in wet years.

In normal and wet years, Long-Term Operations provide somewhat less habitat than the Historic Condition. In normal years, Long-Term Operations provide 10% to 16% less habitat and, in wet years, provide 11% to 18% less habitat as compared to the Historic Condition. The lower amount of spawning habitat in normal and wet years is likely inconsequential relative to the substantially increased availability of this habitat in dry years. Substantial production of rainbow trout/steelhead has been observed in the Santa Ynez River in wet years like 1995 and 1998. In these years, there appears to be sufficient spawning success to fully utilize the available rearing habitat. In dry years, lack of spawning habitat under the Baseline Operations and Historic Condition results in under-utilization of available rearing habitat. This was identified as a significant limiting factor in the Contract Renewal EIS/EIR (Woodward-Clyde Consultants *et al.*, 1995).

4.2.4 Effects on Rearing Habitat

In general, both phases of Interim Operations provide similar amounts of habitat. Long-Term Operations provide slightly more habitat than the Interim Operations in most seasons and reaches. The largest difference between Interim and Long-Term Operations is found in normal years in the Alisal Reach where Long-Term Operations will provide 10.8 acres of habitat, but Interim Operations provide less than an acre. This is due to the long-term provision of higher target flows at the Highway 154 Bridge and providing 1.5 cfs to Alisal in spill years and the year after a spill.

4.2.4.1 Bradbury Dam to Highway 154

Long-Term Operations provide consistently more habitat in dry years and, more importantly, during the latter half of normal or wet years than either the Baseline Operations or Historic Conditions. In dry years, Long-Term Operations result in flows of 3.1 to 6.2 cfs below the confluence of Hilton Creek, while flows under the Baseline Operations range from 0 to 6 cfs, and the Historic Condition results in flows of 0 to 2 cfs (Table 4-3). The increase in flow over the Baseline Operations translates into a gain in habitat for this reach of over 13 acres during the July through September period, and nearly 18 acres or 74% more habitat than the Baseline Operations during the October through December period, and 74% more habitat than was available prior to the construction of Bradbury Dam.

In normal years, Long-Term Operations continue to provide more flow below the Hilton Creek confluence than does the Baseline Operations. The difference in the amount of habitat available is relatively minor (about 2%) during the middle portion of the year (April through September), but is significant during the January through April period and October through December period where Long-Term Operations provide 30% and 45% more habitat than the Baseline Operations. The Baseline and Long-Term Operations provide a similar amount of habitat in wet years.

Table 4-3 Rearing Habitat between Bradbury Dam and Highway 154

Quarter		Dry Years 80% exceedance[1] Flow (cfs)	Dry Years Habitat Area (acres)	Dry Years Change under Long-Term Operations[2] (%)	Normal Years 50% exceedance[1] Flow (cfs)	Normal Years Habitat Area (acres)	Normal Years Change under Long-Term Operations[2] (%)	Wet Years 20% exceedance[1] Flow (cfs)	Wet Years Habitat Area (acres)	Wet Years Change under Long-Term Operations[2] (%)
Jan-Mar	Historic	1.2	36.5	14	18.1	46.3	-7	157.7[3]	51.9	-8
	Baseline	0.2	25.3	64	0.9	33.2	30	21.3	46.8	3
	Long Term	3.1	41.6	-	5.4	43.2	-	33.0	48.0	-
	Int: 0.75	2.4	40.9	-	3.2	41.7	-	21.1	46.8	-
	Int: 1.8	2.5	41.0	-	3.2	41.7	-	30.1	47.8	-
Apr-Jun	Historic	2.0	40.5	7	13.1	45.3	-4	77.0	50.4	-2
	Baseline	0.6	29.8	45	4.3	42.5	2	56.7	49.1	0
	Long Term	5.0	43.1	-	6.2	43.4	-	51.0	49.2	-
	Int: 0.75	3.1	41.6	-	5.4	43.2	-	55.7	49.5	-
	Int: 1.8	3.0	41.6	-	4.6	42.7	-	53.9	49.4	-
Jul-Sep	Historic	0.0	24.2	79	0.0	24.2	86	2.6	41.1	19
	Baseline	0.6	29.8	46	7.7	43.8	2	43.4	48.7	0
	Long Term	6.2	43.4	-	11.5	44.9	-	46.0	48.8	-
	Int: 0.75	4.1	42.4	-	6.8	43.6	-	46.9	49.0	-
	Int: 1.8	3.6	42.0	-	7.1	43.6	-	44.3	48.7	-
Oct-Dec	Historic	0.0	24.2	74	0.0	24.2	79	3.2	41.7	6
	Baseline	0.0	24.2	74	0.6	29.8	45	6.1	43.4	2
	Long Term	3.7	42.1	-	5.9	43.3	-	9.9	44.4	-
	Int: 0.75	2.6	41.1	-	3.4	41.9	-	5.4	43.2	-
	Int: 1.8	2.6	41.1	-	3.4	41.9	-	5.3	43.1	-

[1]Dry years are represented by an 80% exceedance for all years in the model (for example, under Historic conditions from the Dam to HWY 154, 80% of the time flows are greater than 1.6 cfs); Normal years are represented by a 50% exceedance and Wet years by a 20% exceedance.

[2]Based on change in habitat area relative to the Long-Term Operations

[3]Estimated habitat; flows exceed predictive reliability of habitat-flow relationship

Flows resulting from the Historic Condition are greater than either Long-Term or Baseline Operations in the first half of normal and wet years. However, in the later portion of normal years, Historic Conditions have severely reduced habitat when flow is zero and habitat is available only in refuge pools. Long-Term Operations result in about 4% to 7% less habitat during the first half of normal years, and about 79% to 86% more habitat in the latter half of the year than the Historic Condition. In wet years, the Historic Condition retains flow throughout the year, but under Long-Term Operations between 6% and 19% more habitat is available.

4.2.4.2 Highway 154 to Refugio Road

The flows at Highway 154 were used to characterize habitat in the reach from Highway 154 to Refugio Road (Table 4-4). The flow at Highway 154 tends to be less than that below the Hilton Creek confluence for all conditions due to infiltration and evapotranspiration. The pattern of habitat availability among the different scenarios is similar to that described above for the Bradbury Dam to Highway 154 Reach, with Long-Term Operations providing the most habitat throughout the year in dry years and in the latter half of normal and wet years. Minimum habitat levels are highest under Long-Term Operations.

In dry years, the Long-Term Operations provide about seven more acres of habitat than the Baseline Operations, representing more than a seven-fold increase in the amount of available habitat. Long-Term Operations also provide an increase in habitat over the Historic Condition of 4.1 to 7.5 acres in dry years. In normal years, Long-Term and Baseline Operations provide about the same amount of habitat during the middle part of the year, but Long-Term Operations provide 93% and 482% (4.1 and 7 acres) more habitat in the January through March and October through December periods, respectively. Long-Term Operations provide 7.5 to 8 times more habitat than does the Historic Condition in the latter half of normal years, although the Historic Condition provides 8% to 10% more habitat in the first half of normal years. In wet years, Long-Term and Baseline Operations provide a similar amount of habitat throughout the year, never differing by more than .4 acres or about 4%. The Historic Condition in wet years provides 3% to 18% more habitat during the first half of the year than does Long-Term Operations. This increased habitat during the first part of the year is offset by diminished habitat in the latter half of the year when Long-Term Operations provide 1.5 to 2.4 acres (21% to 31%) more habitat.

4.2.4.3 Refugio Road to Alisal Road

The flows at Alisal Bridge were used to characterize the habitat in the reach from Refugio Road to Alisal Road. Flow at Alisal Road is less than that for Highway 154 and the Hilton Creek confluence under most conditions due to continued losses to groundwater and evapotranspiration. Under Historic Conditions, flow is nearly absent from this location in all water year types during the July through September and October through December periods (Table 4-5). Flows under Long-Term Operations are greater than those under the Baseline Operations, except in the July through September period of wet years when they are the same.

Table 4-4 Rearing Habitat between Highway 154 and Refugio Road

Quarter		Dry Years 80% exceedance[1]			Normal Years 50% exceedance[1]			Wet Years 20% exceedance[1]		
		Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)	Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)	Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)
Jan-Mar	Historic	0.3	2.0	325	17.4	9.5	-10	157.1[3]	11.2	-8
	Baseline	0.0	1.0	730	0.8	4.4	93	28.6	9.9	4
	Long Term	3.1	8.3	-	5.0	8.5	-	40.9	10.3	-
	Int: 0.75	2.3	8.1	-	2.8	8.2	-	27.5	9.9	-
	Int: 1.8	2.4	8.1	-	2.9	8.2	-	40.0	10.2	-
Apr-Jun	Historic	0.8	4.4	93	12.1	9.2	-8	75.3	10.8	-3
	Baseline	0.1	1.0	776	4.0	8.4	1	51.9	10.5	0
	Long Term	4.9	8.5	-	5.0	8.5	-	49.9	10.5	-
	Int: 0.75	2.5	8.1	-	5.0	8.5	-	52.5	10.4	-
	Int: 1.8	2.4	8.1	-	4.4	8.5	-	52.2	10.4	-
Jul-Sep	Historic	0.0	1.0	750	0.0	1.0	810	1.6	7.9	31
	Baseline	0.1	1.0	776	6.4	8.7	5	39.7	10.2	1
	Long Term	4.9	8.5	-	10.1	9.1	-	42.0	10.3	-
	Int: 0.75	2.9	8.2	-	6.5	8.7	-	41.0	10.3	-
	Int: 1.8	2.4	8.1	-	6.8	8.7	-	41.7	10.3	-
Oct-Dec	Historic	0.0	1.0	710	0.0	1.0	750	1.4	7.4	21
	Baseline	0.0	1.0	710	0.2	1.5	482	5.1	8.5	4
	Long Term	2.5	8.1	-	4.9	8.5	-	8.8	8.9	-
	Int: 0.75	1.5	7.8	-	2.5	8.1	-	4.6	8.5	-
	Int: 1.8	1.5	7.8	-	2.5	8.1	-	4.2	8.5	-

[1]Dry years are represented by an 80% exceedance for all years in the model (for example, under Historic conditions from the Dam to HWY 154, 80% of the time flows are greater than 1.6 cfs); Normal years are represented by a 50% exceedance and Wet years by a 20% exceedance.
[2]Based on change in habitat area relative to the Long-Term Operations
[3]Estimated habitat; flows exceed predictive reliability of habitat-flow relationship

In dry years, the long-term condition is the only operation that provides flow at Alisal Bridge, although there is no flow from October through December. Flow ranges from .8 cfs in the July through September period to 2.2 cfs in the April through June period. These flows provide between 5.4 and 11.2 acres of habitat, compared to the .1 acres provided by the other conditions. In the middle portion of normal years, the amount of habitat provided by Long-Term Operations is about 11% greater than that available under the Baseline Operations. In the January through March period, however, Long-Term Operations provide 58% more habitat than does the Baseline Condition; and in the October through December period, Long-Term Operations provide over 100 times the habitat as flow under the Baseline Operations is zero. The Historic Condition provides about 8% to 15% more habitat than Long-Term Operations in the first half of normal years, but then flow under the Historic Conditions dries up, and little habitat is available for fish in the second half of the year. During the second half of the year, Long-Term Operations provide between 10.8 and 12.8 acres of habitat compared to .1 acres for the Historic Condition.

In wet years, Long-Term and Baseline Operations provide a similar amount of habitat throughout the year, with the largest difference in the October through March periods when Long-Term Operations offer 6% to 10% more habitat than does Baseline Operations. The Historic Condition in wet years provides about 2.9 acres (10%) more habitat than does Long-Term Operations during January through March. In the latter part of the year, however, the flow under the Historic Condition subsides to .1 cfs, and only .1 acres of habitat are available. Long-Term Operations provide 12.6 acres of habitat during this time of year, representing a substantial increase.

4.2.5 Effects on Minimum Flows

The minimum daily flow during a year represents the most severe bottleneck in rearing habitat that steelhead will face. Minimum daily flows were modeled for the same three stations used for the habitat analysis: below the confluence with Hilton Creek, at theHighway 154 Bridge, and at the Alisal Road Bridge. Under Proposed (long-term) Operations at Alisal, minimum daily flows would generally be much lower than in the mainstem below Hilton Creek or the Highway 154 Bridge, but would remain substantially better than the flows present under the Historic Conditions or Baseline Operations. Under the Historic Condition, all sites have little or no flow during a portion of the year, in all year types (Table 4-6). Under the Baseline Operations, a similar situation prevails, such that there is a small amount of flow (<1 cfs) present below the Hilton Creek confluence in about a third of all years. The river would go dry for at least one day in most years at both the Highway 154 and Alisal sites. Under the Proposed Operations, the minimum daily flow would approach zero below Hilton Creek in three years (1951, 1952, and 1991), all occurring at the end of prolonged droughts. During these years, dissolved oxygen, temperature, and water levels in pools in the upper reaches of the mainstem would be maintained by refreshing flows from the dam. At Highway 154, the minimum daily flow would be at least 2.5 cfs in all but three years, and would be at least 5 cfs in 58% of years. At the Alisal Bridge, the minimum flow would be at least 1.5 cfs in 38% of years.

Table 4-5 Rearing Habitat between Refugio Road and Alisal Road

Quarter		Dry Years 80% exceedance[1]			Normal Years 50% exceedance[1]			Wet Years 20% exceedance[1]		
		Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)	Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)	Flow (cfs)	Habitat Area (acres)	Change under Long-Term Operations[2] (%)
Jan-Mar	Historic	0.0	0.1	9,900	14.0	14.3	-15	161.6[3]	19.4	-10
	Baseline	0.0	0.1	9,900	1.1	7.7	58	38.7	16.6	6
	Long Term	1.4	10.0	-	4.2	12.2	-	58.8	17.5	-
	Int: 0.75	0.2	0.8	-	2.7	11.5	-	41.5	16.7	-
	Int: 1.8	0.2	0.8	-	2.6	11.4	-	54.7	17.3	-
Apr-Jun	Historic	0.0	0.1	11,100	9.4	13.6	-8	77.6	18.1	-6
	Baseline	0.0	0.1	11,100	3.0	11.7	7	44.6	16.9	0
	Long Term	2.2	11.2	-	5.1	12.5	-	46.0	17.0	-
	Int: 0.75	0.4	2.4	-	4.4	12.3	-	45.7	17.0	-
	Int: 1.8	0.4	2.4	-	4.1	12.2	-	45.5	17.0	-
Jul-Sep	Historic	0.0	0.1	5,300	0.0	0.1	12,700	0.1	0.1	26,694
	Baseline	0.0	0.1	5,300	2.8	11.6	11	30.2	16.0	0
	Long Term	0.8	5.4	-	6.1	12.8	-	30.9	16.0	-
	Int: 0.75	0.0	0.1	-	3.9	12.1	-	28.4	15.8	-
	Int: 1.8	0.0	0.1	-	4.0	12.2	-	27.8	15.8	-
Oct-Dec	Historic	0.0	0.1	0	0.0	0.1	10,700	0.1	0.1	21,000
	Baseline	0.0	0.1	0	0.0	0.1	10,700	2.7	11.5	10
	Long Term	0.0	0.1	-	1.5	10.8	-	5.3	12.6	-
	Int: 0.75	0.0	0.1	-	0.2	0.8	-	4.5	12.3	-
	Int: 1.8	0.0	0.1	-	0.1	0.1	-	4.2	12.2	-

[1]Dry years are represented by an 80% exceedance for all years in the model (for example, under Historic conditions from the Dam to HWY 154, 80% of the time flows are greater than 1.6 cfs); Normal years are represented by a 50% exceedance and Wet years by a 20% exceedance.

[2]Based on change in habitat area relative to the Long-Term Operations

[3]Estimated habitat; flows exceed predictive reliability of habitat-flow relationship

4.2.6 DOWNSTREAM WATER RIGHTS RELEASES

The potential exists for steelhead to move downstream during water rights releases. Surveys have been conducted to assess the presence and index of relative abundance of juvenile and adult trout within the area of the Stilling Basin and Long Pool, and in the Refugio and Alisal Reaches prior to and after WR 89-18 releases. Field surveys have been conducted during the recession phase of WR 89-18 releases and after the releases have been completed, to assess fish stranding within pools and other habitats in downstream areas. The result of these field surveys, performed under the guidance of the SYRTAC, is that no strandings have been observed during ramping events and no downstream migration of rainbow trout/steelhead as a result of these releases has been noted. As part of the ongoing fishery monitoring program, additional field surveys and observations will be collected to provide information on movement patterns and the response of rainbow trout to WR 89-18 releases (see Appendix I, Long-Term Monitoring in the Lower Santa Ynez River).

4.3 EFFECTS ON OTHER SPECIES

4.3.1 OTHER FISH IN THE SANTA YNEZ RIVER

Flow-related fish enhancement measures will only affect Lake Cachuma, the mainstem below Bradbury Dam, and Hilton Creek below the upper watering system release site. Mainstem target flow releases will not persist far enough downstream to impact the lagoon, however passage flow releases will likely modify the flow regime to the lagoon to some extent. Impacts to the six native fish species that reside only in the lagoon, as well as the other fish in the mainstem Santa Ynez River, are expected to be negligible because of the nature of the supplementation passage flow releases. Releases from the Fish Passage Account have been designed to mimic the hydrograph of naturally occurring storms (*i.e.*, match the average inflow decay rate). The magnitude of the supplemental flow is well within the range of existing storm flows, and therefore no adverse impacts are anticipated on these sensitive resources. Pacific lamprey, however, are expected to benefit from these releases because they, like steelhead, are anadromous. The additional passage opportunities provided by the Fish Passage Account will benefit this species as well by increasing migration opportunities.

The flow-related enhancement measures should beneficially impact all of the fish inhabiting the mainstem near Bradbury Dam. Conjunctive use of reservoir releases and downstream water rights releases to meet mainstem rearing target flows will benefit these fish by improving over-summering habitat in the mainstem downstream of Bradbury Dam. Late summer and early fall are critical periods for fish in the Santa Ynez River system because warm temperatures and shrinking pool habitat lead to a habitat bottleneck. The Proposed Operations will provide water to maintain pool habitat during this critical period in all but the driest years. The Proposed Operations may potentially have a negative impact on introduced species in the mainstem below Bradbury Dam because the majority of these fish are warmwater species. Rearing target flow

Table 4-6 Minimum Flow by Water Year (cfs)

Water Year	Without Cachuma Operations			Baseline Operations			Proposed Operations (long term)		
	Below Hilton Ck	Hwy 154 Bridge	Alisal Bridge	Below Hilton Ck	Hwy 154 Bridge	Alisal Bridge	Below Hilton Ck	Hwy 154 Bridge	Alisal Bridge
1942	0	0	0	0.5	0.5	0	2	5	3
1943	0	0	0	0.5	0	0	6	5	0.5
1944	0	0	0	0.5	0	0	4.5	5	1.5
1945	0	0	0	0.5	0	0	2.5	5	1.5
1946	0	0	0	0.5	0	0	2.5	5	2
1947	0	0	0	0	0	0	5.5	5	2
1948	0	0	0	0	0	0	3.5	2.5	0
1949	0	0	0	0	0	0	2	2.5	0
1950	0	0	0	0	0	0	2	2.5	0
1951	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	2	5	1.5
1954	0	0	0	0.5	0	0	2	5	1.5
1955	0	0	0	0	0	0	2	2.5	0
1956	0	0	0	0	0	0	1	2.5	0
1957	0	0	0	0	0	0	2.5	2.5	0
1958	0.5	0	0	0	0	0	2	2.5	0
1959	0	0	0	0	0	0	2	5	1.5
1960	0	0	0	0	0	0	3.5	2.5	0
1961	0	0	0	0	0	0	3.5	2.5	0
1962	0	0	0	0	0	0	1	2.5	0
1963	0	0	0	0	0	0	2	5	0.5
1964	0	0	0	0	0	0	3.5	2.5	0
1965	0	0	0	0	0	0	2	2.5	0
1966	0	0	0	0	0	0	1	2.5	0
1967	0	0	0	0.5	0.5	0.5	2	5	2
1968	0	0	0	0	0	0	4.5	5	1.5
1969	0	0	0	0	0	0	6	5	2
1970	0	0	0	0.5	0	0	3	5	1.5
1971	0	0	0	0.5	0	0	3.5	5	2
1972	0	0	0	0	0	0	3	5	0
1973	0	0	0	0	0	0	2	2.5	0
1974	0	0	0	0.5	0	0	2	5	2.5
1975	0	0	0	0	0	0	2	5	1.5
1976	0	0	0	0	0	0	4.5	5	0.5
1977	0	0	0	0	0	0	3.5	2.5	0
1978	0	0	0	0	0	0	2	2.5	0
1979	0	0	0	0.5	0	0	2	5	1.5
1980	0	0	0	0.5	0	0	2.5	5	1.5
1981	0	0	0	0.5	0	0	2	5	1.5
1982	0	0	0	0.5	0	0	2	5	2
1983	1	0.5	0	0	0	0	2	5	2
1984	0.5	0	0	1	0.5	0	4.5	5	3
1985	0	0	0	0.5	0	0	5	5	1
1986	0	0	0	0	0	0	2	5	1.5
1987	0	0	0	0	0	0	3.5	5	0.5
1988	0	0	0	0	0	0	4.5	5	0.5
1989	0	0	0	0	0	0	3	2.5	0
1990	0	0	0	0	0	0	3.5	2.5	0
1991	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	2	2.5	0
1993	0	0	0	0	0	0	5.5	5	3

releases will be of water temperatures less than 18°C. Low temperatures can negatively affect warmwater species by lowering their metabolism and slowing growth rates. Because water in the mainstem warms quickly as it passes downstream, these affects are expected to be minimal and will likely be offset by the habitat maintenance these releases provide. In addition, some warm water fish have been observed to be transported downstream due to water rights releases. Water releases into Hilton Creek through the supplemental watering facilities will directly benefit the sculpin, which presently reside in Hilton Creek. The watering system will provide critical over-summering habitat away from mainstem predatory fish.

4.3.2 WILDLIFE

Flow-related fish enhancement measures will only affect Lake Cachuma, the mainstem below Bradbury Dam, and Hilton Creek below the upper watering system release site. Most of the proposed flow enhancements will not persist far enough downstream to impact the mainstem downstream of Buellton including the lagoon, however passage flow releases will likely modify the flow regime to the lagoon to some extent. The passage releases should have no effect on southwestern willow flycatcher (populations found near Buellton and Lompoc) and least Bell's vireo (near Salsipuedes Creek in Lompoc). The magnitude of the supplemental flow is well within the range of existing storm flows, and therefore no adverse impacts are anticipated on these sensitive resources. The southwestern arroyo toad (found only upstream of Gibraltar Reservoir) and the California tiger salamander (not found near the mainstem) will not be impacted by any of the Proposed Operations.

The southwestern willow flycatcher will likely benefit from the target flow releases through the addition of more suitable habitat. The target flow releases are expected to cause increase riparian growth in the Highway 154 Reach and perhaps in the Alisal Reach as well. Southwestern willow flycatchers prefer dense willow riparian habitat which will likely develop because of the year-round water supply provided by the target flows. It is possible that removal of some of this new vegetation will be required, however a net increase in riparian vegetation is anticipated.

The California red-legged frog, western pond turtle, and two-striped garter snake all need water throughout all or a portion of the year and prefer a well developed riparian zone. Mainstem rearing target flow releases into Hilton Creek will produce good habitat by providing a perennial water source with a good riparian zone. None of these three species currently inhabit Hilton Creek. Benefits to the species will only occur if they colonize Hilton Creek. Conjunctive use will extend mainstem summer flows in almost all years, and habitat will be maintained through pool maintenance releases from Bradbury Dam in the remaining years (drought years). These releases will also have the beneficial effect of providing additional mainstem habitat and improving existing habitats through water quality improvements and riparian growth. The habitat enhancement, however, may also benefit bullfrogs, which have been linked to the decline of red-legged frogs and can hurt turtle populations by predation on hatchlings. Bullfrogs are currently found throughout the mainstem.

4.3.3 SPECIES THAT INHABIT LAKE CACHUMA

Surcharging the reservoir to 3 feet is not expected to impact bass, sunfish, and crappie inhabiting Lake Cachuma. Based on a study of the effect of a 1.8 foot surcharge on spawning and fry rearing in the lake (done for the Cachuma contract renewal [ENTRIX 1995]), the impacts of the 1.8-foot surcharge are almost identical to current operations. A 1.2-foot increase beyond the level already determined to have little impact on these fish should not negatively impact spawning. Bass, sunfish, and crappie create their nests over a range of water depths. Once the nests are built, surcharging the reservoir will only submerge these nests to a slightly deeper level. This will not substantially impact the success of the nests. Surcharging the reservoir will not lead to a decrease in spawning habitat and will allow for access to spawning habitat in the lake's tributaries. Catfish spawn in 8- to 12-foot deep water, and therefore nests should not be impacted by changing lake levels. Surcharging the reservoir will not impact the shad, nor will any of the proposed release operations, because shad prefer open surface waters.

Flow-related enhancements have the potential to affect Lake Cachuma resources because they, like water supply deliveries, reduce the lake surface elevation. Decreasing lake surface elevation has the potential to de-water nests prior to fry emergence; however, because of the small shifts in reservoir surface elevation expected as a result of the flow-related enhancements, this should be a negligible impact. None of the proposed releases (target flows or Fish Passage Account) will dramatically change the reservoir surface elevation in a short period of time. For the steelhead spawning period of January through May, analysis shows that the largest projected release for passage supplementation would be 1,800 AF over at least two 14-day periods. The surface area of Lake Cachuma is approximately 3,000 acres at a reservoir surface elevation of 750 feet. Because of the large surface area of the lake, the 1,800 AF release will amount to a decrease in reservoir surface elevation of slightly more than .5 feet. Such a small change in surface elevation will have the potential to de-water only the most shallow of nests. Bass, sunfish, and crappie generally do not create nests in water shallower than .5 feet, and therefore few if any nests should be impacted by these operations. Water fluctuations should not affect shad because spawning occurs on floating or partially submerged vegetation or other structures.

The flow-related enhancement measures described in this document will provide substantial benefits to the steelhead population. Through conjunctive use of reservoir releases and downstream water rights accounts to meet mainstem rearing target flows, year-round habitat for steelhead can be created in both the mainstem Santa Ynez River and Hilton Creek. These measures will significantly expand the amount of habitat available for steelhead rearing and over-summering, which has been identified as the primary limiting factor in the mainstem Santa Ynez River. In wet years, higher rearing flow target levels will provide more habitat than in normal and dry years. This leverages the use of water to provide higher levels of habitat when there will likely be more steelhead in the river (*i.e.,* in highly productive wet years), and to support less habitat when there are fewer steelhead in the river and when water supplies are lower (*i.e.,* in less productive dry years). The habitat created and enhanced by these measures is located in the portion of the river with the best structural habitat and the greatest opportunity to control water temperatures, which limits the distribution of steelhead in most of the river.

Passage flow release substantially increase the number of passage opportunities over Baseline conditions in those years when releases are made. The combination of good passage opportunities in wet years and Fish Passage Account releases in non-wet years provide at least 14 passage days in about two-thirds of years. Passage supplementation combined with rearing flow targets should provide a considerable benefit to rainbow trout/steelhead in the Santa Ynez River watershed.

The Conjunctive Use Work Group recommends that conjunctive use of reservoir releases and downstream water rights releases be implemented immediately at the interim levels. This includes surcharging the reservoir to 0.75 feet to support the flow-related enhancement actions. The dam modifications necessary to implement a greater surcharge should be completed as soon as possible in order to begin Fish Passage Account releases. Finally, the environmental review necessary to obtain the proposed 3-foot surcharge of Lake Cachuma should be completed as soon as possible. This action will allow for implementation of the long-term enhancement measures: (1) long-term rearing target flows, (2) full Fish Passage Account allocation of 3,200 AF, and (3) the Adaptive Management Account allocation of 500 AF. In addition, the monitoring program discussed in Appendix I should be implemented immediately to continue gathering data appropriate for implementation and evaluation of these measures by the Adaptive Management Committee.

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TRIBUTARIES OF THE SANTA YNEZ RIVER BELOW BRADBURY DAM

Appendix C

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

TRIBUTARIES WORK GROUP

October 2, 2000

Page

List of Tables .... C-iv

List of Figures .... C-v

1.0 Introduction C-1-1

1.1 Objectives C-1-1

1.2 Approach C-1-2

1.3 Prioritization of Enhancement Actions C-1-3

1.4 Conclusions C-1-5

2.0 Overview of Tributaries in Lower Santa Ynez River C-2-1

2.1 Objectives C-2-1

2.2 Steelhead Life History and Habitat Use C-2-1

2.3 Tributary-by-Tributary Assessment C-2-1

2.3.1 Survey Methods C-2-2

2.3.1.1 General Location and Description C-2-2

2.3.1.2 Fish Use C-2-2

2.3.1.3 Water Quality C-2-4

2.3.2 Hilton Creek C-2-4

2.3.2.1 General Location and Description C-2-4

2.3.2.2 Fish Use C-2-7

2.3.2.3 Water Quality C-2-8

2.3.2.4 Enhancement Potential C-2-10

2.3.3 Quiota Creek C-2-11

2.3.3.1 General Location and Description....C-2-11
2.3.3.2 Fish Use....C-2-13
2.3.3.3 Water Quality....C-2-13
2.3.3.4 Enhancement Potential....C-2-15
2.3.4 Alisal Creek....C-2-15
2.3.4.1 General Location and Description....C-2-15
2.3.4.2 Fish Use....C-2-17
2.3.4.3 Water Quality....C-2-17
2.3.4.4 Enhancement Potential....C-2-17
2.3.5 Nojoqui Creek....C-2-17
2.3.5.1 General Location and Description....C-2-17
2.3.5.2 Fish Use....C-2-18
2.3.5.3 Water Quality....C-2-18
2.3.5.4 Enhancement Potential....C-2-18
2.3.6 Salsipuedes Creek and El Jaro Creek....C-2-20
2.3.6.1 General Location and Description....C-2-20
2.3.6.2 Fish Use....C-2-23
2.3.6.3 Water Quality....C-2-24
2.3.6.4 Enhancement Potential....C-2-24
2.3.7 San Miguelito Creek....C-2-27
2.3.7.1 General Location and Description....C-2-27
2.3.7.2 Fish Use....C-2-27
2.3.7.3 Water Quality....C-2-27
2.3.7.4 Enhancement Potential....C-2-27

2.4 Summary C-2-29

3.0 Tributary Enhancements C-3-1

3.1 Habitat Conservation Measures C-3-1

3.1.1 Objective C-3-1

3.1.2 Project Description C-3-1

3.1.2.1 Conservation Management Practices and Landowner Education C-3-2

3.1.2.2 Conservation Easements and Leases C-3-3

3.1.2.3 Physical Enhancement Measures C-3-5

3.2 Passage Impediment/Barrier Modification C-3-7

3.2.1 Objective C-3-7

3.2.2 Description of Physical Environment C-3-7

3.2.3 Project Description C-3-7

4.0 Funding and Implementation C-4-1

4.1 Funding C-4-1

4.2 Implementation C-4-1

5.0 Literature Cited C-5-1

6.0 Personal Communications C-6-1

Page

Table 1-1 Tributaries Enhancement Prioritization Ranking Matrix............................C-1-4

Table 2-1 Definitions and Characteristics of Different Lifestages of Rainbow Trout/Steelhead...C-2-3

Table 2-2 Quiota Creek Road Crossings Passage Impediment Modification Rankings...C-2-14

Table 3-1 Passage Impediments on Tributaries C-3-8

Table 4-1 Outside Funding Approved for Tributary Enhancement Measures...........C-4-2

Page

Figure 2-1 Hilton Creek Enhancement Projects..C-2-5

Figure 2-2 Summary of Hilton Creek Habitat Attributes..C-2-6

Figure 2-3 Seasonal Trapping Results in Hilton Creek (1995) C-2-9

Figure 2-4 Summary of Quiota Creek Habitat Attributes.......................................C-2-12

Figure 2-5 Summary of Alisal Creek Habitat Attributes...C-2-16

Figure 2-6 Summary of Nojoqui Creek Habitat Attributes.....................................C-2-19

Figure 2-7 Summary of Salsipuedes Creek and El Jaro Creek Habitat Attributes..C-2-21

Figure 2-8 Results of Seasonal Migrant Trapping in Salsipuedes Creek (1997)........... 2-25

Figure 2-9 Timing of Rainbow Trout/Steelhead Spawning from Redd Surveys in Salsipuedes, El Jaro and San Miguelito Creeks (1997)......................C-2-26

Figure 2-10 Summary of San Miguelito Creek Habitat Attributes C-2-28

Figure 2-11 Potential Spawning Habitat for Rainbow Trout/Steelhead in the Lower Santa Ynez River C-2-30

Figure 2-12 Potential Summer Rearing Habitat for Rainbow Trout/Steelhead in the Lower Santa Ynez River...C-2-31

Figure 3-1 Conservation Easement Process..C-3-4

1.1 OBJECTIVES

The goal of the Santa Ynez River Fish Management Plan (Plan) is to develop and evaluate enhancement actions that will benefit fish and other aquatic resources in the lower Santa Ynez River basin. The lower basin is defined as the watershed and streams west of Cachuma Reservoir (Lake Cachuma), including the mainstem Santa Ynez River below Bradbury Dam and the associated tributaries. Opportunities to enhance conditions in the mainstem Santa Ynez River are limited to a few miles just below Bradbury Dam. Further downstream below Solvang and Buellton, the mainstem has insufficient flow and poor physical habitat conditions for rainbow trout/steelhead. The tributaries on the south side of the lower basin offer better potential for fish habitat than those on the north side. South-side streams originate at fairly high elevations on the cool and well-vegetated north-facing slopes of the Santa Ynez Mountains. Several streams have perennial flow in their upper reaches, although during summer most go dry in their lower reaches in years with average rainfall. By contrast, tributaries on the north side do not retain summer flows and thus, are too dry to support rainbow trout/steelhead. Starting at Bradbury Dam and moving to the ocean, the tributaries of interest include Hilton, Quiota, Alisal, Nojoqui, Salsipuedes, El Jaro and San Miguelito creeks. The tributary reaches in the lower basin fall into four general categories:

- reaches that have good to excellent rainbow trout/steelhead habitat and support existing rainbow trout/steelhead populations;
- reaches that have good to excellent habitat, but do not currently support an anadromous steelhead population because of downstream passage impediments;
- reaches that have fair habitat and with appropriate enhancement efforts or passage impediment removals could support new or larger populations of rainbow trout/steelhead; and
- reaches where conditions are too poor to support rainbow trout/steelhead (*e.g.*, portions of tributaries which go dry or have major passage impediments).

The enhancement objectives of the Santa Ynez River Technical Advisory Committee (SYRTAC) for the tributaries are:

- to protect tributary habitat that is in good condition and which supports fish;
- to enhance aquatic habitat in areas with fair conditions; and
- to enhance fish passage to suitable habitat in tributaries.

1.2 APPROACH

Over the past eight years, the SYRTAC has collected detailed data on fish presence and habitat use and on the quality of habitat conditions in the lower Santa Ynez River and tributaries (SYRTAC 1994, 1996, 1997, 1998, 2000). These detailed data, combined with anecdotal observations from long-time residents and other surveys and research (*e.g.*, Harper and Kaufman 1988, ENTRIX 1995, Douglas 1995) provide a good basis on which to identify good rainbow trout/steelhead habitat relative to other areas on the lower Santa Ynez River. Much of the SYRTAC's efforts have focused on identifying and prioritizing the tributaries with regard to their ability to support fish populations, enhancement opportunities and the level of effort required to achieve successful results. This appendix presents our evaluation of each of the tributaries. Our approach in the following sections is as follows.

- *Identify tributaries that currently support fish populations*

  We describe each tributary with respect to evidence of rainbow trout/steelhead populations. This includes observations of migrating adults and juveniles, spawning behavior and redds, presence of young-of-the-year, juvenile and adult fish in various months, and the occurrence of potential predators.

- *Describe the current habitat conditions to determine opportunities for protection and enhancement*

  For each tributary, we describe the habitat conditions, including factors such as flow, water temperature and quality, riparian canopy, and instream cover. We note those areas that appear to have suitable habitat for supporting fish populations. Where appropriate, we comment on enhancement activities that could improve habitat, and indicate the magnitude of the enhancements that would be required. Finally, we note which areas cannot be improved to support fish. For example, such areas may lack summer flows or may contain permanent passage impediments.

- *Outline potential actions for selected tributaries and reaches*

  We discuss the suite of potential actions appropriate for each tributary. Such activities include educating landowners and working with them to establish "fish friendly" conservation land management practices, purchasing conservation easements from willing landowners, enhancing physical stream and riparian habitat, and working with appropriate agencies to remove or modify stream passage impediments such as road crossings and culverts.

- *Prioritize potential actions for selected tributaries and reaches*

  For each tributary, we rank potential enhancement actions based on the expected biological benefit, technical feasibility, property access, and cost. Prioritization of actions provides an adaptive management framework for allocating habitat enhancement and restoration resources.

1.3 PRIORITIZATION OF ENHANCEMENT ACTIONS

Several actions were identified for improving fish passage and existing habitat conditions within the tributaries below Bradbury Dam. Each enhancement action was evaluated based on the anticipated rainbow trout/steelhead response, and associated biological benefits. Understanding that multiple factors affect the implementation of actions, we conducted a multi-level assessment of the biological benefits, cost, and ease of implementation associated with each action.

Each tributary action was prioritized among all of the potential enhancement opportunities. The ranking of enhancement actions was performed by the Tributaries Work Group, based on a number of variables including the expected biological benefits, project cost, and property access. The results of the ranking are presented in Table 1-1.

We evaluated the existing tributaries for habitat quantity and quality (composition) data, and data pertaining to fish utilization, prior to assessing potential enhancement actions. Since a majority of the tributary streams flow through private land, fish usage and habitat quality data are limited. Where such data are unavailable, qualitative information was provided by the SYRTAC project biologist and other working group members familiar with the lower Santa Ynez River tributaries. The major habitat criteria for rainbow trout/steelhead in the tributaries includes stream gradient, instream cover, canopy cover, proximity to ocean, and available over-summering habitat. The presence of seed populations within each tributary is an important factor in evaluating the anticipated biological response time for each enhancement action. Seed populations are those where rainbow trout/steelhead are present and reproducing, and adequate over-summering habitat is available. In some cases, fish passage impediments may isolate local populations and suppress fish production and expansion due to limited migration opportunities. We determined that tributaries with seed populations present would likely exhibit short-term biological responses associated with modifying passage impediments. Quiota, Alisal, Salsipuedes-El Jaro, and San Miguelito creeks are tributary streams where seed populations currently exist. However, Alisal and San Miguelito creeks have impassable barriers downstream (*e.g.*, Alisal Reservoir, San Miguelito Creek flood control channel) which are infeasible to effectively modify for fish passage. The resident populations found in upper Alisal and San Miguelito are likely residualized strains of rainbow trout/steelhead. The presence of seed populations in Quiota and Salsipuedes-El Jaro creeks suggest that fish passage impediment modifications will improve migration opportunities during both low-flow and high-flow scenarios.

Generally, habitat quality and fish utilization is lacking within the lower reaches of the tributary streams, with the exception of Hilton Creek. Stream gradient was determined to be a major habitat quality component, since fish utilization may be generally greater in higher gradient streams where adequate over-summering habitat is more available (Douglas 1995). The higher gradient reaches identified within the tributaries include Hilton Creek (confluence with mainstem to headwaters), Quiota Creek (middle and upper reaches), Alisal Creek (above Alisal Reservoir), upper Salsipuedes Creek, and San Miguelito Creek (above Lompoc).

Table 1-1 Tributaries Enhancement Prioritization Ranking Matrix

Tributary	Tributaries Ranking	Intra-Tributary Ranking	Estimated Length	Estimated Stream Gradient	Over-summering Habitat	Proximity to SYR Mouth	Land Access	Enhancement Opportunity	Distance/Area Enhanced	Expected Steelhead Response Time	Seed Population	Estimated Cost
Lower Hilton Creek	1	1	1,500 ft	HIGH 0.117 (0.117)	YES	6th	Good - BOR	Chute Modification, Supplemental Flow, Channel Extension, Riparian Enhancement	2,800 ft (Chute); 2,980 ft (Flow); 1,215 ft (Extension); 200 ft (Riparian)	Short-term	YES (with watering system)	$115k (Chute passage); $360k (Pump & Intake); $220k (Extension)
Upper Hilton Creek		2	3.5 mi	HIGH 0.081 (0.081)	YES	6th	Good - w/in CalTrans easement; None - adjacent private	Impediment Modification (Hwy 154 Culvert)	18,480 ft (via passage)	Short-term	Uncertain	$75-100k
Quiota Creek	2	1	6.4 mi	HIGH 0.0585 (Lower 0.059, Upper 0.058)	YES	5th	Poor - Good SB Co. roads, Poor on private adjacent land	Impediment Modification (Arizona Crossings), Livestock Mgmt. & Erosion Control Measures, Riparian Vegetation	24,300 ft (via passage), 5,280 ft (livestock mgmt.)	Short-term	YES	$150k for 6 crossings (Santa Barbara County Roads has funding for 3 crossings)
Lower Alisal Creek	4	1	3.6 mi	LOW (estimated)	N/A	4th	None - Private adjacent lands	Riparian Enhancement	unknown - depends on access	Long-term	Uncertain	Unknown
Upper Alisal Creek		2	2 mi	HIGH (estimated)	YES (potential)	4th	Poor - Private adjacent lands	Reservoir Passage (ladder)	15,840 ft (via passage)	Short-term	YES	Unknown
Nojoqui Creek	5	1	8 mi	LOW 0.014 (Lower 0.017, Upper 0.011)	NO (low)	3rd	Moderate - Private adjacent lands	Impediment Modification (cascade & culvert)	23,760 ft (via passage)	Long-term	NO	$30k (passage)
Lower Salsipuedes Creek	2	2	4 mi	LOW 0.003 (0.003)	NO	2nd	Good - CalTrans; Private adjacent lands	Impediment Modification (low-flow impediment), Livestock mgmt. & erosion control measures	Passage to Upper Salsipuedes (5.4 mi) and El Jaro (12 mi); 10,560 ft (livestock mgmt. & erosion control measures)	Long-term	YES	$50k (passage); $100-200k? CEs
Upper Salsipuedes Creek		3	5 mi	MODERATE 0.033 (Lower 0.017, Upper 0.042)	YES	2nd	Moderate - Private adjacent lands	Livestock mgmt. & erosion control measures	Unknown - depends on access	Long-term	YES	$200-300k? (CEs)
El Jaro Creek		1	12.5 mi	LOW 0.013 (Lower 0.006, Middle 0.001, Upper 0.017)	YES (potential)	2nd	Moderate - Private adjacent lands	Impediment Modification (low-flow impediment), Livestock mgmt. & erosion control measures	64,240 ft (via passage), 10,560 ft (livestock mgmt. and erosion control measures)	Long-term	YES	$30k (passage); $300-400k? (CEs)
San Miguelito Creek	6	1	9 mi	MODERATE 0.022 (Lower 0.002, Middle 0.019, Upper 0.049)	YES	1st	Poor - SB Co. FCD, Unknown/Private lands	Very Limited by Flood Control Channel (3 mi long), other lg. Barriers U/S	Access to upper 6 mi	N/A	YES	N/A

Stream Gradient - calculated from 7.5 minute USGS quadrangles (others qualitatively assessed by the Tributaries Working Group)- LOW (0-0.02), Moderate (0.02-0.04), High (0.04+)
Over-summering Habitat - presence/absence based on actual observation by SYRTAC, CDFG, *etc.* unless noted.
Proximity to SYR Mouth - based on order of occurrence moving upstream from the lagoon along the mainstem.
Land Access - based upon SYRTAC research and interviews.
Enhancement Opportunity - based on SYRTAC Biologists' evaluation
Distance/Area Enhanced - estimates based on information provided by SYRTAC where possible.
Expected Steelhead Response Time - estimates based on qualitative expectations discussed by the Tributaries Working Group. Expectations largely based on stream gradient and presence of seed population.
Seed Population - presence/absence of seed population for purposes of recovering/increasing numbers of steelhead; based upon SYRTAC, CDFG, *etc.* observations.
Estimated Cost - based on preliminary estimates by SYRTAC for known enhancement opportunities where available.

Persistent trout populations and associated spawning and rearing habitat have been observed in all of these higher gradient reaches. The reaches in upper Alisal and San Miguelito, however, are occupied by resident trout populations and are isolated from themainstem by impassable barriers downstream. Nonetheless, successful spawning and earing have been observed within the lower gradient reaches of Salsipuedes and El Jaro creeks over the past six years.

Another factor limiting fish utilization within the tributary streams is fish passage impediments and barriers. Generally, each tributary has one or more low or high flow fish passage impediment/barrier in its lower reach. Since much of the high quality spawning and rearing habitat is found in the upper reaches, passage is a critical factor to reproductive success.

The proximity of each stream to the Pacific Ocean is also a critical factor for steelhead production. During lower flow years, portions of the mainstem may not be passable, and migrating steelhead may be limited to spawning within tributaries which are connected to the lower mainstem. Access to adequate spawning and rearing habitat within these tributaries is essential during lower flow years.

Finally, as the vast majority of the lower Santa Ynez River and its tributaries lie in private lands, opportunities for habitat enhancement and data collection are necessarily limited by the cooperation and permission of private landowners. Potential tributary actions were ranked by opportunities for access and long-term maintenance of enhancement projects. Lower Hilton Creek (U.S. Bureau of Reclamation property) and portions of Salsipuedes and El Jaro creeks are considered to be accessible for data collection and future habitat enhancements. Currently, reaches on upper Hilton Creek, Quiota Creek, Alisal Creek, Nojoqui Creek, and San Miguelito Creek are generally inaccessible for collecting data and implementing habitat enhancement actions. However, county and state road easements (e.g. Refugio Road crossings on Quiota Creek) are accessible locations where passage impediment modifications may be implemented.

1.4 CONCLUSIONS

Generally, Hilton Creek, Quiota Creek, and Salsipuedes-El Jaro Creek were identified as the tributaries with the greatest potential for enhancing rainbow trout/steelhead habitat. Conversely, Alisal Creek and San Miguelito Creek are considered low priority because they have large passage barriers. Removal or modification of these impediments is considered infeasible at this time due to jurisdictional issues and cost. Nojoqui Creek is considered a low priority because there is no evidence that rainbow trout/steelhead occupy the stream with regularity, even though the habitat conditions would suggest otherwise.

The tributary action ranking and prioritization is based on our best understanding of rainbow trout/steelhead habitat utilization in the lower Santa Ynez River. We recognize that there are inherent limitations to a numerical ranking system. Continued monitoring of habitat quality and fish utilization will focus on developing a firm understanding of steelhead habitat requirements in Southern California streams. Enhancement actions and their associated priority ranking should be managed adaptively over time, as new data become available, and funding or property access opportunities materialize. The implementation of enhancement actions should incorporate long-term monitoring elements to evaluate the effectiveness of actions and to measure rainbow trout/steelhead response. These data will become valuable in making future fisheries management decisions in the lower Santa Ynez River tributaries. The Adaptive Management Committee will be responsible for continued monitoring of tributary habitat, assessment of additional enhancement opportunities, and implementation of the recommended actions (see Section 5.7 of the Plan).

2.1 OBJECTIVES

The following sections provide a tributary-by-tributary assessment of the current rainbow trout/steelhead habitat conditions and fish use. These assessments describe the general location, geomorphology, water quality, and habitat conditions of each tributary. They summarize observations of fish use in the tributary. Finally, the enhancement potential of each tributary is outlined.

2.2 STEELHEAD LIFE HISTORY AND HABITAT USE

In the Santa Ynez watershed, adult steelhead migrate from the ocean typically between January and April, depending on the amount of flow in the river. Spawning activities usually occur from February through April, and into May in some years. Upstream migration requires sufficient streamflow to breach the sandbar at the mouth (usually from Salsipuedes Creek runoff) and to allow passage in the river. In dry years, passage can be impeded. Steelhead typically migrate upstream when streamflows rise during a storm event. The eggs are laid in a nest (redd) in gravel. After spawning, adult steelhead may return to the ocean, and again return to the river to spawn in later years.

The young steelhead hatch in approximately six weeks and emerge from the gravels in May and June. Young steelhead may spend one to four years in freshwater before emigrating to the ocean. Typically, however, Southern California steelhead migrate to the ocean as 1 or 2 year olds (5 to10 inches long). The juvenile outmigration period is typically February through May, but the timing of migration is dependent upon streamflows. Those juveniles that leave the freshwater environment undergo physiological changes that adapt them to a life in saltwater, and become "smolts." Resident rainbow trout may reach maturity and spawn in their second year of life, although the time of first spawning is generally in their third year. Steelhead may also spawn in their second year, but again it is more common for them to spawn for the first time in their third or fourth year.

2.3 TRIBUTARY-BY-TRIBUTARY ASSESSMENT

The three evaluation criteria for the tributary assessments include: (1) presence or absence of rainbow trout/steelhead; (2) physical habitat conditions including spawning substrate, stream gradient, instream cover, canopy cover, and over-summering habitat; (3) opportunities to maintain or enhance fish habitat. In many cases, access to streams running through private property was not available. In these cases, information may be limited to roadside observations or historical records. Opportunities for implementing enhancement measures will be affected by the willingness of private landowners to participate in these activities.

Fish passage impediments and barriers to upstream migration are described for each tributary in Table 3-1. Where possible, suggestions for improving access to upstream spawning grounds are offered.

2.3.1 SURVEY METHODS

This section gives a general overview of the SYRTAC survey methods used in the Santa Ynez River mainstem and lower basin tributaries. Detailed methodologies are available in the SYRTAC compilation reports (*e.g.*, SYRTAC 1996).

2.3.1.1 General Location and Description

Surveys of the Santa Ynez River and lower basin tributaries provide a general description of each creek's topography, major landmarks and passage impediments. Habitat type information for each creek also is presented. Depending on access, habitat surveys estimated percentages of run, riffle, pool and cascade environments, channel width and depth, channel cover, flow levels, substrate characteristics and riparian vegetation quality. All percentages are based on the linear feet surveyed.

2.3.1.2 Fish Use

Since 1993, the SYRTAC has collected information on the presence or absence of rainbow trout/steelhead in the Santa Ynez River and tributaries. Rainbow trout/steelhead presence and overall geographic distribution is documented using direct observation (snorkel surveys), migrant trapping, spawning surveys, and bank observations where access is permitted.

Migrant trapping involves placing a PVC fyke trap across the width of the stream. The purpose is to document the seasonal timing and overall numbers of upstream migrating adults, downstream migrating smolts (juvenile steelhead), and spawned-out downstream migrating adults returning to the ocean. Migrant traps cannot be operated in high flows when steelhead migration is likely highest. Therefore, migrant trapping consistently underestimates the number of migrating fish. Electrofishing is not used in the Santa Ynez system except in sometimes in fish rescue operations, and it is not used to determine the timing of fish entering the system. Migrant trapping is used to determine the timing and numbers of adult and juvenile (smolt) rainbow trout/steelhead migrating into and out of the watershed. Trapped fish are sized, aged, and when possible, sexed. Downstream migrating juvenile rainbow trout/steelhead captured in the migrant traps are inspected for evidence of smolting characteristics (*i.e.*, deciduous scales, silvery appearance, darkened fin margins). Upstream migrating rainbow trout/steelhead are inspected for evidence of ocean residency (*i.e.*, ocean parasites on gills, large size). Table 2-1 provides definitions of different lifestages. Tissue and scale samples are collected for aging purposes and genetic analysis.

Table 2-1 Definitions and Characteristics of Different Lifestages of Rainbow Trout/Steelhead

Lifestage	Description
Redd	A nest excavated by a female rainbow trout/steelhead from the stream gravel, containing fertilized eggs and covered with a layer of gravel. Seen as a depression in the stream gravels.
Young-of-the-Year	Juvenile fish hatched in the spring of that year. Size (fork length) < 100 mm
Juvenile	Young fish after its first fall. Fork length 100-200 mm
Adult	Mature fish 2 or more years old. Fork length > 200 mm
Smolt	Juvenile that has undergone physiological changes to adapt to life in saltwater and is migrating from the river to the ocean. Characteristics include deciduous scales, silvery appearance, darkened fin margins.
Ocean Resident	Large size (fork length > 400 mm) and silvery, examination of rings on scales, evidence of ocean parasites on gills.

Snorkel surveys are conducted in the summer and fall in various pool, riffle, and run habitats. The purpose of snorkel surveys is to: (1) determine if rainbow trout/steelhead successfully spawned in that year by looking for young-of-the-year fish, (2) determine the presence or absence of juveniles and/or adults, and (3) determine and document the composition and relative abundance of fish species. Depending on the width of the survey corridor, one or two divers are used to snorkel each habitat. Divers enter the water at the downstream end of the habitat and traverse the unit upstream, counting fish by species and estimating actual size. Depending on water clarity conditions, one or two passes are made with a short (30 minute) interval between each pass.

Spawning surveys are conducted utilizing bank observation techniques. Once a rainbow trout/steelhead redd has been observed, dimensions of the redd are documented along with depth and velocity measurements along the egg deposition area. Flagging with the redd number and date are attached to adjacent vegetation for future monitoring of successful rainbow trout/steelhead production. Roadside observations are conducted only in those areas (mainly along Quiota Creek) where access to the creek is not permitted. During the roadside observations, surveyors enter the creek (directly adjacent to the road) along the Santa Barbara County easement, and visually inspect aquatic habitats for presence of rainbow trout/steelhead and/or spawning activity.

With all fish survey methods, the presence of predatory, competitive and other fish species of interest is noted.

2.3.1.3 Water Quality

Water temperature is an important parameter that affects the quality and availability of habitat for rainbow trout/steelhead. Three temperature levels have been used to evaluate habitat conditions within the lower Santa Ynez River. A temperature level of 20°C (68°F) for daily average water temperatures has been used in central and southern California by California Department of Fish and Game (CDFG) to evaluate the suitability of stream temperatures for rainbow trout. This level represents a water temperature below which reasonable growth of rainbow trout may be expected. Data in the literature suggest that temperatures above 21.5°C (71°F) result in no net growth or a loss of condition in rainbow trout (Hokanson *et al*., 1977). The temperature level of 22°C (71.6°F) daily average temperature was also used to look at relative habitat suitability for sustaining fish. Maximum daily water temperatures ranging between 25°C (incipient lethal temperature [ILT]) and 29.4°C (critical thermal maximum [CTM]) were used to indicate potentially lethal conditions (Raleigh *et al*., 1984). The ILT indicates potentially lethal conditions due to rather abrupt change in temperature while the CTM describes a potentially lethal condition due to slow, incremental increase in temperature. These temperature levels serve as guidelines to indicate general seasonal and spatial trends where water quality conditions may be a concern, but the levels were not used to rule out particular reaches. Cool water refuges in deep pools or pools with upwelling (*i.e.*, circulation of cooler, deeper water from the bottom of the pool) are available to varying degrees along the mainstem and some tributaries. See Appendix G for a more detailed discussion of the effects of temperature on rainbow trout/ steelhead.

Depending on stream access, water quality observations include temperature and flow measurements. Qualitative assessments of water quality include flow conditions, presence of cattle fecal material, water clarity and general degradation of water quality.

2.3.2 HILTON CREEK

2.3.2.1 General Location and Description

Hilton Creek is a small tributary located immediately downstream of Bradbury Dam that has intermittent or no flows in its lower reaches during the dry season. The estimated watershed area is approximately 4 square miles. About 2,980 feet of Hilton Creek is on U.S. Bureau of Reclamation (Reclamation) property, including the confluence with the Santa Ynez River. Figure 2-1 presents a schematic diagram of Hilton Creek, including a map of the recommended enhancement actions for Hilton Creek. Figure 2-2 provides a summary of Hilton Creek habitat quality and fish utilization attributes.

The lower reach of Hilton Creek is high gradient and well confined. Riparian vegetation and the walls of the incised channel shade the streambed. A rocky cascade and bedrock chute are passage impediments for migrating steelhead, located about 1,380 feet upstream from the confluence with the river. The cascade is approximately 6 feet high. A shallow pool (the "chute

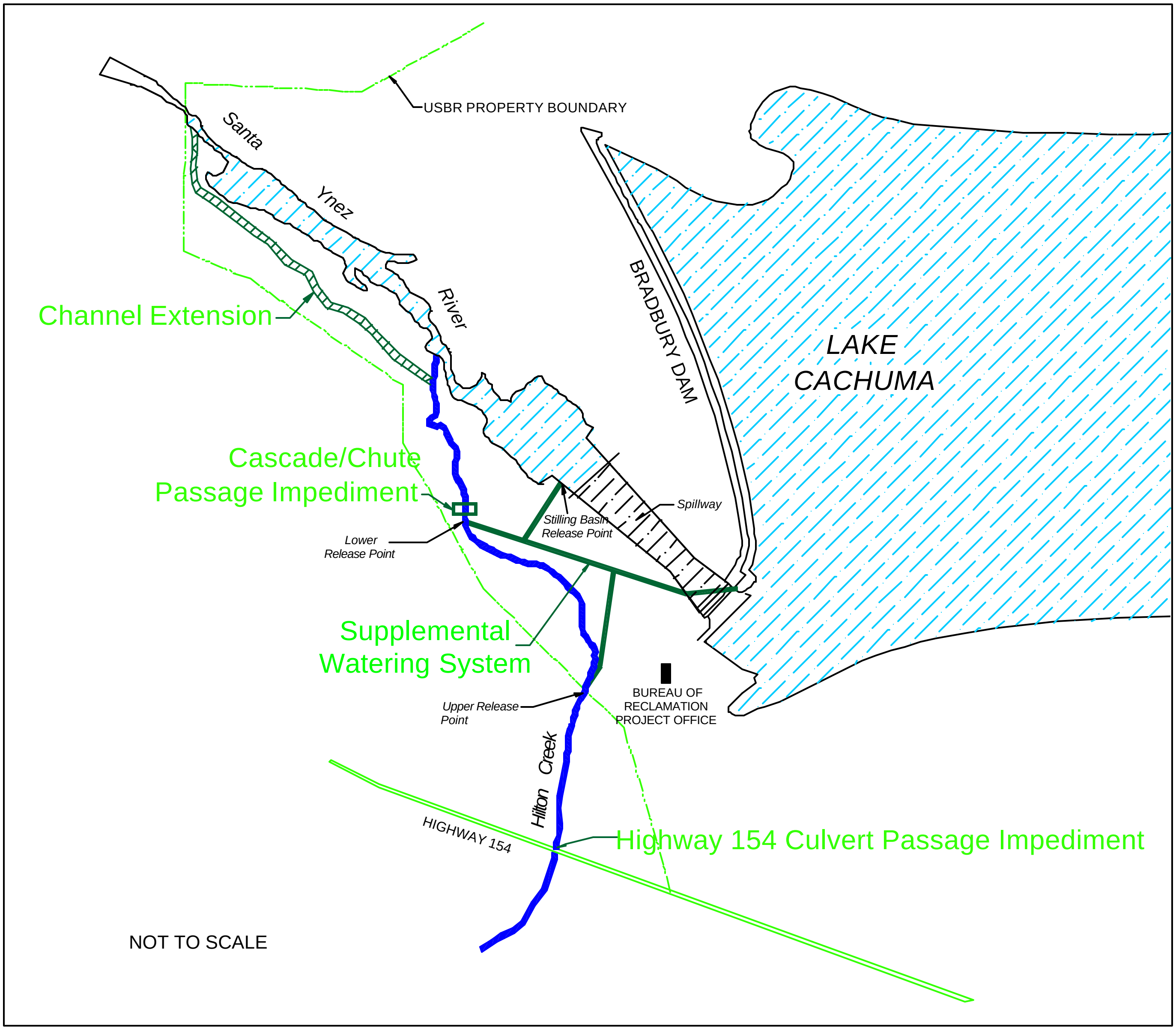


Figure 2-1 Hilton Creek Enhancement Projects

QUICK FACTS
Hilton Creek

Number of *O. mykiss* Observed (1995-1999)	***Present to Common*** *(1,496 in 1995-1999 surveys-1,429 YOY, 38 JUV 34 ADULT; trapping in 1995, 1997, 1998 yielded 68 U/S migrants and 17 D/*
Estimated Watershed Area	***4 sq. mi.***
Estimated Stream Length	***3.8 miles*** *(Lower-0.3 mi., Upper-3.5 mi.)*
Estimated Stream Gradient	***HIGH*** *(Lower-11.7%, Upper-8.1%)*
Percent Canopy (Avg)	***1 to 25*** *(Range: 0 to 100; many with 0)*
Total Distance Habitat Typed (ft)	***2,935*** *(Access above BOR land is restricted by private property)*

Summary of Habitat Attributes
Hilton Creek (Lower)

	Pool	Riffle	Run
Quantity	11	25	20
Distance (ft)	295.5	1764	875
Distance (%)	10.1	60.1	29.8
Avg Depth (ft)	1.7	0.7	0.9
Avg Max. Depth (ft)	2.6	1.2	1.4
Avg Instream Shelter (%)	50 to 75	25 to 75	25 to 75
Avg Canopy (%)	25 to 75	0 to 100	0 to 100
Dominant Shelter Components	Boulders and whitewater elements; aquatic and terrestrial vegetation, bedrock ledges, lg. woody debris	Whitewater and boulders; some aquatic and terrestrial vegetation, bedrock ledges, sm. woody debris	Boulders and whitewater; some bedrock ledges, aquatic and terrestria vegetation, sm. woody debris

Temperature Data
(Lower Hilton Ck. only)

Year	Ave. Daily Mean	Days Exceed 20°C	Daily Max.	Days Exceed 25°C
Lower Hilton (near SYR confluence)				
1995	17.8	33	26.3	5
1996	13.8	0	20.7	0
1997	14.5	0	16.6	0
1998	15.7	30	25.7	14
Lower Hilton (below cascade/chute)				
1995	16.8	2	24.3	0
1997	15.8	0	18.5	0
1998	16.0	14	27.7	19
Mid-Hilton (upstream Reclamation property line)				
1998	16.3	0	21.1	0
1999	16.5	21	28.7	11

Lower (near confluence) monitoring conducted in 1995 (April thru August), 1996 (March to mid-June), 1997 (April to mid-July), 1998 (March to October).
Lower (below cascade/chute) monitoring conducted in 1995 (May thru August), 1997 (mid-August to mid-September), 1998 (April to August).
Mid (Reclamation boundary) monitoring conducted in 1998 (mid-June to mid October), 1999 (mid-June to mid-November).

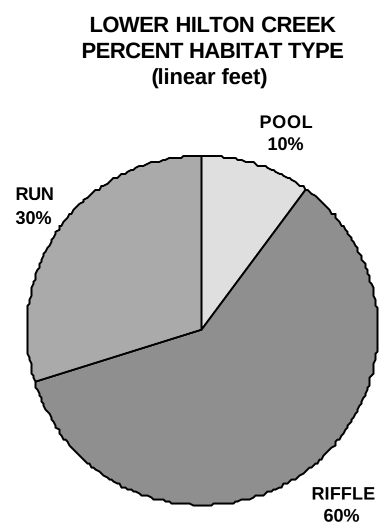


Figure 2-2 Summary of Hilton Creek Habitat Attributes

pool") is at the base of the cascade. The bedrock chute immediately above it is about 140 feet long. Passage can be difficult here during high velocity flows due to the lack of deeper water and resting sites.

Habitat mapping in 1995 classified the stream below the chute pool as 44% run, 27% riffle, 26% pool, and 3% cascade (SYRTAC 1997). Channel width averaged 9.3 feet, and maximum pool depth averaged 3 feet. Most pools had suitable spawning habitat at their tails. High flows in the winter of 1998 altered the lower few hundred feet of channel and moved the confluence with the Santa Ynez River further downstream. In 1998, habitat mapping was conducted on the portion of the creek on Reclamation property. Flow during this survey was 2.7 cubic-feet-per-second (cfs) to 2.8 cfs. The lower creek, up to the chute pool (1,382 feet), was comprised of 58% riffle/cascade, 27% run, and 15% pool.

Habitat surveys in 1998 above the chute pool to the Reclamation property boundary (1,553 feet total) documented 61% riffle/cascade, 34% run, and 5% pool (SYRTAC 1998 data). The reach just above the bedrock chute (about 300 feet) is consecutive run/riffle habitat with little or no canopy cover. Above this open reach to the Highway 154 Culvert (about 2,400 feet total), habitat conditions are good to excellent with excellent riparian shading and cover. Pool habitat is greater than those in the lower Hilton (> 26%) and old growth sycamore dominate the vegetation providing dense canopy cover. Streamflows persist longer in this reach than farther downstream. Stream gradient increases to greater than 5% from the Reclamation property boundary to approximately .5 miles upstream of the Highway 154 Culvert. About 1,200 feet of this habitat is on Reclamation property. The Highway 154 Culvert is a complete passage barrier and is located about 4,200 feet upstream from the confluence and about 1,200 feet upstream from the Reclamation property boundary.

2.3.2.2 Fish Use

In general, steelhead are known to migrate to the uppermost accessible reaches in a river, seeking spawning habitat. Adults migrating up the Santa Ynez River are blocked by Bradbury Dam and must find spawning habitat downstream of the dam. Hilton Creek currently provides the most upstream spawning habitat available to anadromous fish in the lower Santa Ynez basin.

Hilton Creek is inhabited by rainbow trout/steelhead up to the chute pool (1,380 feet upstream) and prickly sculpin (to about 800 feet upstream from the confluence). Sculpin cannot negotiate a small bedrock cascade and are not present in the upper portions of the creek. No introduced warmwater species, such as bass, bullhead or sunfish, are found in Hilton Creek.

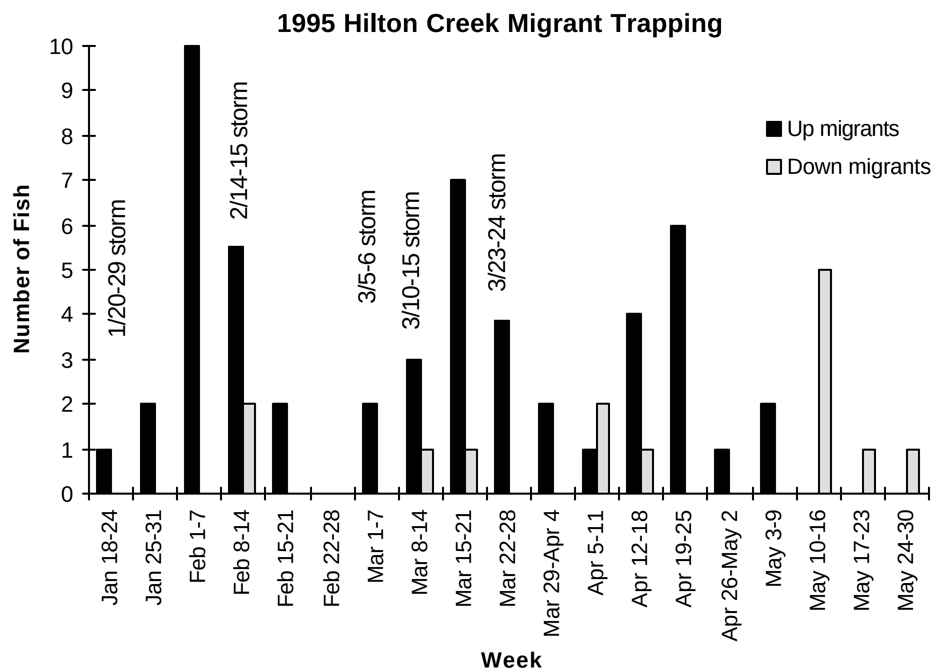
Adult passage to upper Hilton Creek is hampered first at a cascade and bedrock chute (located about 1,380 feet upstream from the confluence with the Santa Ynez River) and then completely blocked at a culvert at the Highway 154 crossing (about 4,200 feet upstream from the confluence). Spawning is generally more common in the upper sections of the lower reach. No spawning or young-of-the-year have been observed above the cascade to the Reclamation property boundary (about 2,980 feet upstream from the mainstem). Anecdotal reports indicate that historically trout were present in upper Hilton Creek above the Highway 154 Culvert prior to the Refugio Fire. It is possible that the 1955 Refugio fire, which burned 84,700 acres, decimated the trout population in this upper reach.

Adult rainbow trout/steelhead have been documented migrating into Hilton Creek in all years that observations have been made, but numbers were low in years with low winter runoff. Migrant trapping captured 2 adults in 1994, 52 in 1995 during the wet winter, 3 adults in February 1996 when the creek briefly flowed, 10 adults in January 1997 before flows declined, and several during abbreviated trapping in 1998 and 1999 (SYRTAC 1997, 1998, 2000). Actual spawning with production of young-of-the-year was documented in 1995, 1997, and 1998. Production has been especially good during high runoff years such as 1995 and 1998, when many adults enter the creek. In 1995, migrant traps captured 52 adults between January 16 and April 17, and the actual numbers were likely higher since the trap is inoperable at high flows (no trapping on 21 of 93 days) (Figure 2-3). Four upstream migrating adults were captured in 1998, while no migrants were captured in 1999. Between 1994 and 1999, 71 adult migrant trout were captured in Hilton Creek. Adults migrating into Hilton Creek are often large and could be anadromous steelhead from the ocean (particularly in wet years), rainbow trout that spilled over from Lake Cachuma, or fish that are resident in the river, its tributaries or the lagoon (SYRTAC 1997, 1998, 2000).

Young steelhead remain in fresh water for a year or more. Because the stream goes dry during the summer, young-of-the-year cannot complete rearing in lower Hilton Creek under natural conditions (SYRTAC 1997, 1998, 2000). The fish are either stranded or must enter the mainstem where the likelihood of predation by bass and catfish increases. Fish rescue operations were conducted in 1995 and 1998 to move young-of-the-year from the drying stream to better habitat. Between July 21 and August 4, 1995 approximately 100 young-of-the-year were rescued and relocated to the portion of the mainstem between the spill basin and the Long Pool. On August 5, 1995, over 120 young-of-the-year and five adults were rescued and relocated. In June 1998, 831 young-of-the-year (up to 100 mm) and three adults were captured in 1,200 linear feet of stream (Reclamation 1998). No juveniles were observed in the creek. Many young-of-the-year and all three adults were found below the pool area just below the cascade. The remaining young-of-the-year were removed from the lower reach of the creek. In the spring of 2000, the supplemental watering system provided consistent, cool water flow from Lake Cachuma to support newly hatched young-of-the-year.

2.3.2.3 Water Quality

Water temperatures have been monitored in the lower reach (about 250 feet upstream of the confluence) and the middle reach in a pool downstream of the chute pool (about 1,000 feet upstream of the confluence) since 1995. Beginning in 1998, temperatures at the Reclamation property boundary (2,980 feet upstream of the confluence) have also been monitored. Hilton Creek flows are very sporadic and highly dependent on seasonal rainfall. During dry and sometimes average years, the creek may only flow for short periods of time before losing



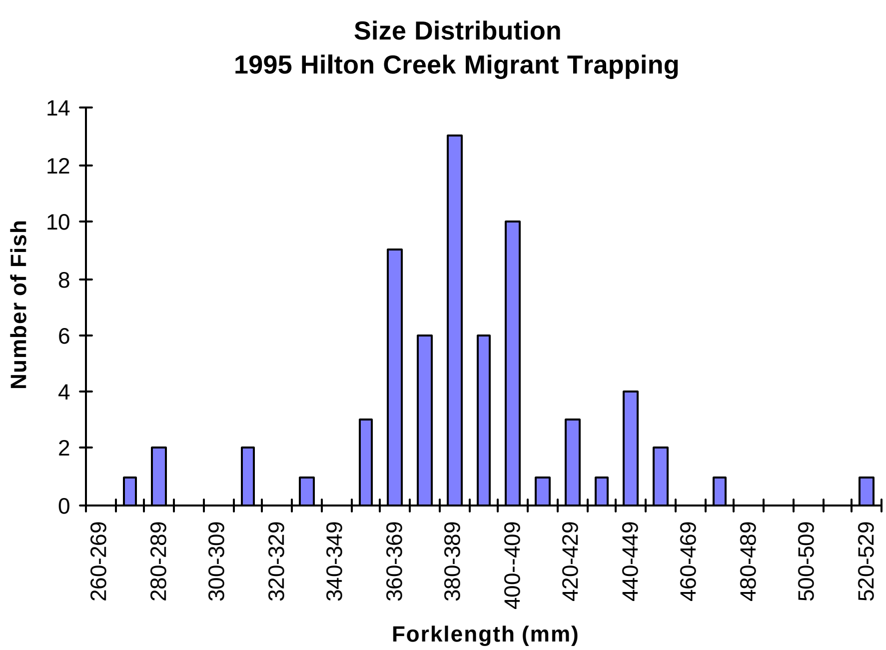


Figure 2-3 Seasonal Trapping Results in Hilton Creek (1995)

continuity with the mainstem. During wet years, the creek typically flows until late May, sometimes later depending on runoff (June 1995, July1998). Thermograph data, coupled with observations throughout the year, indicate that water temperatures, while probably not preferred, are generally suitable for rearing through the entire year. Water temperatures are lowest at the upper Reclamation property boundary, with gradual warming down to the mouth of the creek. Summer watertemperatures at the chute pool (1,380 feet upstream of the confluence) are substantially lower than those measured further downstream. Water temperatures in the chute pool may be suitable through at least August, although the pool would be physically isolated from other areas of potential habitat during a portion of the year. Seasonal patterns in surface flows and the persistence of pools vary annually depending on precipitation and runoff within the watershed.

Maximum water temperatures within Hilton Creek, 250 feet upstream of the confluence with the mainstem, ranged from 16.4 to 26.3°C during the summer of 1995 (June through August). Young-of-the-year rainbow trout/steelhead were observed to be generally healthy and actively feeding at temperatures up to 25.8°C. Young-of-the-year rainbow trout/steelhead were observed up to the fish rescue operations in July 1995. Daily maximum water temperatures exceeded 25°C for rainbow trout/steelhead for a few days in early August 1995.

In 1997, the year a temporary watering system was installed at Hilton Creek, maximum water temperatures measured 250 feet upstream of the mouth never exceeded 18°C during the spring and summer (April to October). Temperatures at the upstream monitoring locations were slightly cooler during this period.

In 1998, summer water temperatures measured at the Reclamation property boundary (2,975 feet upstream of the confluence with the mainstem) were substantially lower than those measured further downstream. Comparison of 1998 thermograph data at the lower two monitoring sites (1,000 feet and 250 feet upstream of the mainstem) indicated that average water temperatures were the same or 1 to 2°C warmer at the lower sites. Maximum water temperatures were sometimes 2 to 4°C at the lower monitoring sites. In this year, flow in the lower creek ceased by July 31. Maximum water temperatures during the last half of July did exceed 25°C at this location. Flow was measured and visually estimated to be less than 1 cfs when water temperatures were exceeding 25°C. Water temperatures at the chute pool exceeded 25°C for only approximately two weeks around late July and early August.

Dissolved oxygen concentrations are within the normal tolerances when water is flowing in the creek (> 5 ppm). Once the creek becomes intermittent, pool water quality can diminish to near anoxic conditions. Channel disturbance and water quality problems appear minimal. Hilton Creek clears rapidly after storm events, usually within a few days after rains have ceased.

2.3.2.4 Enhancement Potential

Hilton Creek has the best potential for enhancement of all the tributaries due to its proximity to a dependable water supply (Lake Cachuma), high gradient orientation, presence of spawning and rearing rainbow trout/steelhead, its good shading conditions and substrate and channel structure, and its presence on Reclamation property. Providing summer flows would allow fish of all age classes (young-of-the-year, juvenile and adult) to rear and over-summer in Hilton Creek. Enhancing or extending the channel near the confluence would extend the benefits of any supplemented flows. Planned modification of the impediment at the chute pool and chute area will open up additional habitat while riparian enhancement upstream of the impediment will help reduce summer water temperatures. Modification of the Highway 154 Culvert would provide passage to an additional mile or more of upstream spawning and rearing habitat. Habitat modifications for Hilton Creek are discussed further in Appendix D.

The enhancement actions identified for Hilton Creek, include bedrock chute/cascade and Highway 154 Culvert modifications, and the proposed creation of additional spawning and rearing habitat via extending the channel near its confluence with the mainstem Santa Ynez River. Tributary actions for Hilton Creek were ranked (No. 1) as the highest priority, particularly the actions involving passage impediment modification at the chute pool and Highway 154 Culvert. The channel extension has the potential to provide valuable additional summer rearing habitat; however, opportunities to provide/improve access to existing habitat in Hilton Creek (and other tributaries) are considered a higher priority.

2.3.3 QUIOTA CREEK

2.3.3.1 General Location and Description

Quiota Creek enters the Santa Ynez River between the towns of Solvang and Santa Ynez. Quiota Creek is estimated to be 6.4 miles long and is a relatively high gradient stream. The Quiota Creek watershed area is approximately 6.3 square miles. Figure 2-4 provides a summary of Quiota Creek habitat quality and fish utilization attributes. Studies are limited due to lack of access on private property. Surveys of lower Quiota Creek in spring 1994 found little flowing water and degraded habitat conditions (ENTRIX 1995, SYRTAC 1997). Oaks and willows generally were abundant, although riparian vegetation was lacking in many places. Silt was the predominant substrate, especially in pools. Summer flow appears to be intermittent in average and dry years in the lower section. Grazing decreased the amount of streamside vegetation in this area.

A total of 602 linear feet of accessible Quiota Creek was habitat typed by the SYRTAC biologist, where habitat composition is 32% pool, 19% riffle, 52% run, and 15% glide. Refugio Road crosses Quiota Creek nine times starting with several crossings 1.3 to 1.6 miles from the mainstem Santa Ynez. In 1998, a survey was conducted from road crossings about 1.5 to 3 miles upstream from the confluence. Habitat conditions in this area are better than in the lower reach, particularly after the storms of 1998. Good canopy conditions provide shading within this section. Additionally, pool habitats have good depth and complexity of instream cover. Numerous undercut banks exist (particularly in pools) providing excellent rearing habitat. In contrast to several other tributaries, substrate is composed of larger size gravel, cobbles, and

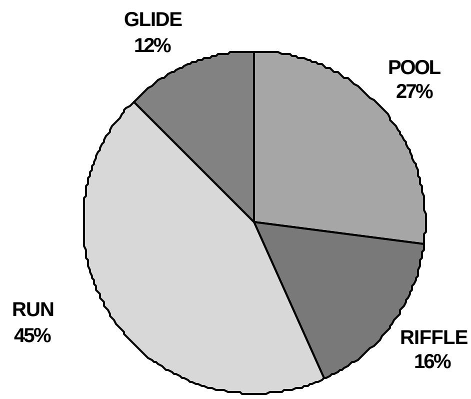
QUICK FACTS
Quiota Creek

Number of *O. mykiss* Observed (1995-1999)	***Generally Common*** *(No sampling or trapping conducted 1995-1999; based on bank observations at selected crossings)*
Estimated Watershed Area	***6.32 sq. mi.***
Estimated Stream Length	***6.4 miles***
Estimated Stream Gradient	***HIGH*** *(5.9%)*
Percent Canopy (Avg)	***50*** *(Range: 25 to 75)*
Total Distance Habitat Typed (ft)	***602*** *(not fully surveyed due to private property access)*

Summary of Habitat Attributes
Quiota Creek

	Pool	**Riffle**	**Run**	**Glide**
Quantity	5	3	5	1
Distance (ft)	192	115	315	88
Distance (%)	31.9	19.1	52.3	14.6
Avg Depth (ft)	1.5	0.36	0.61	0.38
Avg Max. Depth (ft)	2.6	0.85	1	0.8
Avg Instream Shelter (%)	25 to 50	75	25 to 75	75
Avg Canopy (%)	25 to 100	75 to 100	50 to 100	100
Dominant Shelter Components	Boulders, bedrock ledges, root masses; some undercut banks, sm. woody debris and aquatic vegetation	Root masses and boulders; some sm. & lg. woody debris, and terrestrial vegetation	Root massess, terrestrial vegetation, undercut banks, and terrestrial vegetation	Sm. woody debris, root masses, and terrestrial/aquatic vegetation

QUIOTA CREEK
PERCENT HABITAT TYPE
(linear feet)



Temperature Data

No water quality monitoring conducted during the survey period.

Figure 2-4 Summary of Quiota Creek Habitat Attributes

boulders. An unnamed tributary that enters Quiota Creek about 4 miles upstream from the Santa Ynez confluence was examined in August 1994 (ENTRIX 1995). The tributary was spring-fed and in a steep gully. There was little or no flowing water in late summer, and upwelling (cooler water circulating upward from the bottom of the pool) produced most habitats. In some places, there was good boulder cover and adequate pool depths that provided refuge for over-summering rainbow trout/steelhead. Oaks and cottonwoods shaded a significant portion of the creek, but overall there was little riparian vegetation.

The numerous road crossings of Refugio Road are impediments to upstream passage at low and high flows (S. Engblom, pers. comm., 1999). All nine crossings are shallow-water Arizona crossings with concrete beds and, at several sites, a 2- to 3-foot drop downstream of the concrete apron. Four of these crossings warrant further attention for passage enhancement. The County of Santa Barbara maintains Refugio Road.

The road crossings intersecting Quiota Creek were evaluated by the SYRTAC project biologist and ranked for fish passage-associated modifications (S. Engblom, pers. comm., 2000.) The County of Santa Barbara has indicated that three crossings (Crossings No. 2, 5, 8) will be repaired in the near future, incorporating fish-friendly engineering advocated by SYRTAC. The remaining road crossings have been ranked as high priority implementation actions by the work group. Table 2-2 depicts the ranking order and important site elements, for each road crossing.

2.3.3.2 Fish Use

Visual surveys conducted by DFG from 1993 to 1998 and roadside surveys by SYRTAC biologists (1993 to 2000) show that Quiota Creek, especially the upper reach, supports rainbow trout/steelhead. Although a May 1994 walking survey (visual inspection) reported no fish, electrofishing of 125 feet captured three young-of-the-year, six juvenile and four small adult rainbow trout/steelhead. Visual observations at that time also documented over 100 young-of-the-year (SYRTAC 1997). In an unnamed tributary about 4 miles upstream from the Santa Ynez River, an August 1994 survey documented over 100 young-of-the-year and 20 to 30 juvenile/adults (SYRTAC 1997). A visual survey in February 1995 documented spawning activity, redds and two adults (one 16-inch female and 6-to 8-inch male) approximately 2 miles upstream of the confluence with the Santa Ynez River (SYRTAC 1997). Observations from nine road crossings in late 1998 documented approximately 100 young-of-the-year from about 1.5 to 3 miles.

2.3.3.3 Water Quality

No temperature monitoring has been conducted on this stream. In the lower reach, lack of good shading suggests that warming may be a problem. Cattle fecal material was also observed in and around the stream in this area which may contribute to nutrient loading. Shading is better upstream, which may indicate that better water temperature could be found there.

Table 2-2 Quiota Creek Road Crossings Passage Impediment Modification Rankings

Road Crossing	Passage Barrier Type	Jump Height	Important Elements	Ranking
No. 1	Low Flow	2 ft.	Shallow downstream (D/S) pool Shallow flow over road	**5**
No. 2	Low/High Flow	4 ft.	Lg. D/S pool (over-summering) Shallow/high velocity flow over road	**1** (slated for SB Co. repair)
No. 3	Low Flow	2 ft.	D/S pool present Shallow flow over road	**6**
No. 4	Low Flow	3 ft.	D/S pool present Shallow flow over road	**4**
No. 5	Low Flow	< 1 ft.	D/S pool present Shallow flow over road	**7** (slated for SB Co. repair)
No. 6	Low/High Flow	4 ft.	Pool absent D/S (riffle)	**2**
No. 7	Low/High Flow	< 1 ft.	Velocity impediment (culvert)	**8**
No. 8	N/A	N/A	Road washed out	**9** (slated for SB Co. repair)
No. 9	Low/High Flow	4 ft.	Sm. Shallow pool D/S Shallow flow over road	**3**

2.3.3.4 Enhancement Potential

The upper reaches and tributaries of Quiota Creek provide good habitat potential based on observations of fish production in limited surveys. Passage at several road crossings could be improved to provide steelhead better access to these reaches. The lower reach of Quiota Creek, close to the Santa Ynez River, has low potential as fish habitat due to a lack of flow during the summer months. This characteristic is common in the lowermost reaches of many tributaries in the Santa Ynez system. Stream reaches with persistent flow in the lower portion of the creek may benefit from improvements to riparian vegetation and livestock management.

The enhancement actions analyzed for Quiota Creek were ranked as high priority (Rank No. 2). The tributary actions identified for Quiota Creek include road crossing (fish passage impediments) modifications and improving instream and riparian habitat. The modification of nine road crossings (Refugio Road) which currently impede fish passage during low and high-flows was ranked as high priority due to the presence of a seed population, over-summering habitat, and the anticipated short-term biological response time. The County of Santa Barbara, which maintains Refugio Road, has expressed interest in modifying three of the crossings with fish-friendly engineering elements, and will also work in concert with the Adaptive Management Committee to improve the remaining six crossings. Improvement of degraded stream habitat near the confluence with the mainstem through livestock management is of lower priority since property access is not currently available, and this reach does not exhibit perennial flow.

2.3.4 ALISAL CREEK

2.3.4.1 General Location and Description

Alisal Creek enters the Santa Ynez River near Solvang. Alisal Creek is approximately 5.6 miles long and its watershed area is approximately 11.6 square miles. Stream gradient in Alisal Creek is low below the reservoir and high in the stream upstream of the reservoir. Figure 2-5 provides a summary of Alisal Creek habitat quality and fish utilization attributes. Habitat in lower Alisal Creek runs through private property and was not surveyed, although some observations were made from the road. During the summer, flow does not reach the Santa Ynez River confluence, but little is known about water conditions further upstream. Access to Alisal Creek was granted in 1995 and riparian and instream habitat is similar to that of upper Quiota Creek. The lower creek runs through a golf course. A small concrete structure just upstream of the confluence was a potential passage impediment, but it was washed out by storms in 1995. A dam and small reservoir (Alisal Reservoir) exist about 3.6 miles upstream from the confluence and block passage for steelhead to upstream areas. Approximately 2 miles of Alisal Creek flows above the Alisal Reservoir. Conditions below this reservoir appear fair, with good riparian vegetation and canopy cover. The habitat above the reservoir is very good with excellent riparian vegetation and canopy, and has perennial flow.

QUICK FACTS
Alisal Creek

Number of *O. mykiss* Observed (1995-1999)	***Present, but in low numbers*** *(Based on bank observations. No sampling conducted in 1996-1999 due to access; trapping in 1995 yielded 2 U/S migrants. Common above reservoir.)*
Estimated Watershed Area	***11.6 sq. mi.***
Estimated Stream Length	***5.6 miles*** *(Below reservoir-3.6 mi.; Above reservoir-2 mi.)*
Estimated Stream Gradient	***MODERATE*** *(Below reservoir-Low; Above reservoir-High)*
Estimated Canopy	***GOOD*** *(excellent above reservoir)*
Total Distance Habitat Typed (ft)	***0*** *(not habitat typed due to private property access)*

Summary of Habitat Attributes
Alisal Creek

- **Alisal Reservoir dam blocks fish passage to upper Alisal Creek.**
- **Habitat conditions below reservoir are fair with little dry season flow.**
- **Habitat conditions above reservoir are very good above reservoir with perennial flow.**
- **Resident rainbow trout spawn and rear in the upper creek and have been observed to be common to abundant.**
- **Below reservoir oversummering habitat is poor due to low flow.**
- **Habitat conditions and fish utilization below reservoir have not been assessed due to private property access.**
- **No water quality (temperature & DO) monitoring conducted during the survey period.**

ALISAL CREEK
PERCENT HABITAT TYPE
(linear feet)

Figure 2-5 Summary of Alisal Creek Habitat Attributes

2.3.4.2 Fish Use

Fish surveys were conducted in February 1995, when access to the property was available for migrant trapping and an electrofishing survey (SYRTAC 1997). Prior to 1995, migration into Alisal Creek was blocked by a concrete drop structure and apron. This structure was washed away by high flows in early 1995, and rainbow trout/steelhead were subsequently captured in the lower creek. Twenty resident rainbow trout juveniles and adults (78 mm to 235 mm fork length) were found via electrofishing in Alisal Creek upstream of Alisal Reservoir (SYRTAC 1997). Bass and sunfish inhabit the reservoir. Trapping in lower Alisal Creek in January 1995 captured two adult rainbow trout/steelhead migrating upstream into the creek. Many other rainbow trout/steelhead of various size classes were observed to be common to abundant within the upper portions of Alisal Creek (S. Engblom, pers. comm., 1999).

2.3.4.3 Water Quality

No temperature monitoring has been conducted, but observations suggest good temperature conditions in upper Alisal Creek.

2.3.4.4 Enhancement Potential

More information is needed about this tributary to evaluate enhancement potential. Depending on water availability and channel conditions downstream of the reservoir, enhancement measures could be useful to improve spawning and rearing opportunities. Providing fish passage opportunities above the Alisal Reservoir is extremely limited due to the size of the dam and reservoir and private property access. The cost and technical feasibility of such an effort would require significant resources.

Since enhancement opportunities are limited to improving habitat downstream of Alisal Reservoir, and private property access is unlikely, tributary actions on Alisal Creek are considered to be low priority (Ranking No. 4). Improvement of spawning and rearing habitat within lower Alisal Creek could be beneficial to rainbow trout/steelhead, however, the dominant proportion of good habitat exists above Alisal Reservoir.

2.3.5 NOJOQUI CREEK

2.3.5.1 General Location and Description

Nojoqui Creek joins the Santa Ynez River near Buellton. Nojoqui Creek is estimated to be 8 miles long, and its watershed area is approximately 15 square miles. Nojoqui Creek is predominantly a low gradient stream. Figure 2-6 provides a summary of Nojoqui Creek habitat quality and fish utilization attributes. Habitat surveys were conducted in 1994 and 1998. The lower reach of Nojoqui Creek from the confluence with the mainstem Santa Ynez River up to a 1/2 to 3/4 miles had degraded conditions with no canopy, little vegetation, eroded banks, and little or no flow during summer. Further upstream, however, conditions appeared good for spawning and rearing, although flow is fragmented and intermittent within this section, particularly during average and dry years. The stream had dense riparian vegetation and canopy cover, good instream cover from boulders, roots, and undercut banks. The 1998 habitat survey found mainly shallow runs (65% run), 15% riffle, 17% glide, and 4% pool.

No significant passage impediments currently exist. One low-flow impediment exist approximately 3 miles upstream from the Santa Ynez River, and another impediment may exist at a culvert under the Highway 101 Bridge. The second possible impediment has not yet been evaluated. A small concrete dam that impeded passage washed out in 1995.

2.3.5.2 Fish Use

Electrofishing and snorkel surveys in May 1994 found arroyo chub and threespine stickleback abundant in Nojoqui Creek, with small populations of green sunfish and largemouth bass in a few pools. However, no rainbow trout/steelhead were observed or captured. Two adults were captured migrating upstream in March 1998 and another adult observed in a pool, but no other rainbow trout/steelhead were captured in 1995 or 1997. Anecdotal reports from local residents are conflicting, with one resident reporting that steelhead never really used Nojoqui (J.J. Hollister, pers. comm., 1998 to M. Cardenas) and another reporting that steelhead trout were common in the creek (Jack Daniels, pers. comm.). Based on the size of the historical run, there is little doubt that steelhead historically utilized Nojoqui Creek from time to time. It is speculated that, unlike the other creeks in the lower basin, Nojoqui does not have a remnant population within its watershed. Land use activities, coupled with the recent drought effectively dried Nojoqui Creek for several years during the late 1980's and early 1990's. With no remnant seed population within the creek, very small numbers of adults returning from the ocean, and low numbers within the Santa Ynez watershed, it is highly unlikely that Nojoqui Creek could become populated with rainbow trout/steelhead in the near future.

2.3.5.3 Water Quality

Summer water temperatures sometimes exceeded guidelines for rainbow trout/steelhead (20°C daily mean and 24°C maximum); although, in general, water temperatures tend to remain cool.

2.3.5.4 Enhancement Potential

Rainbow trout/steelhead are rarely present in Nojoqui Creek, despite what appears to be suitable habitat and cooler summer water temperatures. In addition to poor habitat condition during the recent drought, there may be some as yet undocumented passage impediments located on private property. The area near the confluence is somewhat degraded. Lack of summer flows in the lower reaches results in a loss of continuity with the mainstem during early spring and summer, although isolated areas of flow and pool Management Committee. Since documented steelhead use within Nojoqui Creek is limited, habitat enhancement is of lower priority (Ranking No. 5).

QUICK FACTS
Nojoqui Creek

Number of *O. mykiss* Observed (1995-1999)	***Generally Absent*** *(1 Adult Observed in 1998 survey; 1998 trapping yielded 2 U/S migrants and 1 D/S migrant)*
Estimated Watershed Area	***15.1 sq. mi.***
Estimated Stream Length	***8 miles***
Estimated Stream Gradient	***LOW*** *(1.4%)*
Percent Canopy (Avg)	***1 to 50*** *(Range: 0 to 100)*
Total Distance Habitat Typed (ft)	***16,382***

Summary of Habitat Attributes
Nojoqui Creek

	Pool	Riffle	Run	Glide
Quantity	14	34	42	15
Distance (ft)	670	2478	10620	2614
Distance (%)	4.1	15.1	64.8	16
Avg Depth (ft)	2.3	0.7	1	1.2
Avg Max. Depth (ft)	3.5	1.3	2	2.3
Avg Instream Shelter (%)	0 to 100	25 to 100	50 to 75	25 to 50
Avg Canopy (%)	0 to 50	0 to 75	0 to 50	0 to 50
Dominant Shelter Components	Aquatic vegetation (lower) and root masses, boulders, terrestrial vegetation, undercut banks (upper); sm. & lg. woody debris	Whitewater, aquatic vegetation (lower), boulders (upper); terrestrial vegetation	Aquatic vegetation (lower/upper) and boulders, terrestrial vegetation (upper); lg. woody debris and root masses (upper)	Aquatic vegetation (lower/upper), terrestrial vegetation (upper); undercut banks/bedrock ledges (upper) and sm. woody debris (upper)

Temperature Data

Year	Ave. Daily Mean	Days Exceed 20°C	Daily Max.	Days Exceed 25°C
1997	<19	0	<19	0
1998	17.8	84	27.0	33
1999	17.1	5	25.4	1

Unknown monitoring period in 1997; 1998 monitoring includes January-February and mid-May to November; 1999 monitoring April to mid August

NOJOQUI CREEK
PERCENT HABITAT TYPE
(linear feet)

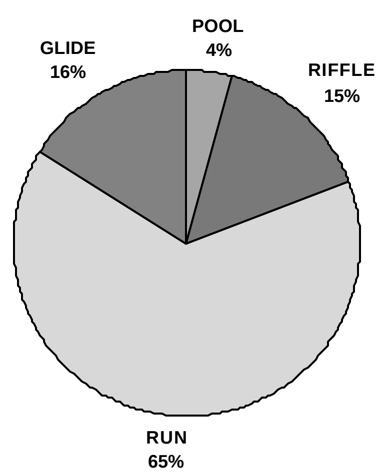


Figure 2-6 Summary of Nojoqui Creek Habitat Attributes

2.3.6 SALSIPUEDES CREEK AND EL JARO CREEK

2.3.6.1 General Location and Description

The Salsipuedes-El Jaro Creek system is the largest tributary drainage in the lower basin. Salsipuedes joins the Santa Ynez River just upstream of the town of Lompoc. El Jaro Creek is a tributary of Salsipuedes Creek. The Salsipuedes-El Jaro Creek watershed area is approximately 47 square miles. Salsipuedes Creek is approximately 9 miles long, and El Jaro Creek is approximately 12.5 miles long. The stream gradient of lower Salsipuedes Creek and El Jaro Creek is relatively low, while upper Salsipuedes is moderately high gradient. Figure 2-7 provides a summary of Salsipuedes-El Jaro Creek habitat quality and fish utilization attributes. This system is the second tributary that returning steelhead encounter after entering the Santa Ynez River from the ocean, and the first into which they can migrate.

Access to habitat within Salsipuedes and El Jaro creeks by anadromous steelhead may be limited by low-flow passage impediments associated with bridges or road crossings (S. Engblom, pers. comm., 1999). Recent surveys by the SYRTAC biologist documented two impediments (S. Engblom, pers. comm., 1999), although an earlier survey reported three low-flow passage impediments (SYRTAC 1994, 1997). These impediments are thought to impede the passage of both adult and juvenile fish primarily during periods of low flow. The Highway 1 Bridge #51-95 on lower Salsipuedes Creek is located approximately 3.6 miles upstream from the Santa Ynez River. This bridge has a 3- to 4-foot drop from the concrete apron into a pool downstream of the bridge. Pool depth may not be sufficient to allow fish to negotiate the apron. Another impediment is a road crossing and concrete apron on El Jaro Creek about 1/3 of a mile upstream of the confluence with Salsipuedes Creek. It is an old ford on a private, unused road, with a 3-foot drop below.

Habitat surveys were conducted by the SYRTAC in 1994, 1996 and 1998 (SYRTAC 1997, 1998). Lower Salsipuedes Creek (below the confluence with El Jaro Creek) was surveyed on June 12 and 13, 1996, at a flow of 2.06 cfs. The habitat was comprised primarily of shallow runs (72% of surveyed reach length), with some deep run (7%), step run (5%), pools (10%), and riffles (6%) (SYRTAC 1998). After the first quarter mile, the flood plain widened, and there was minimal riparian vegetation and canopy (SYRTAC 1997). Canopy cover in 1996 averaged 24% for riffles and 16% for pools, but was less than 10% for all runs. Riparian vegetation was scoured from the main channel in the winters of 1995 and 1998 (S. Engblom, pers. comm.). Several small pools with undercut banks and other features provide important summer habitat for rainbow trout/steelhead (SYRTAC 1997). Instream cover averaged 34% in pools (vegetation, bedrock, some woody debris), 28% in deep runs (vegetation, bedrock, undercut banks), 18% in runs (vegetation with some bedrock and undercut banks), and 13% in riffles (mainly white water) (SYRTAC 1998). Following the heavy winter flows of 1998, a survey on June 22 and June 29, 1998 at a flow of about 10 cfs found mostly runs and slightly less pools (73% runs, 15% glides, 7% riffles, and 4% pools) (SYRTAC data).

QUICK FACTS
Salsipuedes & El Jaro Creeks

Number of *O. mykiss* Observed (1995-1999)	***Present to Common*** *(703 in 1995-1999 surveys- 211 YOY [many present but not sampled], 399 JUV, 93 ADULT; trapping yielded 77 U/S migrants and 46 D/S migrants -lower Salsipudes Ck. only)*
Estimated Watershed Area	***47.1 sq. mi.***
Estimated Stream Length	***21.5 miles*** *(Lower Salsipuedes-4 mi., Upper Salsipuedes-5 mi., El Jaro-12.5 mi.)*
Estimated Stream Gradient	***LOW*** *(Lower Salsipuedes-0.3%, Upper Salsipuedes-3.3%, El Jaro-1.3%)*
Percent Canopy (Avg)	***1 to 25*** *(Range: 0 to 50)*
Total Distance Habitat Typed (ft)	***23,490***

Summary of Habitat Attributes Salsipuedes & El Jaro Creeks

	Pool	Riffle	Run	Glide
Quantity	19	31	43	14
Distance (ft)	905	2278	16995	3312
Distance (%)	3.9	9.7	72.3	14.1
Avg Depth (ft)	2.2	0.9	1.2	1.1
Avg Max. Depth (ft)	4.6	2.5	3	3.3
Avg Instream Shelter (%)	25 to 50	50 to 75	25 to 75	0 to 50
Avg Canopy (%)	0 to 25	25	25	25
nnual Fish Quantity (Av	128.3	12	82.3	2.3
Dominant Shelter Components	Undercut banks, bedrock ledges, boulders, aquatic vegetation, whitewater, sm. woody debris, terrestrial vegetation	Whitewater, boulders, aquatic vegetation, terrestrial vegetation, bedrock ledges	Aquatic vegetation, undercut banks/bedrock ledges, boulders, terrestrial vegetation, sm. woody debris	Aquatic vegetation, undercut banks/bedrock ledges, terrestrial vegetation, sm. woody debris

Temperature Data

Year	Ave. Daily Mean	Days Exceed 20°C	Daily Max.	Days Exceed 25°C
Lower Salsipuedes Creek				
1996	19.3	76	27.6	53
1997	16.0	87	27.4	24
1998	18.4	79	39.4	78
1999	16.8	52	34.4	48
Upper Salsipuedes Creek				
1996	14.2	0	21.6	0
1997	14.5	0	22.8	0
1998	15.2	14	27.3	2
1999	15.6	2	30.7	2
El Jaro Creek				
1996	20.0	83	28.1	27
1997	16.1	45	26.5	9
1998	16.5	74	27.7	40
1999	17.4	23	28.8	22

Lower Salsipuedes - monitoring conducted in1996 (May-October), 1997 (January-June; mid-August thru December), 1998 (early January; mid-April to November), 1999 (February to November).
Upper Salsipuedes monitoring conducted in 1996 (May-June; November-December), 1997 (January-December), 1998 (January-October), 1999 (April-October).
El Jaro monitoring conducted in 1996 (May to November), 1997 (early January ; mid-February thru December), 1998 (January to November), 1999 (April to November).

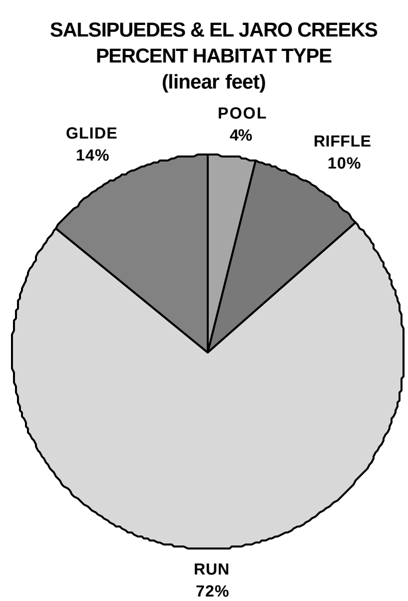


Figure 2-7 Summary of Salsipuedes Creek and El Jaro Creek Habitat Attributes

Substrate conditions varied by habitat in 1996, with silty conditions generally throughout lower Salsipuedes Creek. Pools were dominated by fine sediments, and sub-dominated by bedrock and gravels. Riffles were dominated by small cobbles, and sub-dominated by gravels and large cobbles. Run habitats were dominated by gravels and fine sediments, and sub-dominated by small cobbles.

In 1994, seven habitat units were identified and measured in upper Salsipuedes Creek, directly upstream of the confluence of El Jaro Creek. The habitat units surveyed included 4 pools, 2 riffles, and 1 run, covering a distance of approximately 500 feet, where access issues limited the extent of the survey. Excellent cover and shading were observed in the 1994 survey, and suitable spawning gravels were observed in all riffle and pool tail areas. A survey conducted June 26, 1996 found that habitat was comprised mainly of runs (44% by length), followed by step runs (27%), pools (20%), and riffles (9%). Flow was .68 cfs in upper Salsipuedes and 2 cfs in lower Salsipuedes on that day. Canopy coverage was relatively high compared to lower Salsipuedes and El Jaro creeks, averaging 48% in riffles, 29% in pools, 17% in runs, and 13% in step runs (SYRTAC 1998). Instream cover was 38 to 40% for all habitat types. Substrate composition was also similar across habitat types, with gravels dominant, and in pools and runs fine sediments subdominant.

The banks and channel in El Jaro Creek are very similar to lower Salsipuedes, although El Jaro has two to three times the flow of upper Salsipuedes. The 1994 survey near the confluence with Salsipuedes Creek documented large pools, good riparian cover with overhanging vegetation, good instream cover in the form of vegetation and boulders, and generally excellent trout habitat (SYRTAC 1997). Further upstream there were areas of marginal habitat with abundant fine sediment, slow flow, and medium canopy. Other sections had high gradient riffles, very rocky substrate, and appeared to provide quality trout habitat. Although some reaches upstream of the ford had excellent spawning and rearing habitat, no trout were observed in the stream for 2 miles. A greater incidence of destabilized banks and fine sediments were observed in the upstream portion of El Jaro Creek and in the lower section of Salsipuedes Creek.

El Jaro Creek was surveyed again on June 27, 1996 at a flow of 1.1 cfs. The survey (4,490 feet total) found primarily runs (61% by length), with lower proportions of pools (17%), step runs (13%), riffles (6%), and deep runs (3%) (SYRTAC 1998). Canopy cover averaged 26% in pools, 28% in riffles, 23% in deep runs, and only 5% in runs. Instream cover was greatest in pools (32%, vegetation and boulders), followed by runs (26%, vegetation and boulders), deep runs (15%, boulders and rootwads), and riffles (22%, vegetation, rootwads, and boulders). Substrate in pools and deep runs were dominated by fine sediments and sub-dominated by boulders and gravels. Riffles and runs were dominated by gravels, and sub-dominated by cobbles in riffles and fine sediments and large cobbles in runs. Following the heavy winter flows of 1998, a survey in July 1998 (4,548 feet total) at a flow of 5.9 cfs found more riffles and fewer pools (66% runs, 19% riffles, 12% glides, and 3% pools) (SYRTAC data). The large storms of 1995 and 1998 have altered this reach by filling in some pool habitat and scouring riparian vegetation.

Overall, the reaches with the best conditions are in upper Salsipuedes Creek (upstream of the confluence of the two creeks). All three creeks are steeply banked with a confined channel. Casual observations by the SYRTAC biologist suggest that habitat conditions are fairly consistent throughout the entire system (S. Engblom, pers. comm.).

2.3.6.2 Fish Use

Rainbow trout/steelhead of all size classes have been found in the Salsipuedes-El Jaro Creek system. During summer months when conditions are warm, typically they are found in pools and deep runs. Arroyo chub, fathead minnow, and threespine stickleback were common throughout. Lower Salsipuedes also had warmwater species such as green sunfish, largemouth bass, and bullhead.

In March 1987, an electrofishing survey by U.S. Fish and Wildlife Service (USFWS) collected two adult females and two adult males (Harper and Kaufman 1988). Of these adults, only one female appeared to have been an ocean resident. Captured juveniles did not exhibit smolting characteristics, although several juveniles observed from the bank appeared to be smolts (Harper and Kaufman 1988).

In 1994, an electrofishing survey in May and August found young-of-the-year and juvenile rainbow trout/steelhead around the confluence of Salsipuedes and El Jaro, and one adult larger than 250 mm was found in Salsipuedes upstream of the confluence (SYRTAC 1997). In 1997, snorkel surveys in lower Salsipuedes found young-of-the-year (33), juveniles (172), and small adults (16), while surveys in upper Salsipuedes and El Jaro found young-of-the-year (56 in upper Salsipuedes, 45 in El Jaro) as well as juveniles and adults (10 in upper Salsipuedes, 62 in El Jaro) (SYRTAC 1998).

The results of seasonal migrant trapping on Salsipuedes Creek in 1997 are summarized in Figure 2-8. In 1997, an average rainfall year, 34 upstream migrants and 12 downstream migrants were captured. The fish tended to be small but mature fish (125 mm to 256 mm) that are likely resident rainbow trout possibly reared in the lagoon, and a few large adults (345 mm to 580 mm) that could be anadromous steelhead from the ocean. In 1998, only one upstream migrant was captured, while 40 migrants were captured in 1999. Observations of spawning in wet years such as 1995 and 1998 were limited due to the difficulty of trapping when flows were high and turbid. Spawning has been documented in both streams (SYRTAC 1997). In 1997, redd surveys found most redds just above the confluence (within a 1/2 mile) in El Jaro (18 redds) and upper Salsipuedes (11 redds), with 14 redds also located on lower Salsipuedes Creek within 2 miles downstream of the confluence with El Jaro (Figure 2-9). In 1998 and 1999 redd surveys were conducted in Salsipuedes and El Jaro creeks. Three redds were observed in Salsipuedes Creek in 1998 (upper only), while 64 redds were observed in 1999

(48 lower, 16 upper). No redds were observed in El Jaro Creek during surveys conducted in 1998 and 1999.

Downstream migrant trapping in Salsipuedes Creek indicates that most movement occurs in March and April. In 1994, five fish were captured in June, but none appeared to be smolts (SYRTAC 1997). In 1996, four fish were captured between February and April, and two of them (131 mm and 153 mm) had smolting characteristics. In 1997, nine fish (148 mm to 240 mm) were captured between February and April. Four of these were smolting. Trapping conducted in 1998 and 1999 yielded 23 downstream migrants (17 and 6, respectively).

For additional data, please refer to SYRTAC data compilation reports (1998 and 2000).

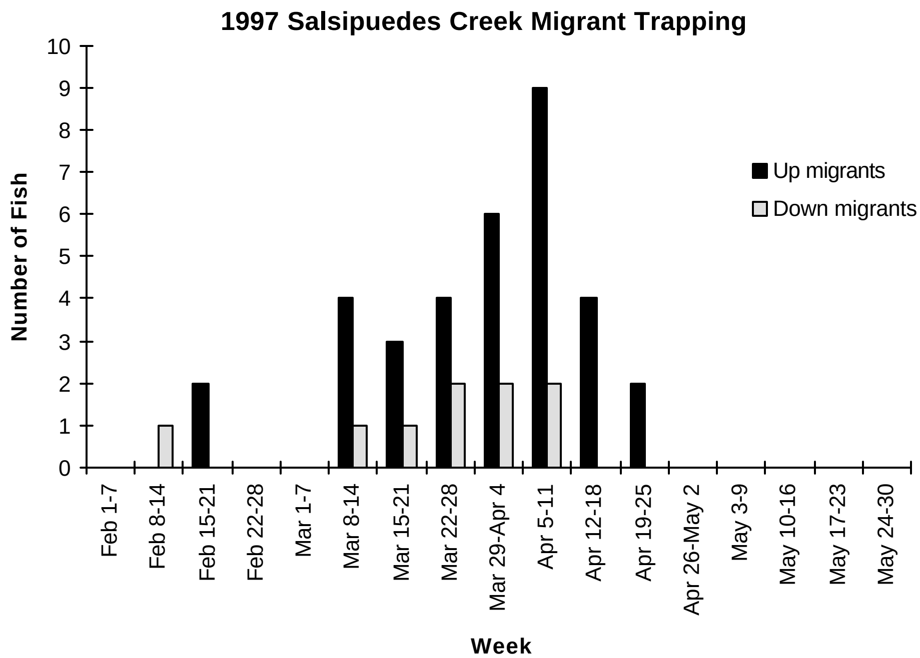
2.3.6.3 Water Quality

Maximum water temperatures in upper Salsipuedes Creek (upstream of the confluence of El Jaro Creek) were monitored periodically from 1995 to 1998. Water temperature was 2 to 3°C cooler in this portion of the stream than in El Jaro Creek or in lower Salsipuedes Creek. Water temperatures did not exceed 22°C in either 1995 or 1996, nor did average daily temperatures exceed 19°C.

Water temperatures in El Jaro Creek, just upstream of its confluence with Salsipuedes Creek and in lower Salsipuedes Creek, were relatively higher than in the upper Salsipuedes. Mean daily temperatures at both locations exceeded 20°C in July and August 1995, and maximum temperatures exceeded 24°C in these months as well. Temperature regimes are almost identical in both El Jaro and lower Salsipuedes creeks.

2.3.6.4 Enhancement Potential

Although this watershed has a generally low gradient, the enhancement potential is high for Salsipuedes and El Jaro creeks, given the availability of year-round water and the presence of rainbow trout/steelhead. Improving canopy cover, increasing the number of pools, and reducing sedimentation in certain areas, especially lower Salsipuedes near the confluence of the two creeks, could reduce water temperatures and improve substrate conditions. Passage impediments also could be modified. Enhancement of the Salsipuedes–El Jaro Creek system was considered to be a higher priority for habitat enhancement. Impediment modification and habitat enhancement measures (Ranking No. 2) on El Jaro, lower Salsipuedes, and upper Salsipuedes are considered important to steelhead utilizing the lower Santa Ynez River, since fish utilization there is ongoing, and opportunities for habitat enhancement on private property are likely. The Salsipuedes-El Jaro system is also considered to be very important to steelhead during drier years since Salsipuedes is the closest viable stream for upstream migration and spawning. The mainstem Santa Ynez, above the Salsipuedes confluence, may not support passable streamflow during low-flow years.



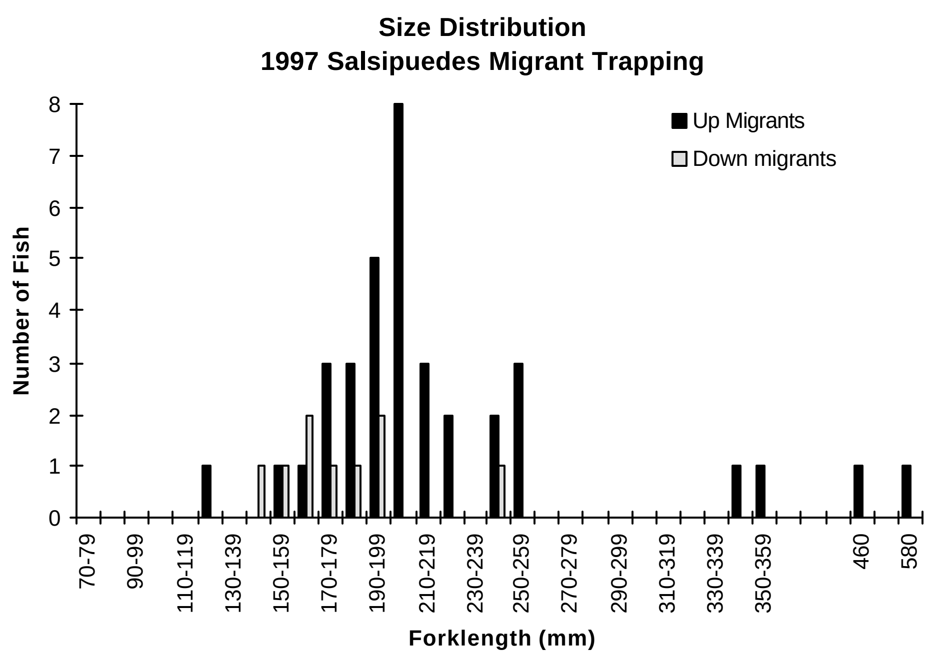


Figure 2-8 Results of Seasonal Migrant Trapping in Salsipuedes Creek (1997)

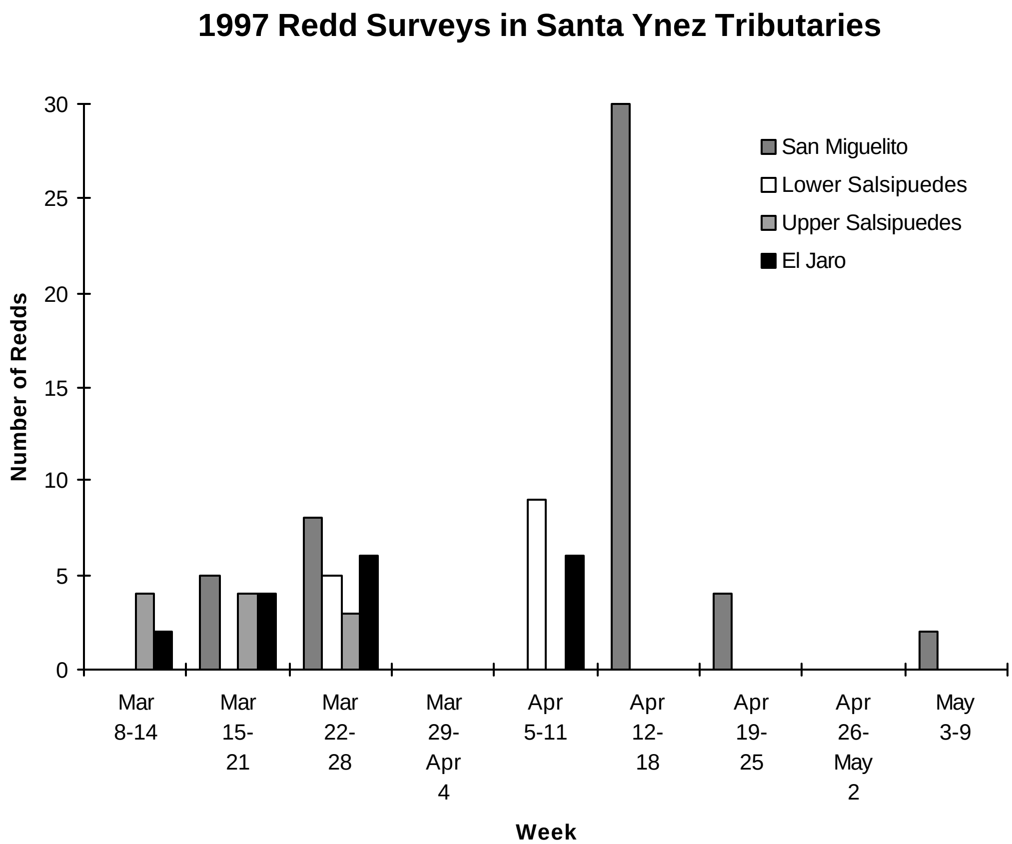


Figure 2-9 Timing of Rainbow Trout/Steelhead Spawning from Redd Surveys in Salsipuedes, El Jaro and San Miguelito Creeks (1997)

2.3.7 SAN MIGUELITO CREEK

2.3.7.1 General Location and Description

San Miguelito Creek flows into the Santa Ynez River at the City of Lompoc. San Miguelito Creek is estimated to be 9 miles long, and the watershed area is approximately 11.6 square miles. The lower reach of San Miguelito Creek near Lompoc is low gradient. The stream gradient in the upper reaches is relatively high. Figure 2-10 provides a summary of San Miguelito Creek habitat quality and fish utilization attributes. The lower 2 miles of San Miguelito Creek is a concrete box culvert with several drop structures. This impedes fish passage at low flows due to shallow depth and at high flows due to high velocities. The culvert empties into the Santa Ynez River near V Street in Lompoc. The creek above this culvert has a narrow channel with well-developed riparian corridor and adequate spawning habitat. Other passage barriers exist, such as a bridge with a 30-foot concrete apron downstream that slopes to a 9-foot drop where the creek has downcut below the concrete.

2.3.7.2 Fish Use

Passage from the Santa Ynez River is completely blocked by the concrete culvert, drop structures and other barriers, such as a bridge with a long concrete apron that is raised 4 feet above the downcut channel. Resident rainbow trout spawn and rear in the upper creek. Young-of-the-year rainbow trout and adults were relatively abundant near San Miguelito Park (about 3 miles upstream of Lompoc) in 1996 surveys (SYRTAC 1997). Spawning surveys began in 1997 and found 49 redds. In 1998, one redd was observed, while 35 redds were observed in 1999. Although upstream passage by steelhead from the ocean is currently impossible, a fish moving downstream was captured in April 1997. Downstream migrating fish captured did not exhibit smolting characteristics. Migrant trapping in 1998 and 1999 yielded only one downstream migrant in 1999.

2.3.7.3 Water Quality

Water temperature has been monitored since 1997. Water temperature conditions appear to be good through the summer, due to good canopy coverage and proximity to the ocean. Perennial flow persists in the stream near the county park.

2.3.7.4 Enhancement Potential

Providing access to the upper creek is the primary enhancement necessary. However, modification of the flood control channel would require considerable work (the feasibility of such an undertaking has not been investigated). Since passage through or around the flood control channel on lower San Miguelito Creek cannot be successfully completed without substantial modifications (*i.e.,* channel removal), the enhancement actions were ranked for lower priority (Ranking No. 6). Although the habitat and fish utilization upstream of these barriers is relatively good, the probability of providing adequate passage upstream is low.

QUICK FACTS
San Miguelito Creek

Number of *O. mykiss* Observed (1995-1999)	***Present to Common*** *(Based on bank observations. No sampling conducted in 1995-1999: trapping in 1997 and 1999 yielded 4 D/S migrants.)*
Estimated Watershed Area	***11.6 sq. mi.***
Estimated Stream Length	***9 miles***
Estimated Stream Gradient	***MODERATE*** *(Lower-0.9%, Middle-1.9%, Upper-4.9%)*
Estimated Canopy	***GOOD*** *(above lower 3 mi.-concrete flood control channel)*
Total Distance Habitat Typed (ft)	***0*** *(not habitat typed)*

Summary of Habitat Attributes
San Miguelito Creek

- **Upper portion of San Miguelito Ck. may have been stocked by CDFG in the past.**
- **Lower 2 miles from the confluence is concrete box culvert with several drop structures and considered impassable**
- **Above the culvert there are additional passage barriers and drop structures.**
- **Resident rainbow trout spawn and rear in the upper creek and have been observed to be relatively abundant.**
- **Spawning and rearing habitat is fair to good above the passage barriers.**
- **Estimated that 70% is run habitat with good canopy and instream shelter complexity.**

Temperature Data

Year	Ave. Daily Mean	Days Exceed 20°C	Daily Max.	Days Exceed 25°C
1997	16.0	57	25.6	12
1998	15.1	0	21.5	0
1999	15.1	2	28.2	1

Monitoring conducted in 1997 (March-July, & December), 1998 (March-July, & September to November) and 1999 (April to November).

SAN MIGUELITO CREEK
PERCENT HABITAT TYPE
(linear feet)

Figure 2-10 Summary of San Miguelito Creek Habitat Attributes

2.4 SUMMARY

The available data from studies of accessible tributary reaches were used to estimate potential spawning and rearing habitat for rainbow trout/steelhead in the lower basin (Figures 2-11 and 2-12). Habitat quality can vary annually depending on rainfall. In wet years, habitat quality is improved and good conditions persist further down the tributaries and close to the mainstem. It is worth noting that these assessments are based on studies conducted during a relatively wet period for the Santa Ynez River.

Good spawning habitat for rainbow trout/steelhead can be found in Hilton Creek and mid-to-upper Quiota Creek (Figure 2-11). Spawning habitat in Salsipuedes and El Jaro creeks is moderate, due to the presence of fine sediments and sands in the stream, with some areas of good habitat. Good habitat exists above passage impediments in San Miguelito and upper Alisal creeks. Stream reaches where young-of-the-year have been observed suggests that spawning habitat exists in those areas.

Successful over-summering of juvenile rainbow trout/steelhead has been observed in lower Hilton Creek, Quiota Creek, Alisal Creek, Salsipuedes Creek (upper and lower), El Jaro Creek, and San Miguelito Creek. Good quality summer rearing habitat can be found in upper Salsipuedes, upper Quiota, and lower Hilton creeks when flow is present (Figure 2-12). Fair to good habitat exists above passage impediments in San Miguelito and upper Alisal creeks. Fair conditions are found on lower Salsipuedes, El Jaro, and the mainstem (Refugio and Alisal reaches). Poor conditions exist on the lower reaches of most creeks (within about 1 to 2 miles of the confluence with the mainstem). While Nojoqui Creek appears to have some good habitat elements, the lack of fish suggests otherwise.

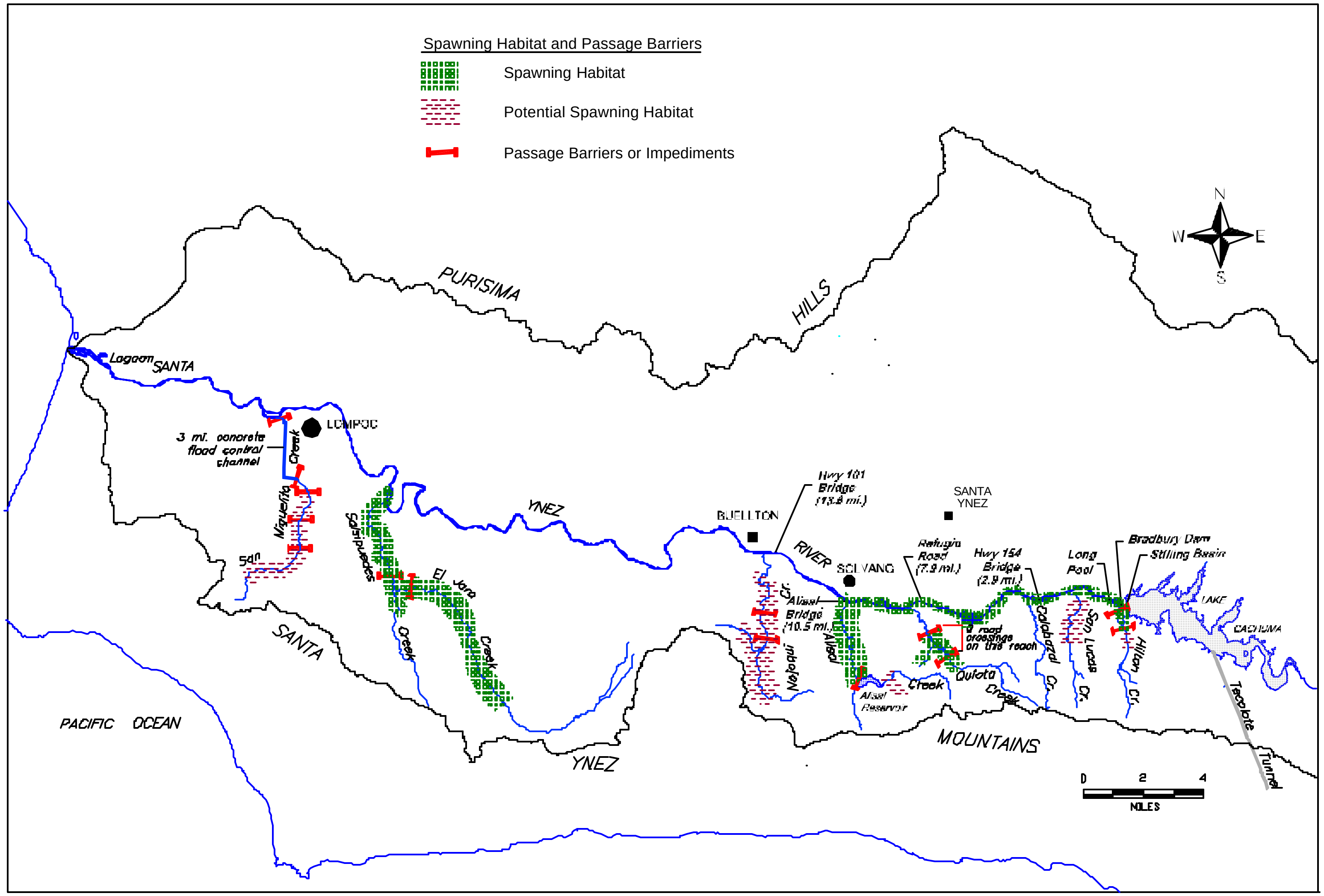


Figure 2-11 Potential Spawning Habitat for Rainbow Trout/Steelhead in the Lower Santa Ynez River

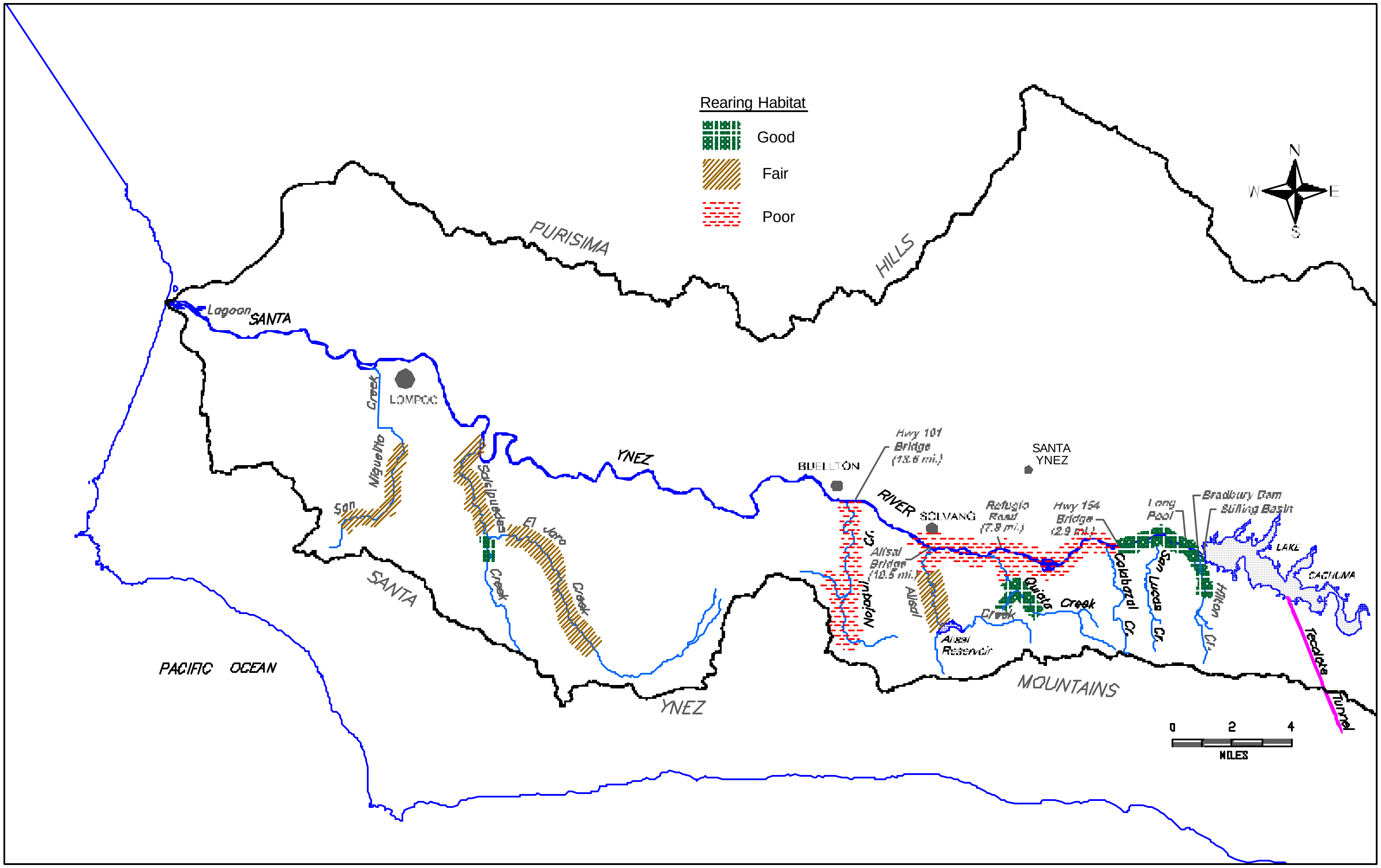


Figure 2-12 Potential Summer Rearing Habitat for Rainbow Trout/Steelhead in the Lower Santa Ynez River

The stated objectives of the Tributaries Work Group are to protect good quality habitat and enhance fish passage at identified impediments. Habitat protection and stream habitat enhancement can be achieved through the implementation of land and habitat conservation measures. Where structures impede or prevent fish migration, modifications will enhance passage and provide greater opportunities for upstream migrating steelhead to reach their spawning grounds. Conservation measures and impediment modifications are described in greater detail in the sections that follow.

3.1 HABITAT CONSERVATION MEASURES

3.1.1 OBJECTIVE

The objective is to protect existing good habitat and improve habitat through enhancement actions to benefit rainbow trout/steelhead. Since much of the tributary habitat is on private lands, establishment of conservation agreements or voluntary joint actions with landowners will be needed.

3.1.2 PROJECT DESCRIPTION

In the tributaries on the south side of the watershed, habitat quality can range from good quality in upper reaches (*i.e.*, perennial flow, good canopy cover, suitable water quality) to poor just above the confluence with the mainstem Santa Ynez River (*i.e.*, intermittent or no flow in summer and little canopy cover). Conservation measures directed at tributary habitat will focus on protecting habitat that is already in good condition and enhancing habitat that is in fair condition. Efforts will not be expended on poor quality habitat where conditions cannot be feasibly improved.

All tributaries in the lower basin, except lower Hilton Creek, are on private property. Therefore, voluntary participation by the landowner is necessary to implement protection and enhancement measures along these streams. Conservation actions can take one of several approaches, including (1) creation of a conservation management plan through the Natural Resources Conservation Service (NRCS), the USFWS or other agencies, (2) creating a partnership with the Adaptive Management Committee to conduct restoration activities, and/or (3) the acquisition of conservation easements or leases. With the conservation easement/lease approach, the Adaptive Management Committee will obtain the easements/leases from landowners to protect property and to implement and monitor appropriate enhancement actions. Priority areas for seeking conservation easements and/or leases will be identified according to the persistence of flows, suitability of habitat (or potential for enhancement), and absence of downstream passage impediments.

This section outlines the conservation management and conservation easement process and describes potential enhancement activities. We also assess the environmental impacts expected for steelhead and other sensitive and protected species.

3.1.2.1 Conservation Management Practices and Landowner Education

Stream enhancement measures can be complemented by habitat protection through conservation practices and educating landowners about "fish friendly" land management practices.

The U.S. Department of Agriculture NRCS has a fifty year history of working in the Santa Ynez watershed and assisting private landowners in applying conservation practices. The service offers consulting to landowners on conservation management practices and has a variety of voluntary cost-share programs to help offset the cost of implementing conservation management plans. Many of these practices would equally benefit land management, stream protection and enhancement for fish habitat. Examples include:

- erosion control
- appropriate fencing
- fish stream improvement
- fish pond management
- riparian forest buffers
- streambank protection
- stream channel stabilization
- vegetative buffer strips

Such actions are initiated by the landowner and are addressed directly to the NRCS office in Santa Maria.

The USFWS also administers several grant programs, including the *Partners for Fish & Wildlife* program, which are designed to benefit landowners while protecting sensitive habitat. As with the NRCS programs, interested landowners apply directly to USFWS for grant information and assistance.

NMFS and USFWS can enter 'Safe Harbor' agreements with private landowners. The agreements benefit endangered and threatened species while giving the landowners assurances from additional, future restrictions based on the landowner's conservation actions. Interested landowners would apply to NMFS, for steelhead, and to USFWS for other listed plants and wildlife.

In addition to the services offered by federal agencies, the SYRTAC proposes offering literature and a series of public workshops designed to provide the public with an understanding of the importance of improving habitat conditions and steelhead use in the lower Santa Ynez River. These efforts will demonstrate ways in which the protection of fish habitat can be mutually beneficial to the landowner as well as to critical fish habitat. We will also solicit voluntary participation from private landowners and the public in restoration and protection activities.

Public outreach and education is discussed in greater detail in the main section of the Fish Management Plan.

3.1.2.2 Conservation Easements and Leases

Results of fisheries investigations performed by the SYRTAC (1997, 1998, 2000) have shown that habitat conditions are suitable for steelhead spawning and/or rearing within a number of tributaries in the lower watershed. Habitat conditions within these tributaries, however, could be enhanced and improved for steelhead. Although, because these tributaries are in private ownership, steps must be taken to gain access to these lands in order to implement enhancement measures. Conservation easements and leases allow for protection of habitat and may grant access for additional enhancement activities while providing benefits to landowners.

Habitat protection will focus on obtaining conservation easements or long-term leases from private landowners along tributary corridors. A conservation easement is a legal agreement between a landowner and a non-profit group or government agency, such as the Santa Barbara Land Trust or the Cachuma Operation and Maintenance Board (COMB). Conservation easements entail purchasing the rights to manage a strip of property along streams from the property owner. The owner retains ownership of the property, but is paid for loss of use. In many cases, the owner can realize tax and estate planning benefits from the easement. In exchange, the Adaptive Management Committee would be able to implement fish conservation measures within the easement. Conservation leases are similar to the easements, however, a lease is acquired for a specific time period. For the purpose of this program, only long-term (10- to 20-year) leases will be considered for habitat enhancement protection and projects. Hereafter, the description of conservation easements also applies to the lease agreements.

Conservation easements can be effective at fostering habitat improvement both where land use is negatively affecting riparian and aquatic habitat and/or where the stream characteristics provide opportunities for enhancement. Conservation easements can foster natural recovery of habitat over time, as well as enhance the success of active intervention through other actions, such as planting riparian vegetation.

The Adaptive Management Committee will work with landowners to develop erosion control measures and/or land use practices that protect steelhead and their habitat without adversely affecting the operation of the landowners' property. Such practices may include livestock management, creation of catchment ponds to settle fine sediments and other materials from runoff waters before they enter the stream, streambank protection, vegetative buffer strips, and upland erosion control measures.

The general process for establishing conservation easements starts with discussions between the landowner and COMB (Figure 3-1). Potential actions and evaluation of benefits, such as collecting information to evaluate the stream as steelhead habitat, and assessing opportunities to improve habitat, will be discussed with the landowner. An independent appraiser familiar with assessing property values for conservation easements

CONSERVATION EASEMENT PROCESS

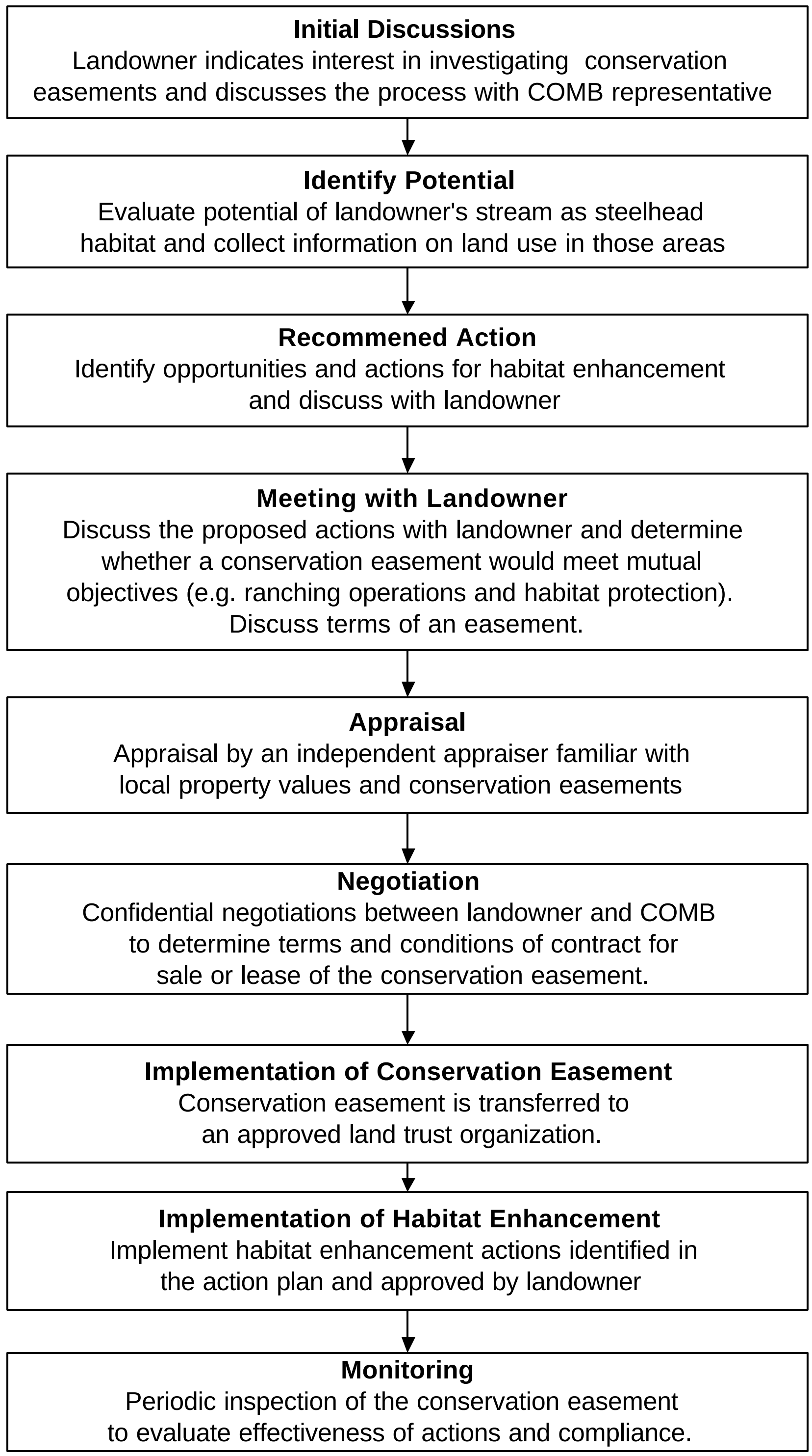


Figure 3-1 Conservation Easement Process

will do an appraisal. The landowner and COMB determine the terms and conditions for sale or lease of the conservation easement. After the easement is established, the Adaptive Management Committee would then implement the habitat enhancement actions identified and monitor improvements to appropriately manage the conservation easement. Each step in this process is completely voluntary, and the landowner reserves the right to bow out at any point up to the purchase of the easement.

In addition to protecting and improving habitat for endangered steelhead, the conservation easements and associated habitat enhancement measures will also benefit other protected species. The California red-legged frog is known to inhabit Salsipuedes Creek. This species occurs in the stream corridor and prefers dense riparian vegetation. The conservation easements will therefore also protect and enhance frog habitat. Other fish inhabiting the protected and enhanced reaches will likewise benefit from these actions.

Several landowners have approached the SYRTAC in regards to establishing conservation easements. The public education and outreach program will complement this action by educating landowners about "fish friendly" land management practices and encouraging others to participate in conservation easements.

3.1.2.3 Physical Enhancement Measures

3.1.2.3.1 Structural Modification of Instream Habitat

Habitat improvements would include structural modifications to instream habitat such as the creation of additional pool and riffle areas and augmentation of spawning gravel. Boulders and large woody debris would be used to create additional habitat features within selected reaches of the mainstem and the tributaries. Access to private lands and the results of field fisheries surveys and habitat typing, in combination with results of water temperature monitoring, will be used as a basis for identifying specific locations for habitat protection and improvement.

3.1.2.3.2 Addition of Instream Structures

Physical modifications of the channel through the addition of instream structures would be used to create more over-summering pool habitat. Habitat complexity has been positively correlated with fish density. Methods for physical enhancement include: (1) improving the quality of pools by increasing cover and complexity, and (2) increasing the amount of pool habitat by increasing depths in existing pools or scouring new pools.

The first step of a pool enhancement program would be to identify areas where opportunities exist for enhancement measures to be successfully implemented. Surveys would be conducted of existing permanent pools to determine their habitat characteristics, as well as to identify additional areas where pools could be created that would likely persist. Site selection would take into account accessibility, channel hydraulics, geomorphology (*e.g*., bankfull width, depth, gradient, sinuosity, sediment load, and substrate size), streamflow regime, and availability of structural materials. Sites with relatively stable streambed, stable banks, and woody riparian vegetation will afford the greatest opportunities, while sites with steep streambanks, non-cohesive sandy soils, little riparian vegetation, and high stream gradients present greater challenges to the successful use of instream structures.

Once suitable sites have been identified, a conceptual enhancement plan can be developed. A feasibility analysis would be performed to evaluate factors such as continued site accessibility, structural stability, cost, and longevity prior to developing final engineering plans for the proposed enhancements. Although the instream habitat improvements will be designed to withstand damage due to flood flows to the maximum extent practicable, periodic maintenance will be required to correct problems such as unsuitable scouring of cover structures or infilling of pools with excess sediment.

Overhanging riparian vegetation, undercut banks, exposed root wads or logs may naturally form cover elements in pools. Structures typically added to pools to enhance cover include logs, root wads, boulders and cobbles. These structures would need to be secured to stable locations to prevent washout. Boulders and cobbles can be placed into pools to create interstitial spaces that provide cover. Consideration should be given to using boulders and cobbles that are large enough to minimize entrainment and transport during high flows. This may require somewhat larger bed materials than those that are currently found in the river.

Installing instream structures to increase scour, direct excavation, and/or manipulating channel geomorphology, can also increase pool depth. Instream structures such as log and boulder weirs, deflectors, and/or digger logs would be used to constrict the channel, increase flow velocities, and thereby scour pools. The objective is to promote self-maintaining pools and to create backwater conditions during periods of low flow.

In some areas, spawning habitat may be enhanced or increased through addition of suitable gravel to the stream.

3.1.2.3.3 Riparian Enhancement

Riparian zones perform a number of vital functions that affect the quality of aquatic habitats, as well as provide habitat for terrestrial plants and animals (Spence *et al*., 1996). Fallen leaves and branches are an important source of food for aquatic macroinvertebrates and nutrients for aquatic vegetation, while fallen terrestrial insects are valuable prey for fish. The roots of riparian vegetation maintain bank structure and provide cover via undercut banks. Overhanging branches also provide cover. The riparian canopy can reduce water temperatures by shading the stream. Large woody debris that falls into the stream further increases cover and creates areas of scour that increase water depth. Riparian vegetation can also reduce water velocities and create refuge areas of relatively low velocity during storm flows.

Propagation of native riparian vegetation can improve stream habitat through the mechanisms described. The Plan will enhance and restore riparian vegetation at specific pools along the

Santa Ynez River and tributaries. This type of restoration effort is relatively inexpensive and easy to perform, as long as permission can be obtained from landowners to access these areas to plant vegetation or conduct other enhancement activities and to protect new plants. Planting or enhancement of riparian vegetation would be useful at sites where the canopy cover is low and the stream channel is not too wide. Where possible, deep-rooted vegetation such as sycamore or cottonwood would be preferable to shallow-rooted vegetation such as willow. The species of vegetation selected for propagation can have a measurable effect on streamflow. The enhancement or expansion of streamside vegetation will likely increase water loss due to transpiration within the stream corridor, although this would be balanced by decreases in evaporation due to improved shading.

3.2 PASSAGE IMPEDIMENT/BARRIER MODIFICATION

3.2.1 OBJECTIVE

Under current conditions, man-made and natural structures may impede or prevent steelhead movements in the tributaries of the lower Santa Ynez River, especially under low and moderate streamflows. Since habitat availability may be a primary factor limiting the steelhead in the watershed, it is imperative to improve access to existing aquatic habitat by modifying or removing impediments. These efforts will serve to expand the available habitat for spawning and rearing steelhead, thereby expanding the carrying capacity of the lower river system.

3.2.2 DESCRIPTION OF PHYSICAL ENVIRONMENT

Habitat surveys conducted by the SYRTAC and others have documented passage impediments on several tributaries (Table 3-1). The tributaries of primary interest are Salsipuedes-El Jaro, Hilton, and Quiota. These creeks have perennial flow, at least in their upper reaches, and can support spawning and rearing. Passage enhancement measures for the cascade and bedrock chute in Hilton Creek and the Highway 154 Culvert are described in Appendix D. Impediments on the other tributaries are man-made structures such as road crossings, bridges, and culverts. Passage impediments on San Miguelito Creek include concrete channels, aprons and walls. Mitigating such impediments would entail significant engineering effort. Studies of the creek upstream of these impediments indicate that the habitat supports rainbow trout/steelhead and that spawning occurs in these areas.

3.2.3 PROJECT DESCRIPTION

Access to habitat within Salsipuedes and El Jaro creeks by anadromous steelhead is limited by two low-flow passage impediments, associated with bridges or road crossings (S. Engblom, pers. comm., 1999). These impediments were thought to impede the passage of both adult and

Table 3-1 Passage Impediments on Tributaries

Creek	Location of Impediment	Structure	Type of Impediment	Jurisdiction
Hilton	1,380 Feet above Santa Ynez River	Cascade and bedrock chute	High-flow passage impediment	USBR
	Below Highway 154	Concrete culvert	Velocity impediment	CalTrans
Quiota	1.3 to 1.6 Miles above Santa Ynez River and beyond	9 Road crossings	Low-flow and high-flow passage impediments	Santa Barbara County Road Department
Nojoqui	3.5 Miles upstream of Santa Ynez River	Culvert	May be an impediment	CalTrans
Alisal	2-3 Miles upstream of the Santa Ynez River	Dam and reservoir	Physical barrier	Private Landowner
Salsipuedes	3.6 Miles above Santa Ynez River	Bridge crossing on Highway 1	Low-flow passage impediment	CalTrans
El Jaro	1/3 Mile above Salsipuedes confluence	Road crossing	Low-flow passage impediment	Abandoned private road
San Miguelito	Lower 3 miles	Concrete channel	Physical impediment	County Flood Control
	3 Miles upstream of Santa Ynez River	Debris basin with 12 foot high concrete wall	Physical barrier	Unknown
	4 Miles upstream of Santa Ynez River	Small concrete ford with 4.5 foot drop	Physical impediment	Unknown
	5 Miles upstream of Santa Ynez River	Concrete apron 19 feet high with a 9 foot vertical drop	Physical barrier	Unknown

juvenile fish primarily during periods of low flow. The Highway 1 Bridge #51-95 on lower Salsipuedes Creek is located about 3.6 miles upstream from the Santa Ynez River. This bridge has a 3 to 4 foot drop from the concrete apron into a pool downstream of the bridge. Pool depth may be insufficient to allow fish to negotiate the apron. This region is frequented by poachers who can observe fish from the adjacent bridge. The SYRTAC has created preliminary designs to provide low-flow passage over the concrete apron and implementation is anticipated in the summer of 2001.

Road crossings, such as those in Quiota and El Jaro creeks, can also be an impediment to fish movement. El Jaro Creek has a road crossing and concrete apron about 1/3 mile upstream of the confluence with Salsipuedes Creek. It is an old ford on a private, unused road, with a 3-foot drop below. Refugio Road crosses Quiota Creek many times beginning approximately 1.3 miles upstream from the mainstem Santa Ynez. All nine crossings are shallow-water Arizona crossings, with concrete beds and, at several sites, a 2- to 3- foot drop downstream of the concrete apron. The County of Santa Barbara maintains Refugio Road.

Arizona crossings are typically concrete aprons placed across the streambed to permit vehicles to drive through the stream on a firm surface during periods of low or no streamflow, and permit debris and sediment to pass downstream during periods of high streamflow. Generally, these crossings require little maintenance to provide access across the stream. However, they often flatten the local stream gradient upstream, gradually developing a broad shallow channel (filled in by sediment). Downstream, an incised channel often develops (scoured by high velocity flows). Upstream migrants have difficulty swimming across the Arizona crossing due to shallow depth, or in some instances, the amount of downstream incision requires fish to jump onto the crossing.

Migration impediments associated with Arizona road crossings can be eliminated by either replacing the crossing with a small bridge or by constructing jump pools in the downstream reach. To provide low-flow passage, these road crossings can often be notched to create a low-flow channel. In addition, relatively inexpensive bridges can be made from retrofitted railroad flat cars and pre-fabricated modular bridges. In some locations large boulders can be used downstream of the crossing to construct weirs that form backwater pools which typically only hold water during periods of high streamflow. Steelhead migrating during periods of moderate to high streamflow can jump and swim between the backwater pools until they reach the crossing and swim across it. Modifying the depth of flow across these crossings would reduce their utility for vehicular use at some flow levels, making travel inconvenient. The County of Santa Barbara Public Works Department and the Adaptive Management Committee will team together to develop more fish-friendly crossings, as the County makes plans to repair several of these crossings.

Surveys of other potential passage impediments and barriers will be conducted to determine the benefits and feasibility of modifying them to enhance fish passage. For example, there is a culvert on Nojoqui Creek that may be an impediment about 3.5 miles upstream of the Santa Ynez River, but further assessment is required (S. Engblom, pers. comm., 1999). Box culverts under state and county roads can impede migration. The concrete bottom of the box culvert forms a broad, shallow impediment during low flow and often acts to form an impediment downstream of the grade control because of a drop in the streambed elevation. Downstream, boulder weirs can often provide adequate backwater during high streamflows to drown the culvert outfall and provide passage. If site conditions prevent use of backwater weirs, then installing wooden or concrete baffles or large rocks ("roughness elements") in the culvert can slow down the water flow through the culvert, creating a deeper flow and allowing easier fish migration. It is also possible that the culvert could be replaced with a bridge or arch culvert.

Preliminary engineering designs are in development for the low to moderate flow fish passage facilities in consultation with the bioengineering staffs of the NMFS and CDFG. The preliminary engineering designs for fish passage facilities will be used as a basis for estimating costs for final design and construction, the range of flow conditions for which the passage facilities would provide benefit, identification of permitting requirements and preparation of environmental documentation, and requirements for access to private lands for the construction of fish passage facilities.

The proposed projects will enhance passage at several fish passage impediments and barriers on principal tributaries throughout the lower watershed including Hilton, Quiota, Nojoqui, Salsipuedes, and El Jaro creeks. Passage impediment modification will provide or improve access to about 160,000 linear feet of existing tributary habitat, thus dramatically increasing the availability of spawning and rearing habitat. Construction activities associated with modifying these impediments will have temporary, negative impacts on steelhead and other fish and wildlife in the project area. Steps will be taken to minimize impacts on steelhead as discussed in the Cachuma Project Biological Opinion (NMFS 2000) and summarized in Section 4 (Implementation). These actions should also minimize the impact on other fish species. Actions to reduce impacts to other sensitive species, such as red-legged frogs and western pond turtles, will be identified through discussions with USFWS and CDFG.

4.1 FUNDING

Reclamation and the Member Units are proposing to fund the conservation actions from the Cachuma Project Contract Renewal Fund and the Warren Act Trust Fund. These funds are presently administered by COMB and are overseen by the Trust and Renewal Fund Committee and the Advisory Committee. These funds were established in 1996 during the contract renewal process to provide money for enhancement and watershed improvements, and come from an assessment on water taken from the Project ($10 per AF) and on use of the reservoir for delivery of State Water ($43 per AF), providing $257,000 to $500,000 per year. The Santa Barbara County Water Agency is also required under a contract with the Member Units to provide $100,000 annually for projects that may include conservation-type activities related to the Cachuma Project. Allocation of these funds for specific projects requires consensus by the County and Member Units, subject to public input. In the future, approximately $300,000 per year will continue to be dedicated to rainbow trout/steelhead restoration.

In addition to these funds, Reclamation and the local water agencies are seeking funds from other sources, such as the State’s Watershed Restoration and Protection Council, the CDFG's Fishery Restoration Program, the Pacific Coastal Salmonid Conservation and Recovery Initiative, the National Fish and Wildlife Foundation, the SWRCB Non-point Source Program and other sources to supplement funds available from local sources. The Member Units have been successful in obtaining outside funding for enhancement projects. Table 3-2 summarizes the outside funding for the tributary enhancement projects approved to date. In addition to seeking grant funds, the Member Units are working with CalTrans and the Santa Barbara County Roads Department to develop partnerships for implementation of the Highway 154 Culvert and Quiota Creek fish passage projects.

4.2 IMPLEMENTATION

Coordination and administration of Plan activities will be performed by the Adaptive Management Committee in conjunction with federal and state agencies. Project designs will be reviewed by NMFS, CDFG, and USFWS prior to implementation (NMFS must approve the project, NMFS 2000). Currently it is estimated that the tributary enhancement measures can be completed by 2005. Should implementation take longer, then Reclamation will need to reinitiate consultation with NMFS and provide them with (1) an explanation for the delay, (2) the steps that will be taken to implement the project(s), and (3) a new anticipated completion date (NMFS 2000).

Table 4-1 Outside Funding Approved for Tributary Enhancement Measures

Project	Grant Program	Funding Award
Hilton Creek Cascade/Chute Fish Passage Project	CDFG's Fishery Restoration Grants Program	$50,300
Hilton Creek Pump and Flexible Intake	National Fish and Wildlife Foundation	$147,000
	Proposition 12 (Parks Bond)	$230,000
El Jaro Creek Demonstration Projects (bank stabilization/ workshops)	SWRCB Non-Point Source Program	$48,500
	Proposition 12 (Parks Bond)	$48,500
Salsipuedes Creek Fish Passage at the Highway 1 Bridge	Environmental Enhancement and Mitigation Program	$20,885
	Pacific Coastal Salmonid Conservation and Recovery Program	$25,000
Conservation Easements on El Jaro Creek	Proposition 12 (Parks Bond)	$234,000

To minimize impacts to rainbow trout/steelhead and other species during the construction phase of many of the tributary enhancement projects, NMFS has established a number of best management practices. These practices will be incorporated into the project description of each individual construction project and are presented below. The practices are taken verbatim from the Biological Opinion (NMFS 2000, Term and Condition #8):

- Reclamation, or it's designated agent (here after referred to as Reclamation), shall isolate work spaces from flowing water for the purpose of avoiding heavy equipment in flowing water, sedimentation, turbidity, and direct effects to steelhead. Prior to work, sandbag cofferdams, straw bales, culverts, or visqueen (here after referred to as diversion) shall be installed to divert streamflow away or around the workspace. The diversion shall remain in place during the work, then removed immediately after work is completed.

- As a result of isolating the workspace from flowing water, Reclamation shall ensure and maintain a corridor for unimpeded passage of steelhead during work activities.

- When practical, Reclamation shall use existing ingress or egress points, or perform work from the top of creek banks, for the purpose of avoiding work and heavy equipment in flowing water and disturbing instream habitat.

- Reclamation shall photograph the work space during and immediately before and after work activities are completed for the purpose of developing a reference library of instream and riparian habitat conditions.

- Excavation of a channel for the purpose of isolating the work space from flowing water is prohibited.

- Reclamation shall minimize disturbance of riparian and upland vegetation. Using only native plant species, Reclamation shall replace vegetation affected by the work and ensure a revegetation success ratio of no less than 2:1.

- Reclamation shall revegetate soil exposed as a result of work activities using seed casting, hydroseeding, or live planting methods, no later than 30 days after the work has been completed. Only native plant species shall be used for revegetation.

- Reclamation shall inspect the revegetated area during spring and fall for two years for the purposes of qualitatively assessing growth of the plantings or seedlings and the presence of exposed soil. Reclamation shall note the presence of native and non-native vegetation and extent (percent area) of exposed soil, and photograph the revegetated area during each inspection.

- Reclamation shall prepare and implement a NMFS approved plan for restoring instream habitat and streambed within the areas affected by work activities to pre-work conditions and characteristics unless the intent of the work was to positively affect these areas by improving habitat conditions such as by fixing passage impediments and barriers or placing cover in pools. For example, if an access route cut into a stream bank for heavy equipment cannot be avoided by the use of existing ingress, then the bank must be returned to its pre-work condition when work is completed.

- Reclamation shall retain or designate a fisheries biologist with expertise in areas of resident or anadromous salmonid biology and ecology, fish/habitat relationships, biological monitoring, and handling, collecting, and relocating salmonid species. On a daily basis Reclamation's fisheries biologist shall monitor work activities, instream habitat, and performance of sediment control/detention devices for the purpose of identifying and reconciling any condition that could adversely affect steelhead or their habitat. The fisheries biologist shall be empowered to halt work activity and to recommend measures for avoiding adverse effects to steelhead and their habitat. Reclamation's biologist shall ensure a corridor for unimpeded passage of steelhead during the work.

- Reclamation's fisheries biologist shall continuously monitor the placement and removal of any diversion needed to isolate work spaces from flowing water for the purpose of removing any steelhead that would be adversely affected. The fisheries biologist shall capture steelhead stranded in residual wetted areas as a result of streamflow diversion and workspace dewatering, and relocate the steelhead to a suitable location immediately upstream or downstream of the work area. The fisheries biologist shall note the number of steelhead observed in the affected area, the number of steelhead relocated, and the date and time of collection and relocation. One or more of the following NMFS approved methods shall be used to capture steelhead: dip net, seine, throw net, minnow trap, hand. Electrofishing is prohibited from use unless prior separate written consent is obtained from NMFS.

- Reclamation's fisheries biologist shall contact NMFS fisheries biologist Darren Brumback (562-980-4026) immediately if one or more steelhead are found dead or injured. If Darren Brumback is unavailable Reclamation shall immediately contact NMFS Protected Resources Division at 562-980-4020. If no one at Protected Resources is available, Reclamation shall immediately contact NMFS's Office of Law Enforcement at 562-980-4050. The purpose of the contact shall be to review the activities resulting in take and to determine if additional protective measures are required. Reclamation will need to supply the following information initially: The location of the carcass or injured specimen, and apparent or known cause of injury or death, and any information available regarding when the injury or death likely occurred.

- Erosion control and sediment detention devices shall be incorporated into Reclamation's work activities and implemented immediately before commencing work. These devices shall be in place during construction activities, and after if necessary, for the purposes of minimizing fine sediment (sand and smaller particles) and sediment water/slurry input to flowing water, and of detaining sediment laden water on site. The devices shall be placed at all locations where the likelihood of sediment input exists.

- Placement of any soil/sediment berm for isolating any workspace from flowing water is prohibited.

- When dewatering any area, either a pump shall remove water to an upland disposal site, or a filtering system shall be used to collect and then return clear water to the creek for the purpose of avoiding input of sediment/water slurry to flowing water. The pump intake shall be fitted with a device to exclude all life stages of steelhead.

- Reclamation shall provide a written monitoring report to NMFS within 30 working days following completion of any work activity. The report shall include the number of steelhead killed or injured during the work activity and biological monitoring; the number and size of steelhead removed; and photographs taken before, during, and after work activity.

- Reclamation shall provide a written report to NMFS describing the results of the revegetation task within 30 working days following completion of revegetation. The report shall include a description of the locations planted or seeded, the area (m^2) revegetated, a plant palette, planting or seeding methods, proposed methods to monitor and maintain the revegetated area, performance or success criteria, and pre- and post-planting color photographs of the revegetated area.

- Reclamation shall provide a written report to NMFS describing the results of the vegetation monitoring within 30 working days following completion of each fall inspection. The report shall include the color photographs taken of the work area during each inspection and before and after implementation of the work activities, and estimated percent of exposed soil remaining within each area affected by the work.

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HILTON CREEK ENHANCEMENT

Appendix D

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

HILTON CREEK WORK GROUP

October 2, 2000

Page

List of Tables .... D-iii

List of Figures .... D-iv

1.0 Introduction D-1-1

2.0 Hilton Creek Characteristics D-2-1

2.1 General Location and Description D-2-1

2.2 Hydrology D-2-1

2.3 Habitat Description D-2-2

2.4 Water Quality D-2-2

2.5 Rainbow Trout/Steelhead Utilization D-2-3

3.0 Proposed Enhancement Measures D-3-1

3.1 Supplemental Watering System D-3-1

3.1.1 Infrastructure D-3-1

3.1.2 Operations D-3-3

3.2 Channel Extension D-3-5

3.2.1 Hydrologic Criteria D-3-5

3.2.1.1 Groundwater Monitoring D-3-5

3.2.1.2 Infiltration Rate Study D-3-9

3.2.2 Habitat Criteria D-3-10

3.2.3 Feasibility Criteria D-3-11

3.2.4 Project Design Considerations D-3-11

3.3 Fish Passage Improvement Projects D-3-12

3.3.1 Cascade and Bedrock Chute....D-3-12

3.3.1.1 Project Background D-3-13

3.3.1.2 Project Design D-3-13

3.4 Riparian Enhancement D-3-16

3.5 Fish Rescue Plan....D-3-16

3.5.1 Monitoring....D-3-17

3.5.2 Rescue and Relocation....D-3-17

4.0 Benefits to Steelhead and Other Species....D-4-1

4.1 Benefits to Steelhead....D-4-1

4.2 Other Species....D-4-3

5.0 Literature Cited....D-5-1

6.0 Personal Communication....D-6-1

Page

Table 3-1 Hilton Creek Ramping Schedule D-3-4

Table 3-2 Hilton Creek Channel Extension Alternative Assessment Matrix D-3-6

Table 4-1 Amount of Habitat and Steelhead Lifestages Affected by Hilton Creek Enhancement Project D-4-2

Page

Figure 3-1 Hilton Creek Enhancement Project..D-3-2

Figure 3-2 Alignment Options for Hilton Creek..D-3-8

Figure 3-3 Conceptual Diagram of Fish Passage Enhancement to the Cascade/
Chute Impediment in Hilton Creek..D-3-14

1.0
INTRODUCTION

Hilton Creek provides the uppermost spawning habitat available to anadromous fish in the lower Santa Ynez basin. Although the habitat conditions in the creek appear to be conducive for steelhead spawning and rearing, fish productivity in Hilton Creek appears to be limited by intermittent flows and impediments to fish migration. Accordingly, it appears that Hilton Creek could support a much greater population of rainbow trout/steelhead. The objective of the actions proposed in this report is to enhance steelhead utilization of the creek by modifying impediments to upstream migration and improving spawning and rearing habitat. The proposed actions at Hilton Creek are consistent with the Santa Ynez River Technical Advisory Committee's (SYRTAC) habitat enhancement objectives in the tributaries of the Santa Ynez River.

In the following sections, information related to Hilton Creek characteristics is provided (Section 2), the proposed enhancement measures are discussed (Section 3) and the impacts of the enhancement measures are evaluated (Section 4). Implementation and management of the actions recommended in this appendix will be coordinated by the Adaptive Management Committee (see Section 5.7 of the Plan).

A description of Hilton Creek including location, habitat, water quality, and steelhead utilization is presented below. The information is based on data collected by the SYRTAC and anecdotal observations from long-time residents of the area. Please refer to *Appendix C - Tributaries of the Santa Ynez River Basin below Bradbury Dam,* for more detail on Hilton Creek habitat characteristics and fish utilization.

2.1 GENERAL LOCATION AND DESCRIPTION

Hilton Creek is a small tributary located immediately downstream of Bradbury Dam. The creek has intermittent or no flow in its lower reaches (north of the Highway 154 Crossing) during the dry season. The estimated watershed is approximately 4 square miles, and approximately 2,980 feet of the creek is situated on U.S. Bureau of Reclamation (Reclamation) property, including the confluence with the Santa Ynez River. The lower reach of Hilton Creek is high gradient and well confined. The stream is shaded by riparian vegetation and the banks of the incised channel.

A cascade and bedrock chute, located approximately 1,380 feet upstream from the confluence with the river, are passage impediments for migrating steelhead. The cascade is approximately 6 feet high. A shallow pool (the "chute pool") is at the base of the cascade. The bedrock chute immediately above it is about 140 feet long. Passage can be difficult here during high velocity flows due to the lack of deeper water and resting sites.

Upstream migrating steelhead are further impeded by a passage barrier at the Highway 154 road crossing. A culvert is located here, about 4,200 feet upstream from the confluence and about 1,200 upstream from the Reclamation property boundary. High water velocities during storms, shallow water depth in the culvert during low flows, and a concrete apron drop structure make this a complete passage barrier to migrating steelhead. Modification of the Highway 154 Culvert would provide passage to several additional miles of upstream spawning and rearing habitat.

2.2 HYDROLOGY

Hilton Creek is primarily dependent upon runoff from local and regional rainstorms, and the flows within the creek are typically low and intermittent. However, during large storm events and years with high cumulative rainfall such as 1995 and 1998, flow in the creek can be very high, and the creek can transport a high bed load, suspended sediment, and debris. Based on field observations, it appears as if much of the larger boulders and debris found in the creek originate from stream bank failure both above and below the bedrock passage reach.

2.3 HABITAT DESCRIPTION

Habitat surveys were conducted along the reach below the chute pool in 1995 and 1998, and between the Reclamation property boundary (approximately 2,980 feet upstream of the confluence) and the chute pool in 1998. No surveys have been conducted upstream of the Reclamation property boundary since access is limited as this section is situated on private property.

The results of the 1995 habitat survey classified the stream below the chute pool as 44% run, 27% riffle, 26% pool, and 3% cascade (SYRTAC 1997). Channel width averaged 9.3 feet, and maximum pool depth averaged 3 feet; and most pools appeared to have suitable spawning habitat at their tail end. The 1998 habitat survey classified the reach below the chute pool as 27% run, 58% riffle/cascade and 15% pool. The reduced pool and run habitat and increased riffle habitat within this section between 1995 and 1998 is due to the high flows experienced during the winter of 1998 which altered the lower portion of the channel and moved the confluence of Hilton Creek with the Santa Ynez River further downstream.

Habitat surveys in 1998 between the Reclamation property boundary and the chute pool (1,553 feet total) documented 61% riffle/cascade, 34% run, and 5% pool (S. Engblom, pers. comm., 1999). The 300-foot reach immediately above the bedrock chute was classified as consecutive run/riffle habitat with little or no canopy cover. The habitat conditions above this open reach up to the Highway 154 Culvert (about 2,400 feet total) and beyond were classified as good to excellent with a mature riparian corridor and canopy.

2.4 WATER QUALITY

The results of previous surveys indicate that the water quality in Hilton Creek is suitable for rainbow trout/steelhead. During these surveys, the water temperatures, dissolved oxygen concentrations, and turbidity were within acceptable ranges for steelhead habitat.

Water temperatures are monitored in the lower reach (about 250 feet upstream of the confluence) and the middle reach (in a pool downstream of the Spawning Pool, about 1,000 feet upstream of the confluence). In 1998, monitoring began at the Reclamation property boundary (2,980 feet upstream of the confluence). Thermograph data, coupled with observations throughout the year, indicate that water temperatures, while not preferred, are generally suitable for steelhead rearing through the entire year. Summer water temperatures at the chute pool (1,380 feet upstream of the confluence) are substantially lower than temperatures measured further downstream. Water temperatures in the chute pool may be suitable through at least August, although the pool would be physically isolated from other areas of potential habitat during a portion of the year unless flows were supplemented. Seasonal patterns in surface flows and the persistence of pools vary annually depending on precipitation and runoff within the watershed. Dissolved oxygen concentrations are within the normal tolerances for rainbow trout/steelhead when water is flowing in the creek (>5 mg/l). However, the pool water quality can diminish to near anoxic conditions when flows become intermittent.

Channel disturbance and water quality problems appear minimal. Hilton Creek clears rapidly after storm events, usually within a few days after rains have ceased.

2.5 RAINBOW TROUT/STEELHEAD UTILIZATION

In general, steelhead are known to migrate to the uppermost accessible reaches in a river seeking spawning habitat. Adults migrating up the Santa Ynez River are blocked by Bradbury Dam and must find spawning habitat downstream of the dam. Hilton Creek currently provides the most upstream spawning habitat available to anadromous fish in the lower Santa Ynez basin.

Hilton Creek is inhabited by rainbow trout/steelhead between the confluence with the mainstem and the chute pool, and prickly sculpin to approximately 800 feet upstream of the mainstem. Sculpin are not present in the upper portions of the creek, and introduced warmwater species, such as bass, bullhead or sunfish, are not found in Hilton Creek.

Spawning is generally limited to a 400-foot section situated immediately below the chute pool. No spawning or young-of-the-year have been observed between the cascade and the Reclamation property boundary. However, anecdotal reports indicate that trout were historically present in upper Hilton Creek above the Highway 154 Culvert. It is possible that the 1955 Refugio fire, which burned 84,700 acres, decimated the trout population in the upper reach.

Adult rainbow trout/steelhead have been documented migrating into Hilton Creek in all years that observations have been made, but the numbers were low in years with low winter runoff. Adults migrating into Hilton Creek are often large and could be anadromous steelhead from the ocean (particularly in wet years) (SYRTAC 1997, 1998, 2000e), rainbow trout that escaped from Lake Cachuma during spill events, or fish that are resident in the river, its tributaries, or the lagoon.

Young steelhead remain in freshwater for a year or more and, therefore, young-of-the-year cannot complete rearing in lower Hilton Creek under natural conditions because the stream goes dry during the summer (SYRTAC 1997, 1998, 2000e). The fish are either stranded within the creek or must enter the mainstem where they are exposed to predatory bass and catfish. Fish rescue operations were conducted in 1995 and 1998 to move young-of-the-year from the drying stream to better habitat. Many young-of-the-year and all adults were found near the pool area just below the cascade. The remainder of the young-of-the-year were found in the lower reach of the creek. Some young-of-the-year that were not captured in the 1998 fish rescue operations did over-summer successfully in the Spawning Pool.

Hilton Creek provides the most upstream spawning habitat for steelhead in the lower Santa Ynez River. SYRTAC studies have documented migration, spawning activity and successful reproduction (SYRTAC 1996, 1997, 1998, 2000e). However, when flows become intermittent, fry usually perish in isolated pools or move downstream into the mainstem of the Santa Ynez River and are more vulnerable to predation.

The habitat within Hilton Creek has been classified as conducive to steelhead spawning and rearing, but steelhead utilization is limited by intermittent flows and several passage impediments. The measures discussed below were developed to enhance conditions in Hilton Creek and increase steelhead utilization by improving access to spawning and rearing habitat. The actions are focused on the lower reach of the creek, which is situated on Reclamation property, and include the following:

- augmenting streamflow in Hilton Creek through the use of a supplemental watering system to release water for flow-related enhancement;
- increasing rearing habitat by constructing a channel extension at the lower end of Hilton Creek;
- improving fish passage past migration impediments; and
- enhancing habitat within the existing channel of Hilton Creek at selected locations.

In addition, fish rescue activities may be necessary in lower Hilton Creek during drought conditions. A protocol for identifying when a rescue would occur and the methods to be employed is also discussed.

3.1 SUPPLEMENTAL WATERING SYSTEM

As previously discussed, streamflow in Hilton Creek is intermittent, and the objective of the supplemental water system is to provide a dependable year-round source of cool water to allow the fish to survive the summer months until natural flow resumes in the winter. Construction of the supplemental watering system was completed in the fall of 1999, and the system is presently being used to support the current young-of-the-year. The details of the supplemental watering system are provided below.

3.1.1 INFRASTRUCTURE

The system is comprised of a pipeline with two release locations in Hilton Creek and one release location in the Stilling Basin (Figure 3-1). An energy dissipation/aeration structure has been constructed at each release point in order to maintain dissolved oxygen concentrations near the saturation point. Presently, water is delivered from Lake Cachuma to the release points via gravity flow through a fixed intake along Bradbury Dam. The system was designed to have a total capacity to 10 cubic-feet-per-section (cfs) with all three release points operating, and a capacity to deliver 8.85 cfs to Hilton Creek with the upper and lower release points operating. The existing infrastructure (distribution pipeline) of the watering system is being repaired to increase the capacity

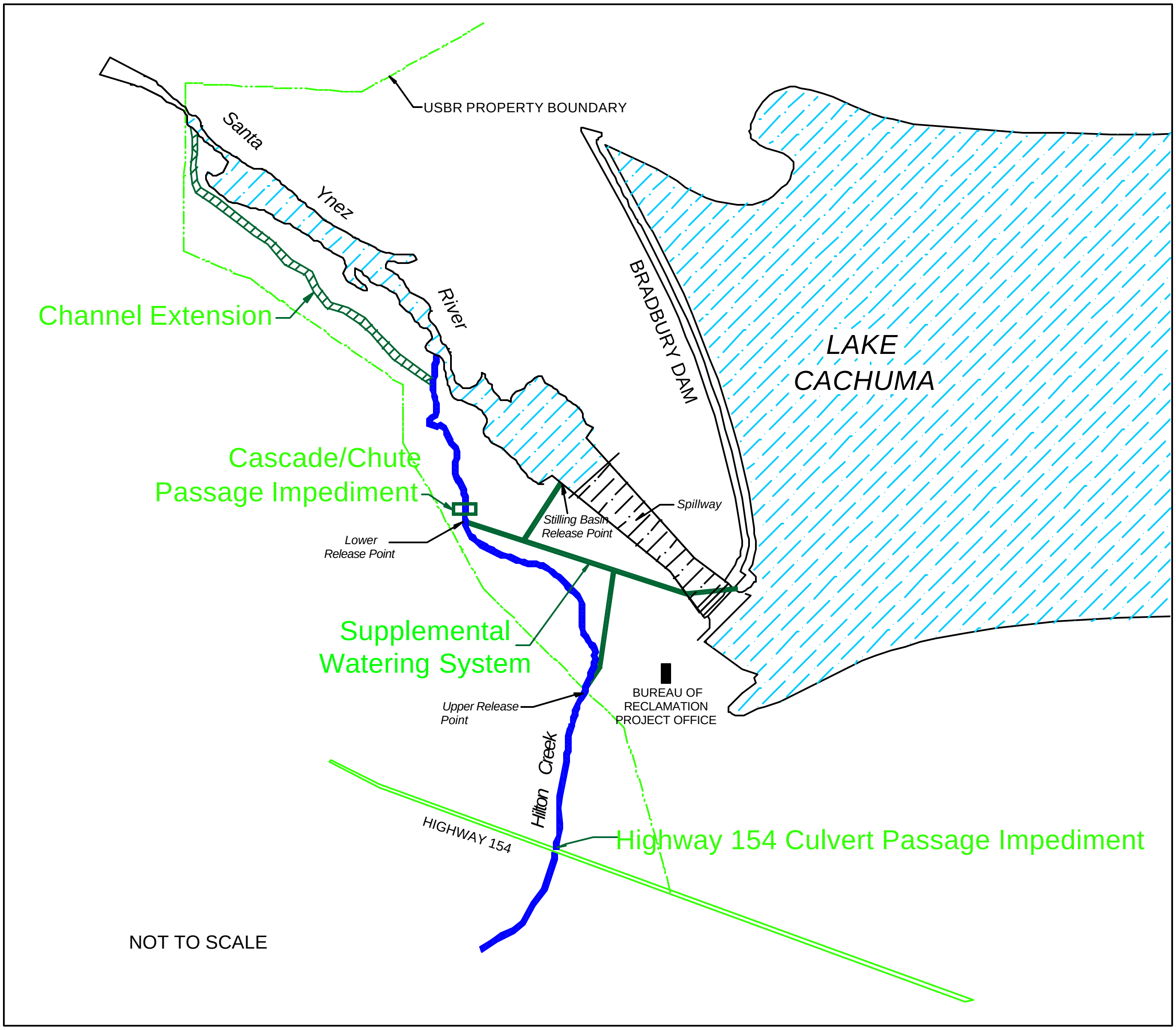

Figure 3-1 Hilton Creek Enhancement Project

of the system (currently below the anticipated level), and additional portions of the infrastructure (pump and flexible intake) will be added in the next two years. These enhancements to the water delivery system, which will enable the system to deliver water via gravity feed or pumping, are presently being designed. If these upgrades require turning off the flow of water into Hilton Creek and/or the mainstem, then Reclamation will need to reinitiate consultation with NMFS.

The facility will operate by gravity flow or pumped flow depending on flow targets and lake surface elevation. The capacity of the permanent watering system will vary with lake level because of the gravity fed system. When the pump is in use, the main pump will run off the local electricity supply. A secondary, fuel-powered pump will be located on site in the event of a problem with the existing pumping system (*e.g.*, a power outage or maintenance). Having both the gravity-flow and pump systems will ensure consistent water deliveries to Hilton Creek.

Rainbow trout/steelhead require cool water. Lake Cachuma is thermally stratified during spring and summer, with warm water near the surface (the epilimnion layer) and cold water at deeper levels (the hypolimnion). Vertical thermal profiles measured during the summer indicate that water should be obtained from a minimum depth of 65 feet (20 meters) below the lake's surface in order to obtain water measuring 18°C or cooler (SYRTAC 1997). A variable intake line (snorkel) to regulate the depth from which water in Lake Cachuma is drawn will also be installed.

3.1.2 OPERATIONS

Supplemental water releases into Hilton Creek will be made to maintain flows generally between 2 and 5 cfs depending on the water year type, natural flow in Hilton Creek, and the amount of water stored in the lake. A 2 cfs minimum flow in Hilton Creek will be maintained once the pump system is installed thus creating the ability to water the lower reach in 98% of years (NMFS 2000).

The reservoir releases for fish enhancement, especially mainstem target flow releases (see *Appendix B - Flow Related Fish Enhancement*), will be made via the Hilton Creek supplemental facility. Mainstem target flows will be established in all years except critical drought years. During drought situations, when the elevation of Lake Cachuma declines below 665 feet (2% of years), the watering system will not be able to deliver water to Hilton Creek. Migrating steelhead, however, are not expected to reach Hilton Creek in drought years. When such a situation occurs, a fish rescue will likely be performed in Hilton Creek assuming any steelhead spawned there that year. The decision to conduct a fish rescue will be made in consultation with NMFS and CDFG.

The Hilton Creek water delivery system was designed, and will be operated, to meet temperature and dissolved oxygen criteria appropriate for rainbow trout/steelhead. The two release points in Hilton Creek (upper site at the Reclamation property boundary and lower site in the chute) provide greater flexibility in adjusting the amount of water delivered to the different reaches of the creek. During operation of the temporary watering system in 1997, where water deliveries were made at the lower release point, water quality conditions were suitable throughout lower Hilton Creek. Water released at the upper release point could experience greater warming as it travels through the channel, or it may temporarily go subsurface at the open alluvial area before rising again at the bedrock chute. If this is a problem, releases could be shifted to the lower release point. Monitoring of water temperature, flows, and dissolved oxygen will be conducted in order to adjust operations of the two release points as necessary.

Further study of the conditions within Hilton Creek and the operation of the watering system will be needed to develop specific release scenarios for this system. Therefore, releases from the supplemental facility will be adaptively managed within the capability of the system. The releases to Hilton Creek within and among years will be managed by the Adaptive Management Committee. This committee is composed of a representative from Reclamation, the Cachuma Conservation Release Board, Santa Ynez River Water Conservation District (SYRWCD) Improvement District #1, SYRWCD, National Marine Fisheries Service (NMFS), and California Department of Fish and Game (CDFG). The Adaptive Management Committee may decide to modify the 2 cfs minimum flow required by NMFS once the pump is installed (NMFS 2000), although the decision must be approved by NMFS. Data to determine the flow versus habitat quantity in lower Hilton Creek will be collected to assist in system evaluations.

It is anticipated that releases will be primarily made through the upper release point in Hilton Creek to provide water supplementation to the longest portion of channel. In years when there are larger quantities of water to be released to meet the mainstem target flows, it is anticipated that a portion will be released through the Hilton Creek system into the Stilling Basin to enhance mainstem habitat between the release point and the confluence with Hilton Creek. Management of both the distribution of water among the three release points and the amount of water to be released will be based on a number of factors including, but not limited to, presence of spawning adult rainbow trout/steelhead, presence of rearing juveniles, reservoir storage, downstream water rights releases, water quality in Hilton Creek (*e.g.*, temperature), water losses, water temperature at the intake depth in Lake Cachuma, and natural flow in the system.

A ramping schedule will be used in Hilton Creek to protect rainbow trout/steelhead. The ramping schedule is shown in Table 3-1. During the first year of releases, managed flow changes will be made during daylight hours, and the creek will be monitored for potential stranding during ramping events.

Table 3-1 Hilton Creek Ramping Schedule

Release Rate (cfs)	Maximum Ramping Increment (cfs)	Minimum Ramping Frequency
10 to 5	1	4 hours
Less than 5 cfs	0.5	4 hours

3.2 CHANNEL EXTENSION

The objective of the proposed channel extension is to enhance the benefits of the supplemental water supply by creating additional steelhead rearing habitat in Hilton Creek. Four extension alternatives were considered and evaluated based on various hydrologic, habitat, and feasibility factors. Of these four alternatives, extension Alignment B was selected as the preferred alternative by the Hilton Creek Work Group, a subgroup of the SYRTAC. Further studies are required to determine the feasibility of this alignment in relation to such factors as seepage loss, water temperature, stream gradient, and predation.

The four alignment alternatives that were considered are shown in Figure 3-2, and consist of the following:

- Alignment A – consists of an alluvial floodplain which would provide an increase in net channel length of 596 feet.
- Alignment B – consists of a relic stream channel which would provide an increase in net channel length of 1,215 feet.
- Existing Alignment – represents the "no action" alternative.
- Former Alignment – consists of the former Hilton Creek alignment which discharged to the Stilling Basin. This alignment would decrease the net channel length by 145 feet.

The extension alignment selection criteria are summarized in Table 3-2, and a discussion of the criteria and project design considerations is presented below.

3.2.1 HYDROLOGIC CRITERIA

Since the water available for supplemental releases is limited, the most significant hydrologic concern regarding the proposed extension was potential seepage loss. In order to address this concern, piezometers were installed and groundwater elevations were monitored along Alignment A and Alignment B (Figure 3-2), and an infiltration study was performed along each of the alignments. The groundwater monitoring data and results of the infiltration study are presented below.

3.2.1.1 Groundwater Monitoring

In order to gain further understanding of the groundwater hydrology in the lower reach of Hilton Creek, seven piezometers were installed along Alignment A, and five piezometers were installed along Alignment B in February 1999.

The piezometers were installed using a backhoe, and are constructed of 4-inch diameter blank and .020-inch slotted Schedule 40 PVC pipe. The piezometers were installed to the greatest possible depth at each location, which was determined by the structural stability of the encountered sediment and/or the limitations of the backhoe. The piezometers are generally situated at depths between .5

Table 3-2 Hilton Creek Channel Extension Alternative Assessment Matrix

Criteria	Alignment A (Close to SYR)	Alignment B (Along base of bluff)	Existing Alignment (No Extension)	Former Alignment
Net Change in Channel Length[1]	+ 596 feet	+ 1,215 feet	No change	- 145 feet
Channel Gradient (% Slope)[2]	0.91%	1.1%	3.5%	3.9%
Estimated Water Loss Potential:	High	Low-Moderate	Low	Low
Infiltration Rate (gal/sec· ft^2)*	0.159	0.034 gal/sec· ft^2	unable to measure because water in creek	0.013 gal/sec· ft^2
Soil Type	Alluvium (gravel/cobble)	Predominantly colluvium (silt/sand/gravel)	Alluvium (gravel/cobble)	Alluvium (gravel/cobble)
Thermal Heating Potential	High • long channel • poor canopy cover	Moderate • longest channel • good canopy cover	Moderate • medium channel • fair canopy cover	Low • short channel • good canopy cover
Projected Rearing[3] Habitat Quality	Moderate quality habitat	High quality habitat	High quality habitat	Moderate quality habitat
Projected Spawning[3] Habitat Quality	Moderate – High	Moderate – High	Moderate – High	Low
Habitat for Other[3] Fish Species	Only sculpin currently use Hilton Creek. By designing the entrance to the channel with a moderate gradient, we can keep out predatory fish. CA red-legged frogs, western pond turtles and two striped garter snakes may find the extension to be good habitat.			
Avian Predation Potential	High • poor canopy • poor instream shelter	High • good canopy, good instream shelter, blue heron rookery	Low • fair canopy • good instream shelter	Low • good canopy • good instream shelter
Existing Riparian Zone	One side of channel has riparian zone	Well developed	Well developed in places, exposed in other places	Well developed

Criteria	Alignment A (Close to SYR)	Alignment B (Along base of bluff)	Existing Alignment (No Extension)	Former Alignment
Flow Control Structure Needed?	The "existing alignment" is considered the 'no action' alternative, and therefore that alignment will not require a flow control structure. If we choose to build an extension, whatever extension channel we select will require a flow control structure and an associated overflow channel (which will not require a structure).			
Fish Stranding Potential	Fish stranding potential is low since the watering system will provide year-round watered habitat except in dry years. Lower seepage rates along alignment B will help maintain water in the extension and therefore help reduce fish stranding.			
Potential for Flood Damage	High • near SYR • entrance aligned with river course	Low • along bluff at edge of flood plain	High • close to SYR	High • outlet in Stilling Basin • aligned w/ SYR
Long-Term Maintenance[4]	High • long channel • repair road crossings • storms can easily shift course	Moderate • long channel • repair road crossings	None	Moderate • short channel • storms can easily shift course
Additional Expenses[5]	• channel lining (most of length) • channel excavation • road crossing (1) • pipeline crossing	• channel lining (downstream[D/S] connection to SYR) • channel excavation • road crossings (2) • pipeline crossing	None	• remove debris jam • pipeline crossing
Construction Cost[6]	High	High	None	Low

[1]Relative to the length of the existing alignment
[2]Channel gradient was determined by subtracting the thalweg elevation at the confluence of the alignment with the SYR from the thalweg elevation at the outlet of the canyon (*i.e.*, the top of the old alignment) and dividing this value by length of the alignment.
[3]High quality habitat is possible in whichever alignment is selected provided that we design and construct it. The anticipated cost of this construction and its permanence varies between alignments.
[4]Long-term maintenance includes dealing with infilling of pools, riparian overgrowth, accumulation of woody debris, and the like. The effort and cost of these types of maintenance are relative to the channel length. Any structures listed under 'additional expenses' will also have to be maintained as well as the flow control structure.
[5]Includes structures required on only one alignment
[6]The 'additional expenses' make alignments A and B more expensive.
*Additional infiltration measurements will be taken in summer and fall because infiltration rates vary with the degree of saturation of the basin.

Assumptions: Assumes water in the creek year round (either from natural flows or the watering system)
"Existing alignment" represents the 'no action' alternative (*i.e.*, there are no improvements to this habitat, it is allowed to exist as is).
The channel extension is designed primarily to provide over-summering habitat and not spawning habitat (available upstream in Hilton Creek), therefore the channel design will not focus on spawning habitat.

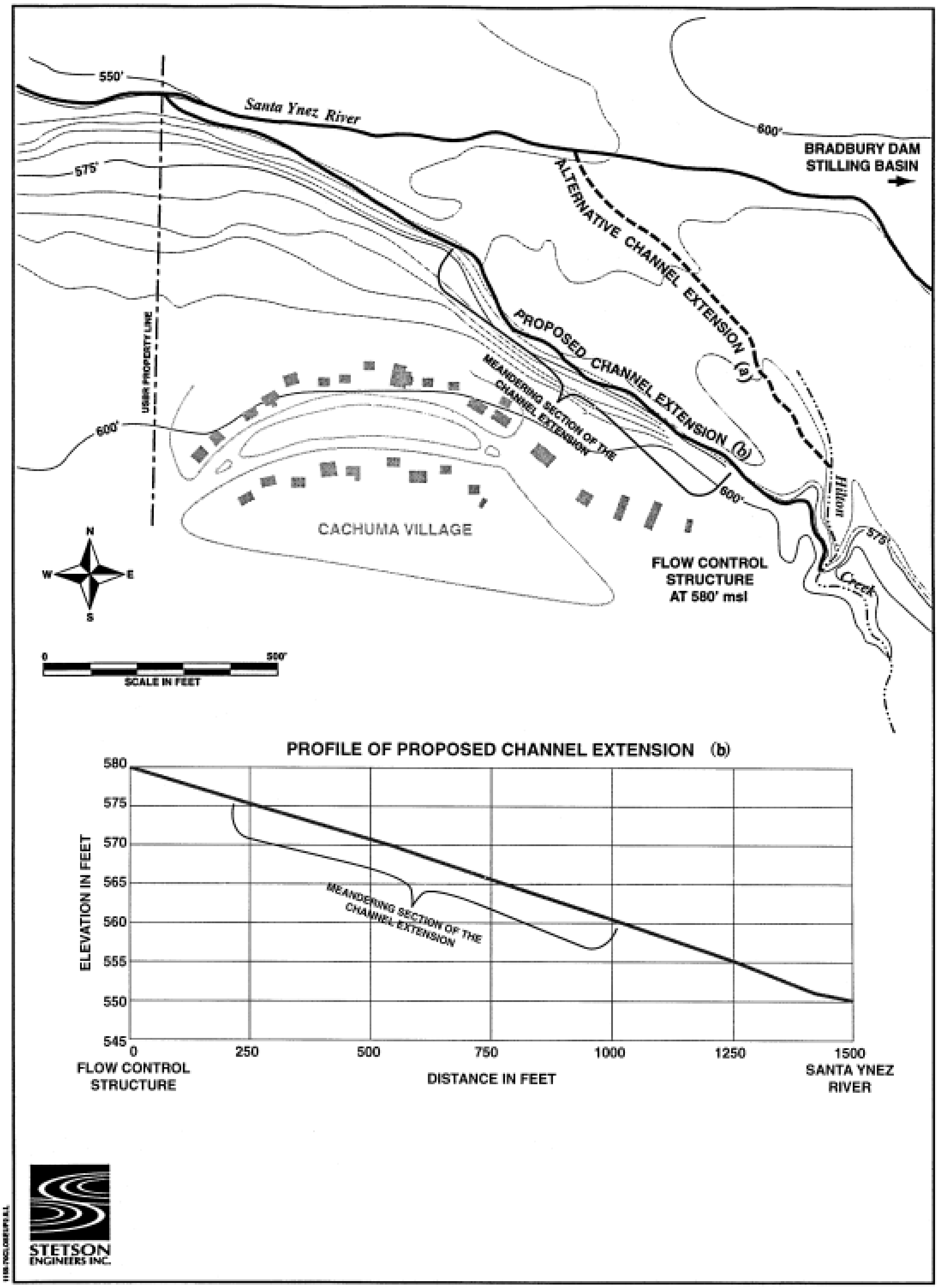

Figure 3-2 Alignment Options for Hilton Creek

and 2 feet below the groundwater table as sediment sloughing prevented installation at greater depths. The lithology encountered during installation of the piezometers generally consisted of sand, gravel, and cobble material along Alignment A, and silt, sand, and gravel along Alignment B. Groundwater was encountered at all locations except for PZ-B (SYRTAC 2000a, 2000b).

Groundwater elevation measurements have been collected monthly from the piezometers to aid in determining the proximity of groundwater to the surface, seasonal fluctuations in the groundwater table, and the groundwater flow direction gradient. Based on the data collected to date (SYRTAC 2000a), depth to groundwater below ground surface is greater along Alignment B as compared to Alignment A, and groundwater levels appear to be highest in the spring with fluctuations up to greater than 4 feet at some locations. The groundwater flow direction in the vicinity of Hilton Creek is toward the northwest and turns toward the west in the vicinity of the Long Pool.

3.2.1.2 Infiltration Rate Study

In order to estimate relative seepage loss along Alignments A and B and the former channel, an infiltration study was performed in March 2000. Data was not collected along the existing channel since there was approximately 7 cfs of surface flow in the creek. The infiltration study results indicate that the relative infiltration rates were highest along Alignment A, followed by Alignment B and the Former Alignment, respectively (SYRTAC 2000b).

In order to obtain data which is representative of the entire length of each alignment, the study was conducted at one location along the former alignment and three locations along Alignment A and Alignment B. At each test location, three bottomless 5-gallon buckets were situated 10 feet apart along the alignment thalweg, except at test location 1A along Alignment B at which only one bucket was used due to dense vegetation. The bottomless buckets were carefully pressed approximately 2 to 3 inches below ground surface. These buckets were filled with water, and the incremental drop in water level within the bottomless bucket was recorded per unit of time until the water level passed below ground surface. The infiltration rate for each test location was determined by averaging the infiltration rates of the three bottomless buckets, and the infiltration rate for each alignment was calculated by averaging the average rates at each test location.

The study results indicate that the relative infiltration rate is highest along Alignment A (.159 gallons/second-square foot) followed by Alignment B (.034 gallons/second-square foot) and the Former Alignment (.013 gallons/second-square foot), respectively. The results are presented in units of gallons per second per square foot (gallons/second-square foot) since the incremental drop in water level is applicable to the unit area of the bottomless bucket.

3.2.2 HABITAT CRITERIA

The habitat selection criteria included an evaluation of the stream gradient, potential quality of spawning and rearing habitat, thermal heating potential, avian predation potential, and the quality of the existing riparian zone.

The stream gradient for each alignment was determined by subtracting the thalweg elevation at the confluence of the alignment with the Santa Ynez River from the thalweg elevation at the outlet of the bedrock canyon (*i.e*., the top of the old alignment) and dividing this value by the length of the alignment. The calculations did not account for variations in topography between the two elevations. Based on these calculations, the highest stream gradient was along the former alignment at 3.9% and was followed by the existing alignment at 3.5%, Alignment B at 1.1%, and Alignment A at .91%.

For the other categories, a qualitative descriptor was assigned to each alignment based on an assessment of the area by SYRTAC biologists and hydrologists. The evaluation is based on current conditions and an estimate of future conditions with year-round streamflow. The results of the habitat evaluation are as follows.

- Alignment A has a high thermal heating potential due to the channel width and the lack of mature trees and vegetation. Consistent streamflow likely would support willows and the long-term development of mature riparian vegetation. Potential rearing habitat was ranked of moderate quality due to the projected lack of instream cover and structure for pool development. Potential spawning habitat was ranked moderate to high quality due to the present substrate. The lack of riparian and instream cover suggested a high avian predation potential. Currently, a riparian zone exists on only one side of the proposed channel alignment.

- Alignment B has a moderate thermal heating potential based on the high degree of shading provided by the canopy of dense riparian vegetation and mature sycamore trees and the adjacent bluff. Projected instream complexity and cover suggest high quality potential rearing habitat, while gravel and sand substrate suggest moderate to high quality potential spawning habitat. Dense canopy cover suggests low to moderate avian predation potential, although it was noted that the trees adjacent to the proposed alignment support a heron rookery.

- The Existing Alignment, evaluated on existing conditions, has a moderate thermal heating potential, high quality potential rearing habitat, moderate to high quality potential spawning habitat, a low avian predation potential, and areas of well-developed riparian zones.

- The Former Alignment has a low thermal heating potential due to existing canopy cover, moderate-quality potential rearing habitat, low-quality potential spawning habitat, a low avian predation potential, and a well-developed riparian zone.

3.2.3 FEASIBILITY CRITERIA

The feasibility criteria included an evaluation of the necessity of a flow control structure, the potential for flood damage, long-term maintenance, additional expenses, and the construction cost. These criteria were evaluated by SYRTAC working group hydrologists, engineers and biologists. The assigned qualitative descriptors are as follows:

- Alignment A would require a flow structure and an associated overflow channel (see design considerations below). It has a high potential for flood damage due to its proximity to the mainstem Santa Ynez River. This higher potential for flood damage suggests that long-term maintenance costs would be higher than for the other alignments. Projected construction costs would also be high due to required channel engineering and grading, protection of road and pipeline crossings and potential channel lining materials.

- Alignment B would require a flow structure and an associated overflow channel (see design considerations below). It has a low potential for flood damage as it is further from the mainstem and partially protected by the mature riparian zone. Similarly, associated long-term maintenance costs are projected to be moderate. Projected construction costs would also be high due to required channel engineering and grading, protection of road and pipeline crossings and potential channel lining materials.

- The Existing Alignment would not require a flow structure and has a high potential for flood damage due to its proximity to the Santa Ynez River.

- The Former Alignment would require a flow structure and an associated overflow channel. It has a high potential for flood damage. Construction and long-term maintenance costs are projected to be moderate, limited primarily to debris removal and minor grading.

3.2.4 PROJECT DESIGN CONSIDERATIONS

Since the objective of the extension project is to create additional rearing habitat, the extension will be designed as a low-flow channel. The channel will be designed to accommodate flows up to 15 cfs, but operating flows are anticipated to be less than 5 cfs. As part of the design, the existing channel would continue to serve as an overflow channel to convey water during large rainstorm events, and it is anticipated that both the channel extension and the existing channel would serve as migration corridors for adult rainbow trout/steelhead during high-flow events.

In order to regulate flows into the channel extension, flow control structures will need to be included in the design. Structures such as a submerged boulder weir could be used to direct flow into the channel extension during low flows, and a limiter log structure could be used to prevent high flows from entering the extension.

Habitat improvements may also be included in the project design. Materials such as boulders, woody debris, suitable gravel, and vegetation could be used to create high value fish habitat. Riparian vegetation including willow cuttings, cottonwood, oak, and sycamore could be planted along the channel to provide shading and reduce increases in water temperature, and a temporary irrigation may need to be installed to establish the plantings.

The channel extension would be monitored to assess its performance and determine the need for any maintenance. Following a high-flow year, it may be necessary to repair the channel where it meets the Santa Ynez River. Sediment transport through the channel extension is expected to be minimal, since high flows would be diverted to the current Hilton Creek channel. Habitat monitoring will be used to decide whether sediment supplementation or removal would be necessary. The success of riparian plantings would also be assessed and corrective measures taken as needed.

3.3 FISH PASSAGE IMPROVEMENT PROJECTS

The objective of the Hilton Creek fish passage improvement project is to improve fish passage through two identified migration impediments so that the steelhead can utilize upstream spawning and rearing habitat. The lower migration impediment consists of a steep 6-foot cascade and 140-foot long confined bedrock chute located approximately 1,380 feet upstream of the confluence with the mainstem. Above this impediment there is a complete passage barrier at the Highway 154 Culvert. The SYRTAC project biologist has never observed steelhead in the reach upstream of the chute pool to the Reclamation property boundary although fish have been observed in the pool directly downstream from the Highway 154 Culvert. Providing passage through the cascade and bedrock chute will give access to approximately 2,800 feet of stream channel up to the culvert at the Highway 154 crossing, and providing access through the culvert will give access to additional upstream habitat. The fish passage improvements to allow better access through the cascade and bedrock chute are scheduled to be constructed in the 2001, and the preliminary design to modify the Highway 154 Culvert is presently being completed.

3.3.1 CASCADE AND BEDROCK CHUTE

Since it is not known whether the impediment to migration is due to the height of the cascade or the high-flow velocity in the bedrock chute, this project concentrates on modifying the hydraulic conditions at both of these impediments. Additionally, the project focuses only on improving passage upstream of the plunge pool since adult steelhead have been observed in this pool.

The design involves creating a backwater effect in the plunge pool, modifying the streambed near the crest of the cascade, and constructing two cast-in-place concrete channel obstructions (or roughness elements) and five boulder-sized cast-in-place concrete elements in the bedrock chute area. Collectively, these actions will reduce the effective height of the cascade and lower velocities in the bedrock chute. This design is expected to provide acceptable adult steelhead passage at streamflows above 5 cfs with increased effectiveness at flows above 10 cfs. The uppermost streamflow at which passage can be expected will need to be determined from field observations.

3.3.1.1 Project Background

The conceptual plan for the fish passage project as presented in the approved grant proposal for the *Enhancement of Instream Habitat in Hilton Creek* (COMB 1998) and the *Public Review Draft Santa Ynez River Fish Management Plan* (SYRTAC 1999) involves the construction of five cast-in-place concrete weirs and the emplacement of approximately ten boulders. This plan was developed based on qualitative field observations and has been modified based on further studies conducted in 1999.

In February 1999, the tentative improvement locations were selected based on water marks and channel geometry, and a hand level was used to estimate differential elevation and estimated backwater effects of the proposed structures. Using this information, a more detailed assessment was conducted between July-September of 1999, which involved surveying streambed profiles and cross-sections. A preliminary design was developed using the streambed profile and cross-section information, and this design was modified based on stage-discharge relationship data (at 3 cfs) collected in December 1999 and field observations made during a "ground-truthing" assessment. The preliminary design was presented to the Hilton Creek Work Group for review in February 2000, and the design was revised based on comments from the group members and observations made during the winter of 2000.

The final fish passage project design presented, incorporates the following considerations: ability to pass fish, constructability, site impacts, effects on flood stage, ability to pass sediment and debris, and overall stability of the structures and adjacent stream banks.

3.3.1.2 Project Design

The objective of the fish passage project is to improve fish passage through the existing migration impediment, which consists of a near-vertical 6-foot cascade and an approximately 140-foot long, confined bedrock chute situated immediately upstream of the cascade. The fish passage project design focuses on reducing the effective height of the cascade by modifying the streambed immediately upstream of the top of the cascade to create a resting pool and constructing a channel obstruction at the downstream control of the plunge pool to increase water depth in the pool. The high-flow velocities in the bedrock chute area will be addressed by constructing two large channel obstructions (or roughness elements) and five boulder-sized elements which will significantly reduce flow velocities and increase water depth in this area. The proposed project design element locations are presented in Figure 3-3, and detailed design drawings are provided in the memos entitled *Hilton Creek-Revised Fish Passage Project Design* dated May 3, 2000 and the *Hilton Creek-Design of Fish Passage Improvement Structures* dated May 26, 2000 (SYRTAC 2000c and 2000d).

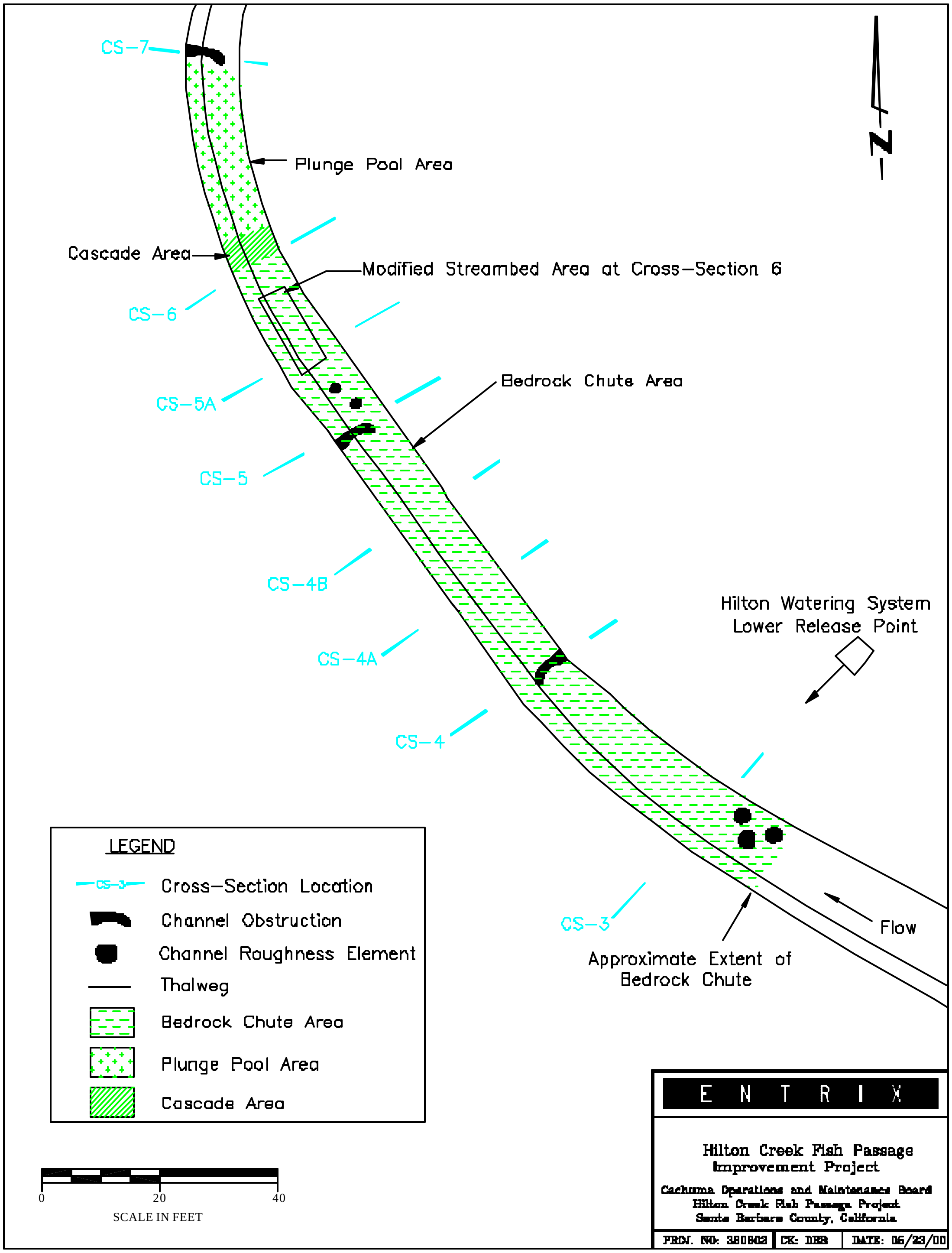

Figure 3-3 **Conceptual Diagram of Fish Passage Enhancement to the Cascade/ Chute Impediment in Hilton Creek**

Improved passage over the cascade will be achieved by modifying the streambed immediately upstream of the top of the cascade to create a pool in which the fish can rest and reducing the effective height of the cascade by constructing a channel obstruction at the downstream control of the plunge pool below the cascade. The revised design proposes to lower the thalweg 1 foot over a distance of approximately 15 feet upstream of the top of the cascade. The purpose of the lowered thalweg elevation is to create a pool at the top of the cascade while not increasing the height of the cascade. In order to prevent erosion of the downstream control of the pool, a cast-in-place concrete plug will be placed at the downstream edge of the pool. The proposed channel obstruction at the downstream control of the plunge pool will reduce the low-flow channel conveyance area by approximately 70% and the high water conveyance area by approximately 50%. Backwater effects from this roughness element will increase the water surface elevations up to 3 feet in the plunge pool for streamflows between 10 and 50 cfs. In general, the proposed improvements are anticipated to reduce the effective height of the cascade from 6 feet to 3 feet at streamflows above 20 cfs.

The proposed roughness elements within the bedrock chute will reduce the low-flow conveyance area of the channel from 67% to 90% and the high-flow conveyance area of the channel between 18% and 24%. The elements will also reduce flow velocities, increase surface water elevations, and provide areas of rest for the migrating steelhead. Additionally, the roughness elements will increase the thalweg elevations which will decrease the stream gradient and reduce flow velocities upstream of the structure.

The channel obstructions (or roughness elements) will consist of cast-in-place concrete structures securely anchored to the exposed bedrock channel, and will be constructed to resemble an exposed bedrock protrusion into the stream channel. The design of the roughness elements is specific to each proposed structure location. The roughness elements will be secured using re-enforcing steel rods which will be anchored into the

bedrock channel. Cast-in-place concrete is being proposed instead of natural rock boulders due to easier constructability, superior anchoring, greater control over size and shape, and lower installation cost. The final design was developed in consultation with fish passage experts from CDFG and NMFS and is consistent with the *CDFG California Stream Habitat Restoration Manual* and the requirements of the Endangered Species Act. Highway 154 Culvert

The Highway 154 Culvert is located approximately 4,000 feet upstream of the confluence of Hilton Creek with the Santa Ynez River. The culvert presents a physical barrier to migration due to the height of the outlet drop and a velocity barrier, since the smooth concrete lining of the culvert does not provide any velocity shadows at high flows, and sheet flow occurs under low-flow conditions. The fish passage modification project through the cascade and bedrock chute will improve access to stream habitat up to the Highway 154 Culvert. The objective of this project is to provide access to habitat upstream of the culvert.

SYRTAC working group members attended a field trip to the culvert where design considerations were presented and reviewed in detail. The proposed initial project design is being prepared by the engineers from the U.S. Fish and Wildlife Service (USFWS) and consists of constructing baffles in the culvert and a flow control structure downstream of the culvert outlet. The baffles are being designed to reduce flow velocities, provide velocity shadows, and create resting pools within the culvert at flows between 10 and 50 cfs. The purpose of the downstream flow control structure is to create a backwater effect which will reduce the height of the outlet drop. The project may also include the removal of debris at the upstream inlet of the culvert which may present an impediment.

The USFWS is preparing the project designs in consultation with CalTrans since the project would be constructed within the CalTrans easement which is approximately 35 to 40 feet on either side of Highway 154. Ongoing discussions with CalTrans, USFWS, CDFG, NMFS, and SYRTAC and/or Adaptive Management Committee scientists will determine the final project design.

3.4 RIPARIAN ENHANCEMENT

The objective of this project is to enhance riparian habitat along a 300-foot section above the cascade and bedrock chute, approximately 1,700 feet upstream from the confluence. This area consists of a broad flood plain which is fairly depauperate of riparian vegetation, and the streambed consists of cobble and gravel substrate. The riparian enhancement project would significantly improve the habitat along this section by providing a good canopy for protection and stabilizing the streambanks. It is likely that riparian growth in this reach will occur when the channel is watered by releases through the upper Hilton Creek release point and therefore a specific restoration effort may not be necessary. The Hilton Creek Work Group recommends that the riparian restoration effort not be implemented until the effect of watering this section of the creek on the riparian vegetation is known. The Adaptive Management Committee will be responsible for monitoring this section of Hilton Creek and making additional recommendations as necessary.

3.5 FISH RESCUE PLAN

While the supplemental water supply system will provide flow to Hilton Creek in most years, it may not be feasible to provide streamflow during the summer and fall in dry or critically dry years when the lake level falls to near 665 feet. Under natural conditions, over-summering fish are restricted to isolated pools as flows decline and are vulnerable to predation (by both fish and birds), desiccation, and exposure to elevated water temperatures. Therefore, in those years that supplemental streamflow cannot be provided, a fish rescue program may be implemented to move fish residing in Hilton Creek to more suitable habitat. In addition, should the Hilton Creek supplemental watering system fail and fish be at risk for stranding, a fish rescue would likely also be initiated. The decision to proceed with a fish rescue will be made in consultation with NMFS and CDFG.

Fish rescue operations have been successfully conducted in Hilton Creek in 1995 and 1998. In June 1998, approximately 831 young-of-the-year rainbow trout/steelhead and three adults were successfully moved from Hilton Creek to the mainstem Santa Ynez River above the Long Pool (676 fish) and San Miguelito Creek (153 young-of-the-year). During 1998, specific protocols were developed for determining when fish rescue operations would be initiated. These protocols include the Hilton Creek Fish Rescue Plan (Reclamation 1998) and the recommendations of the August 9, 1998 Hilton Creek Fish Rescue Assessment Report (Reclamation 1998b). Reporting requirements have also been established by NMFS that include (1) a specific description of the removal/relocation activities performed, (2) the number of steelhead removed from the project area and the number transferred to each relocation site, (3) the number of steelhead killed or injured during the removal/relocation, (4) a description of any problems encountered during the project or when implementing special conditions, (5) any effect of the project on steelhead that was not previously considered (NMFS 1998). These protocols may not be appropriate for all years, but 1998 provided a template for future coordination and cooperation between the Adaptive Management Committee, CDFG, NMFS, Reclamation, and USFWS. Future modifications must be approved by NMFS and documented in writing.

Hydrologic analysis indicates that a fish rescue operation would be necessary in approximately 2% (drought years) of all water years. During most of these years, it is likely that the river mouth would not open during the winter, thus, eliminating the potential for anadromous steelhead spawning in Hilton Creek. However, resident rainbow trout may still spawn, and juvenile steelhead from the previous year may still reside in the stream if winter flows do not cue them to emigrate.

The fish rescue plan for Hilton Creek is composed of two parts: (1) monitoring to determine when a fish rescue should be initiated, and (2) the capture and transfer of fish. These operations are described below.

3.5.1 MONITORING

Monitoring of flow levels and water temperatures within Hilton Creek will provide the primary information on when a fish rescue operation should be implemented. If flows are diminishing, or if water temperature is approaching stressful levels, then the project biologist will consult with the Adaptive Management Committee, CDFG, NMFS, Reclamation, and USFWS to decide if a fish rescue should be implemented. Once the need for a fish rescue has been identified, the creek will be monitored daily for signs of additional stress.

3.5.2 RESCUE AND RELOCATION

Fish rescue and predator control operations will be conducted as necessary in consultation with the Adaptive Management Committee, CDFG, NMFS, Reclamation, and USFWS. Fish rescue operations could also be conducted in other stream reaches in which conditions are threatening to rainbow trout/steelhead survival. Fish rescue operations in other areas will be conducted as necessary, based on the landowner's permission and in consultation with the resource agencies.

The most critical issue for a successful fish rescue operation is the availability of a receiving site with suitable habitat. If a fish rescue operation is necessary, the project biologist will investigate likely relocation areas and determine if the conditions (adequate streamflow, temperature, etc.) are favorable to steelhead. Once a suitable relocation area is identified, a survey of fry/juvenile density will be conducted to determine the availability of space for additional fish. Potential relocation sites include the Long Pool, portions of the mainstem, and several tributary reaches below Bradbury Dam.

After identifying an appropriate receiving site, the fish rescue will proceed using protocols similar to those used in 1998 in consultation with the Adaptive Management Committee, CDFG, NMFS, Reclamation, and USFWS. The fish rescue operations will be planned to commence in the morning to coincide with cooler water temperatures and will cease when water temperatures exceed 18°C. The operation will utilize seines and nets, and the fish will be placed in cool, well-aerated water. The temperature of the transport water will be adjusted to coincide with the receiving area water before release. If electrofishing is determined by the inter-agency discussions to be necessary, then the NMFS electrofishing policy will be adhered to.

To reduce the potential loss of relocated young-of-the-year rainbow trout/steelhead to predation, warmwater fish (largemouth, bass, smallmouth bass, and bullheads) may be removed from the receiving site if they are abundant. The warmwater fish can increase the mortality rates of young rainbow trout/steelhead both directly through predation, and indirectly by forcing young fish to occupy less suitable areas, which can impact growth rates, fitness, and exposure to other predators. Predator removal could also temporarily provide localized benefits to native fish in the mainstem pools, but over time these benefits would be reduced by recolonization from other areas (other stream reaches and/or Lake Cachuma). Predator removal would be most valuable as refuge pools become isolated during the summer.

Predators will be selectively removed from key pools using physical capture methods such as fyke nets (also called box traps) in larger pools and runs and seines in smaller pools. Captured native species will be returned to the stream and captured non-native species will be released in Lake Cachuma. The operations will be conducted under the supervision of a qualified fishery biologist. Predator removal activities have the potential to stress rainbow trout/ steelhead residing in the pool during the process. Steps to minimize the impact to these fish have been outlined in the Cachuma Project Biological Opinion (NMFS 2000) and are repeated from that document verbatim below:

> "A. Site inspections shall be performed prior to removal activities for the purpose of identifying the presence of endangered steelhead within the relocation area. Instream areas found to harbor steelhead shall be avoided during predator removal activities. Removal timing and techniques, and point of egress and ingress shall be modified to either avoid or minimize take of steelhead.
>
> B. A fisheries biologist with training and expertise in steelhead biology shall supervise pre-action, removal, and post-removal surveys. The biologist shall be empowered to

halt those activities that may adversely affect steelhead, and recommend and implement avoidance measures.

C. The fishery biologist shall conduct a brief training session for all project personnel who are not fishery biologists familiar with steelhead before the action is implemented. The training session shall include a description of the steelhead and its habitat, general provisions and protections provided by the ESA, and the terms and conditions of this incidental take statement that will be implemented to minimize injury and mortality of steelhead.

D. Reclamation's fisheries biologist shall contact NMFS fisheries biologist Darren Brumback (562-980-4026) immediately if one or more steelhead are found dead or injured. If Darren Brumback is unavailable Reclamation shall immediately contact NMFS Protected Resources Division at 562-980-4020. If no one at Protected Resources is available, Reclamation shall immediately contact NMFS's Office of Law Enforcement at 562-980-4050. The purpose of the contact shall be to review the activities resulting in take and to determine if additional protective measures are required. Reclamation will need to supply the following information initially: The location of the carcass or injured specimen, the apparent or known cause of injury or death, and any information available regarding when the injury or death likely occurred.

E. Any steelhead captured, collected, or trapped shall be revived, if necessary, and immediately released without delay to either the capture location or a more suitable instream location. No steelhead body length or mass data shall be measured.

F. Reclamation shall provide a written report to the NMFS within 4 weeks following completion of the proposed action. One report shall be submitted to the NMFS for each year that the project action is implemented. The report shall include the number of steelhead observed, handled (captured, collected, trapped), killed and injured during the proposed action; the estimated size of individual steelhead observed, handled, injured, or killed; a map delineating the location(s) where steelhead were observed or handled; a description of any problem encountered during the project or when implementing terms and conditions; and, any effect of the proposed action on steelhead that was not previously considered."

The objective of the actions proposed in this report is to enhance steelhead utilization of Hilton Creek by removing impediments to upstream migration and improving spawning and rearing habitat. The benefits of the enhancement measures to steelhead and other species are discussed below.

4.1 BENEFITS TO STEELHEAD

The enhancement measures included in Hilton Creek would benefit steelhead in several ways. The supplemental watering system would increase the availability of rearing habitat during the summer-fall dry season. The proposed channel extension would utilize the supplemental watering system to create additional rearing habitat, and the fish passage improvement projects will allow steelhead access to upstream spawning and rearing habitat. A summary of the benefits is presented in Table 4-1.

The supplemental watering system combined with natural runoff will provide perennial instream flows which would directly benefit steelhead by improving the availability and quality of juvenile rearing habitat, particularly during late spring, summer, and fall. At the time of this report, this system is successfully being used to support approximately 450 young-of-the-year below the cascade. The supplemental watering system provides perennial flow to 2,980 feet of habitat below the upper release point and 1,380 feet of habitat below the lower release point. The supplemental water also benefits the habitat of additional fisheries in the lower Santa Ynez River downstream of Hilton Creek.

The proposed channel extension project would enhance the benefits of the supplemental water supply by creating approximately 1,215 feet of additional steelhead rearing habitat in Hilton Creek. Channel modifications in other river systems have resulted in highly variable success, depending on the design features and operation of the system. Therefore, further studies are required to determine the feasibility of this project in relation to such factors as seepage loss, water temperature, stream gradient, and predation.

The Hilton Creek fish passage improvement projects will improve fish passage through two identified migration impediments so that the steelhead can utilize upstream spawning and rearing habitat. The migration impediments consist of (1) a steep 6-foot cascade and 140-foot long confined bedrock chute located approximately 1,380 feet upstream of the confluence with the mainstem and (2) the Highway 154 Culvert. Providing passage through the cascade and bedrock chute will allow access to approximately 2,980 feet of stream channel up to the culvert at the Highway 154 Crossing, and providing access through the culvert will give access to several miles of upstream habitat.

Table 4-1 Amount of Habitat and Steelhead Lifestages Affected by Hilton Creek Enhancement Project

Project Element	Steelhead Lifestage Affected	Benefit	Amount of Habitat Affected
Supplemental Watering System	Fry, rearing juveniles, and over-summering adults	Maintain streamflow to support habitat through spring, summer, and fall.	1,380 feet to lower release 2,980 feet to upper release
Fish Passage Facilities	Migrating and spawning adults	Enhance access to spawning and rearing habitat above chute pool	2,800 feet between chute pool and Highway 154 Culvert and the upper reaches of Hilton Creek (3+ miles)
Channel Extension	Fry, rearing juveniles, possibly spawning adults	Create additional stream habitat for summer rearing and possibly spawning by extending lower channel	1,215 feet

Based on the information collected to date, impacts associated with these enhancement measures will be limited to construction related effects. The Adaptive Management Committee will work with NMFS and CDFG during the design phase of each project to minimize construction related impacts. Sediment management techniques will be employed as necessary and construction will occur in a dry channel when possible (e.g. the cascade/chute project, the channel extension). In addition, a number of minimization measures have been identified by NMFS for reducing construction related impacts on steelhead. These measures are summarized in Appendix C (Section 4, Implementation) and will be implemented for each project.

In conclusion, the proposed enhancement measures would produce an overall net environmental benefit to steelhead in Hilton Creek based upon field observations of spawning and juvenile rearing within Hilton Creek and operational experience with the temporary water delivery system. The modifications to Hilton Creek would directly increase available juvenile rearing and possibly spawning habitat within the Santa Ynez River system. Using the number of fish rescued from lower Hilton Creek in June 1998 (831 young-of-the-year over approximately 1,200 linear feet), the proposed project has the potential to produce up to approximately 2,850 young-of-the-year when winter flows are good (approximately 850 fish for Hilton Creek below the passage impediment, 1,000 fish between the bedrock chute and upper release site, and up to 1,000 fish in the channel extension minus the lowermost 100 to 250 feet of the existing Hilton

Creek). As part of the implementation plan, a monitoring program will evaluate habitat use, spawning success, and juvenile rearing of steelhead within Hilton Creek. The monitoring results will be used to document the expansion of available habitat through the fish passage structure and channel extension, and the incremental contribution of thermal warming from Hilton Creek to habitat conditions in the lower Santa Ynez River.

4.2 OTHER SPECIES

Native fish, especially the prickly sculpin which currently inhabits Hilton Creek, will likely benefit from the proposed actions. The watering system will provide a perennial water supply to the creek, and the proposed channel extension will create an additional 1,215 feet of predator-free habitat that will benefit sculpin. Construction of passage structures at the cascade/chute and Highway 154 Culvert are not likely to affect fish as construction will occur while the channel is dry, and because these fish will not migrate through the cascade/chute structure. Fish rescue activities may negatively affect fish present in Hilton Creek; however, measures taken to minimize the impact to steelhead should also minimize impacts on sculpin inhabiting the lower reach.

While many other sensitive species occur in the Santa Ynez River watershed, only the two-striped garter snake has been reported in the vicinity of Hilton Creek (Woodward-Clyde Consultants 1995, Reclamation 1998b). The snake has been observed immediately downstream of Bradbury Dam near the mouth of Hilton Creek. The proposed actions should benefit the snake by increasing the fish (prey) population in the stream and enhancing the riparian corridor along the creek.

Although red-legged frogs, southwestern willow flycatchers, and western pond turtles are not currently found in Hilton Creek, the proposed enhancement measures would create habitat which is more conducive for these species. The supplemental watering system would benefit the California red-legged frog, which requires perennial water, and the flycatcher and the pond turtle, which require water during the spring and fall. The watering system may also, however, provide habitat for bullfrogs which prey on red-legged frogs, so net benefits to this species are unknown.

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UPPER BASIN ACTIONS FOR THE PROTECTION AND ENHANCEMENT OF SOUTHERN STEELHEAD IN THE SANTA YNEZ RIVER

Appendix E

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

UPPER BASIN WORK GROUP

October 2, 2000

Page

List of Figures ..... E-iv

1.0 Introduction E-1-1

1.1 Introduction E-1-1

1.2 Rainbow Trout/Steelhead Life History E-1-2

1.3 Enhancement Opportunities E-1-2

2.0 Rainbow Trout/Steelhead in the Santa Ynez River Upper Basin E-2-1

2.1 Historic Use of the Upper Basin E-2-1

2.2 Current Conditions E-2-4

3.0 Genetic Protection E-3-1

3.1 Background E-3-1

3.1.1 Genetics of Steelhead and Rainbow Trout in Santa Ynez River Basin E-3-1

3.1.2 Proposed Action E-3-3

3.2 Establishment of a Southern Steelhead Hatchery E-3-3

3.2.1 Broodstock Development E-3-3

3.2.2 Hatchery Facilities E-3-4

3.2.2.1 Existing Hatchery Facilities E-3-4

3.2.2.2 Construction of a New Hatchery Facility E-3-5

3.2.3 Additional Information and Monitoring E-3-5

3.2.4 Evaluation E-3-6

3.2.4.1 Technical Feasibility E-3-6

3.2.4.2 Biological Concerns E-3-6

3.2.4.3 Institutional Concerns E-3-7
3.2.5 Conclusions E-3-7
3.3 Stocking Sterile Trout E-3-8
3.3.1 Evaluation E-3-9
3.3.1.1 Technical Feasibility E-3-9
3.3.1.2 Biological Concerns E-3-9
3.3.1.3 Institutional Concerns E-3-9
3.3.2 Conclusion and Recommendations E-3-9
3.4 Summary of Genetic Protection E-3-10
4.0 Fish Passage around Bradbury Dam E-4-1
4.1 Background E-4-1
4.2 Ladder at Bradbury Dam E-4-1
4.2.1 Proposed Action E-4-1
4.2.2 Technical Feasibility E-4-2
4.3 Fish Ladder from Hilton Creek to Lake Cachuma E-4-2
4.3.1 Proposed Action E-4-2
4.3.2 Technical Feasibility E-4-2
4.3.3 Biological Concerns E-4-3
4.3.4 Institutional Concerns E-4-3
4.4 Bio-Engineered Fish Passage Channel E-4-3
4.4.1 Proposed Action E-4-3
4.4.2 Technical Feasibility E-4-4
4.5 Trap-and-Truck Transport of Adult Steelhead E-4-4
4.5.1 Proposed Action E-4-4

4.5.2 Technical Feasibility E-4-5
4.5.3 Biological Concerns E-4-5
4.5.4 Institutional Concerns E-4-6
4.6 Conclusions and Recommendations E-4-6
5.0 Smolt Production Enhancement E-5-1
5.1 Background E-5-1
5.2 Proposed Action E-5-1
5.3 Evaluation E-5-2
5.3.1 Technical Feasibility E-5-2
5.3.2 Biological Concerns E-5-3
5.3.3 Institutional Concerns E-5-3
5.4 Conclusions and Recommendations E-5-4
6.0 Literature Cited E-6-1
7.0 Personal Communications E-7-1

Page

Figure 2-1. Upper Santa Ynez River above Bradbury Dam....................................... E-2-2

1.1 INTRODUCTION

The Santa Ynez River Fisheries Technical Advisory Committee (SYRTAC) was formed in 1993 to:

1. investigate steelhead and rainbow trout use of the Santa Ynez River,
2. identify actions that could benefit steelhead and rainbow trout within the drainage, and
3. develop plans to implement those actions that have a high potential for promoting the recovery of steelhead populations from their low current levels.

Various management actions to benefit steelhead were developed through a consensus-based process including local, state and federal agencies, environmental groups, landowners and other interested parties. Among these actions were several measures that would allow steelhead to access the area above Bradbury Dam (the upper basin). Before the construction of Bradbury Dam (completed in 1953), this area provided most of the suitable spawning and rearing habitat in the Santa Ynez River basin. These actions were identified in recognition that opportunities to provide mainstem habitat below Bradbury Dam were limited because of rapid warming of water released from the dam and the high percolation rate of water into the groundwater basins.

Through this process, various actions in the Santa Ynez River upstream of the Bradbury Dam have been identified that may benefit rainbow trout/steelhead populations throughout the basin. These actions were first described in the 1998 Management Alternatives Plan (SYRTAC 1998). In order to evaluate actions that could potentially benefit steelhead populations in the basin, the SYRTAC created the Upper Basin Work Group.

The Upper Basin Work Group was responsible for assessing the benefits, impacts and feasibility of potential actions that could be taken in the portion of the Santa Ynez River above Bradbury Dam (upper basin) to enhance steelhead populations within the basin. Bradbury Dam is currently the lowermost impassable barrier to steelhead migration on the Santa Ynez River. The objective of the technical appendix is to evaluate the potential actions being considered for the upper basin and decide whether these actions should be pursued further. Two aspects were considered to be of primary importance in evaluating these alternatives: (1) the probability that the action would result in benefit to the steelhead population, and (2) the technical and institutional feasibility of the action. Only those actions technically and institutionally feasible and which have a high likelihood of successfully benefiting the rainbow trout/steelhead population have been included in the Management Plan.

1.2 RAINBOW TROUT/STEELHEAD LIFE HISTORY

Coastal rainbow trout exhibit two distinctive life history strategies: freshwater residency or anadromy. Resident rainbow trout live their entire lives in freshwater. Anadromous steelhead are born in freshwater, emigrate to the ocean as smolts to rear to maturity, and then return to freshwater to spawn. It is common to find populations exhibiting both life history strategies within the same river system. As members of the same species, they can interbreed within a given aquatic system and form a single cohesive population. Some mature resident rainbow trout have been documented downstream of impediments (Shapovalov and Taft 1954) and some proportion of the offspring of resident populations may exhibit the anadromous life history. Individuals exhibiting one life history strategy can produce offspring that exhibit the other strategy (J. Nielsen, pers. comm., 1998a). Due to the extreme environmental cycles of Southern California, it is common for one life history strategy or the other within a population to have poor success or be extirpated periodically. This life history pattern can potentially be restored by the progeny of the other life history pattern. The Southern California steelhead may have adapted to the unpredictable climate by being able to remain landlocked for many years or generations before returning to the ocean when flow conditions allow (Titus *et al*., 1994).

In many historical steelhead streams, passage barriers have blocked migration to and from upper stream reaches and resulted in residualization of steelhead populations, forcing them to adopt a resident life history strategy (resident rainbow trout). On the Santa Ynez River, there are natural and man-made impediments (*e.g*,. dams and road crossings) to upstream migration that separate populations of steelhead and resident rainbow trout. In addition, impediments exist upstream of habitat accessible to steelhead trout which separate the populations of resident rainbow trout (*i.e.*, Gibraltar Dam and Juncal Dam).

1.3 ENHANCEMENT OPPORTUNITIES

The Upper Basin Work Group evaluated three actions for the upper basin that could benefit the anadromous steelhead population. These actions are:

1. ***Genetic Protection*** – The rainbow trout planted to support the put-and-take fishery in Lake Cachuma and below Gibraltar Dam are derived from non-native stocks. These stocks evolved under different environmental conditions than those present in Southern California, and thus are likely less adapted to survive the extreme environment. While most of these fish are caught by fishermen, some fish survive and may be washed over the dam in spill years. These fish may then interbreed with native stocks and thereby reduce the fitness of the resulting progeny in the Santa Ynez River. The Work Group evaluated opportunities to prevent the introgression of non-native stocks into the native steelhead population, while protecting the recreational fishery in Lake Cachuma and below Gibraltar Dam.

2. ***Increase Habitat Availability*** – Prior to the construction of Bradbury Dam, the tributaries upstream of Bradbury Dam provided the majority of the quality spawning and

rearing habitat for steelhead. The upper basin tributaries historically maintained perennial flow and cooler water temperatures than areas in the lower basin. The Work Group evaluated opportunities to provide steelhead access to historical habitat above the dam.

3. ***Increased Smolt Production*** – Since the division of the basin as a result of dam construction, the only successful life history form upstream of Bradbury Dam has been resident rainbow trout. However, a portion of the progeny of the upper basin resident rainbow trout exhibit anadromous tendencies. The Upper Basin Work Group evaluated the feasibility of trapping juveniles migrating downstream (smolt) above the dam and transporting those juveniles by truck downstream of the dam to increase the number of smolt reaching the ocean.

This appendix provides a complete discussion and evaluation of these actions. Section 2 provides background on the historic usage of the upper basin by steelhead and rainbow trout prior to the development of the watershed as well as the current status of habitat and stocking practices within the upper basin. Section 3 describes and evaluates the genetic protection measures considered. Section 4 covers measures to provide steelhead access to areas above Bradbury Dam. Section 5 describes how juveniles produced by the resident rainbow trout population in the upper basin might be used to supplement the endangered steelhead stocks in the lower basin.

The upper basin is defined as the portion of the Santa Ynez River watershed upstream of Bradbury Dam (Figure 2-1). Currently, the upper basin of the Santa Ynez River is divided into three isolated sub-basins by three dams. Gibraltar Dam was completed in 1920, Juncal Dam was completed in 1930, and Bradbury Dam was completed in 1953. The three sub-basins are:

1. ***Lower sub-basin*** **–** Mainstem Santa Ynez River from Bradbury Dam to Gibraltar Dam, including Lake Cachuma. Some of the major tributaries include Cachuma, Santa Cruz, Oso, Tequepis, Los Laureles and Devil's Canyon creeks.

2. ***Middle sub-basin*** **–** Mainstem Santa Ynez River from Gibraltar Dam (including the reservoir) to Juncal Dam. The major tributaries include Blue Canyon, Mono, Indian, Gidney, Camuesa, Agua Caliente Canyon, Fox and Alder creeks.

3. ***Upper sub-basin*** **–** Mainstem Santa Ynez River from Juncal Dam eastward into the headwaters of the Santa Ynez River. The major tributaries include Juncal, and North Fork Juncal creeks.

In order to evaluate the management alternatives, it is necessary to understand (1) the historic use of the upper basin by anadromous steelhead, and (2) the current conditions in the upper basin. This section provides an overview of these issues.

2.1 HISTORIC USE OF THE UPPER BASIN

The Santa Ynez River is typical of many Southern California streams in that streamflow in the lower reaches often declines to zero during summer and fall months. During the summer and fall when both streamflow and wave energy are low, a sandbar forms across the mouth of the river. This bar prevents adult steelhead from entering the river until high flows associated with winter storms and winter wave energy are sufficient to breach the sandbar. During dry years, streamflows sufficient to breach the bar and allow access into the river are of relatively short duration (possibly only one to two weeks in duration). During exceptionally dry years, streamflow may never be sufficient to breach the bar and thus, adult steelhead are prevented from migrating up and spawning in the Santa Ynez River (Lantis 1967).

Once adult steelhead were able to enter the river, they migrated to the area upstream of Solvang and particularly to the tributaries to spawn (Shapavolov 1944). Access to the tributaries above the current location of Gibraltar Dam was blocked by the construction

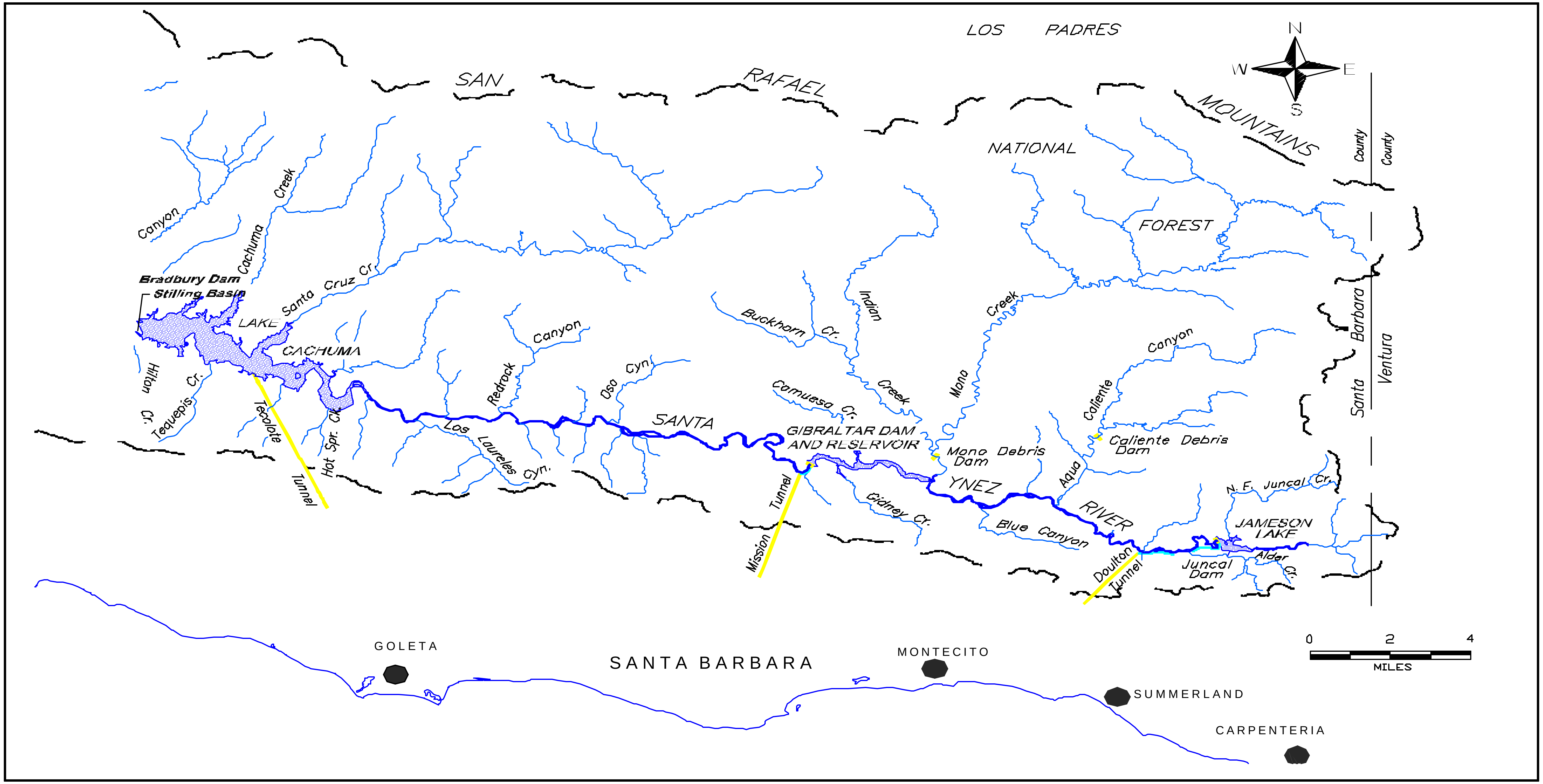

Figure 2-1. Upper Santa Ynez River Above Bradbury Dam.

of that facility in 1920. The completion of Bradbury Dam in 1953 blocked access to much of the remaining historic habitat.

Prior to the development of these projects, the upper basin provided spawning, summer rearing, and over-wintering habitat as many of the upper tributaries have perennial flow. However, during years of high rainfall, suitable habitat extended into the lower portion of the basin. California Department of Fish and Game (CDFG) documents from the 1940's (prior to construction of Bradbury Dam) confirm that migration and spawning in the Santa Ynez River were highly dependent upon rainfall (ENTRIX 1995a). The upper basin is believed to have historically contained at least 60% of the spawning and rearing habitat in the Santa Ynez River (Chubb 1997).

During the winter of 1943 to 1944, Shapovalov (1944) reported that steelhead were spawning in "practically all accessible tributaries below Gibraltar Dam." Spawning tributaries mentioned included Alisal, Santa Cota, Cachuma, Tequepis Canyon, and Santa Cruz creeks. In 1946, Shapovalov (1946) observed that flows in the tributaries were insufficient to allow migration of steelhead, even though a rainstorm had increased the flows in the mainstem Santa Ynez River to the point where they were "quite favorable" for steelhead migration and spawning. This situation may have been common, as the upper basin receives substantially more rainfall than the lower basin.

Based on review of the records prior to 1946, Chubb (1997) concluded that the best historical spawning habitat was concentrated in the mid- to upper-third of the Santa Ynez basin. After the completion of Gibraltar Dam, the best mainstem spawning habitat extended from the Solvang area up to Oso Creek (Shapovalov 1946). Cachuma and Santa Cruz creeks were noted as significant spawning tributaries. Steelhead populations began to decline in the 1940's, subsequent to the construction of Gibraltar and Juncal dams, but prior to the construction of Bradbury Dam.

Shapovalov (1944) identified Indian and Alamar creeks as historical steelhead spawning areas until the construction of Gibraltar Dam blocked access to these creeks in the 1920's. Subsequent to the construction of Gibraltar Dam, landlocked salmon (rainbow trout) living in Gibraltar Reservoir were reported to spawn in Gidney Creek, the mainstem Santa Ynez River above the reservoir, and Mono Creek below Mono Debris Dam (Shapovalov 1944).

Since the construction of Bradbury Dam, anadromous steelhead have been prevented from migrating upstream into the upper basin. Soon after the construction of Bradbury Dam, a "landlocked" run of steelhead continued to run up and out of the Cachuma Reservoir, utilizing the lower reaches of Cachuma Creek to spawn. Due to concerns with poaching and predators on Cachuma Creek, a fish impediment apparently was constructed at the outlet (Chubb 1997). This population of landlocked rainbow trout/steelhead are believed to be the ancestors of the current resident rainbow trout population. These resident rainbow trout have similar spawning and rearing habitat requirements as that of the anadromous steelhead. Consequently, the resident trout migrate from the reservoirs upstream into the Santa Ynez and its tributaries to spawn in the habitat historically used by the steelhead.

The resident rainbow trout population has been "augmented" with the planting of non-native rainbow trout. Stocking non-native rainbow trout into the Santa Ynez River and its tributary streams has taken place since at least the 1930's. While native stock may persist in some areas (*e.g.*, above Juncal Dam), CDFG has planted a variety of different strains including Whitney, Coleman, Hot Creek, Whitney and Kamloop crosses and Hot Creek-Wyoming throughout the basin above Bradbury Dam (Adams, CDFG Fillmore Hatchery, pers. comm.). Stocking above Gibraltar Dam was discontinued at least twenty years ago as was the stocking of Cachuma Creek. Additionally, Santa Cruz and Coche creeks have not been stocked in over ten years. Since approximately 1980, stocking has been primarily confined to Lake Cachuma and the mainstem below Gibraltar Dam (near the Los Prietos Ranger District Office) (Adams, 1999, CDFG Fillmore Hatchery, pers. comm.).

2.2 CURRENT CONDITIONS

Each of the three dams in the upper basin prevents upstream migration. Downstream migration can occur only during years when the reservoirs spill. This results in an unknown amount of gene-flow in a downstream direction. As a result of these impediments, native rainbow trout populations above Gibraltar Dam are less affected by introgression with stocked rainbow trout, as most stocking has occurred below Gibraltar Dam. The resident rainbow trout in these sub-basins use habitat in the same way as steelhead did historically. Some fish remain stream resident throughout their life, while other fish likely migrate downstream into the reservoirs and rear to adulthood there. These lake adults then return to the tributary streams to spawn.

Many of the tributary streams have passage impediments (natural and man-made) which prevent these resident fish from reaching suitable habitat in some areas. These impediments, in addition to the major dams on the mainstem, reduce gene flow among the various sub-populations. Some of these impediments, like the Mono debris dam, prevent lake fish from reaching much of the suitable habitat on the tributary streams, and may limit the amount of suitable spawning and rearing available to lake resident fish.

Stocking to supplement resident rainbow trout populations began in the 1930's and continues today. Today the majority of stocking occurs between Bradbury and Gibraltar dams. Currently, Lake Cachuma is stocked with approximately 54,000 pounds of non-native trout between three to five fish per pound each year. Additionally, the section of mainstem Santa Ynez River between Lake Cachuma and the Gibraltar Dam is stocked with 8,000 pounds of trout similar in size to those used to stock Lake Cachuma (M. Haynie, CDFG, pers. comm.). This stocking supports a valuable put-and-take fishery managed by CDFG.

3.1 BACKGROUND

The rainbow trout fishery in Lake Cachuma and the mainstem below Gibraltar Dam are the predominant recreational fisheries for the citizens of Santa Barbara County. These areas provide fishing opportunities for bass, sunfish and catfish as well as trout. The rainbow trout fishery is supported by the stocking of rainbow trout. Current stocking practices include the release of rainbow trout derived from genetically northern stocks into the Santa Ynez River between Bradbury Dam and Gibraltar Dam. These rainbow trout currently come from two sources, neither of which is derived from southern stocks. CDFG annually supplies 31,000 pounds (three to five fish per pound) of fish from the Fillmore Hatchery each year. The County of Santa Barbara matches this volume with fish from the Mt. Lassen Hatchery, although in the past, fish from Idaho hatcheries were also released (A. Kvaas, Santa Barbara Co. Fish and Game Commission pers. comm.). These stocked fish have the potential to breed with the native trout in the basin. Genetic sampling indicates that a large proportion of the rainbow trout in Lake Cachuma have genetic patterns suggestive of a strong northern stock influence (ENTRIX 1995b).

While introgression resulting from stocking is primarily affecting the population above Bradbury Dam, the possibility of migration downstream exists during spill events and releases from the reservoir. Hatchery rainbow trout that end up downstream of the dam could potentially breed with native steelhead, resulting in genetic introgression within the protected population. It seems that the southern steelhead are better adapted to survival in the highly variable climate and flow conditions of Southern California streams (National Marine Fisheries Service [NMFS] 1996, Matthews 1996, Chubb pers. comm.). As a result, interbreeding of northern stocks with southern steelhead could result in a decrease in fitness of the resultant progeny, leading to a further decline in the population.

3.1.1 GENETICS OF STEELHEAD AND RAINBOW TROUT IN SANTA YNEZ RIVER BASIN

Genetic analyses have been conducted of rainbow trout and steelhead throughout the Santa Ynez basin (ENTRIX 1995b, Nielsen 1998). Dr. Jennifer Nielsen analyzed both mitochondrial DNA (mtDNA) and nuclear microsatellite DNA (microsatellites) using samples collected recently by the SYRTAC and earlier collections from the lower and upper basin, as well as those from other watersheds (Malibu Creek and Northern California). The following is a summary of the key points of Dr. Nielsen's report and a discussion of their relevance to management of Santa Ynez rainbow trout/steelhead. (Dr. Nielsen's report is provided in *Appendix F*).

MtDNA is DNA from the mitochondria, which is maternally-inherited and does not undergo recombination. Only one segment of this DNA strand (the d-loop) was examined. Ten different forms (haplotypes) of this segment have been found in Santa Ynez basin fish, the most common being mtDNA haplotypes 1, 3, 5, and 8. All four haplotypes can be found throughout the California coast, although haplotypes 1 and 3 are more common in northern populations and hatchery trout, and haplotypes 5 and 8 are more common in the south (Nielsen *et al.*, 1994). A wild-caught fish cannot be determined to be hatchery-derived simply by examination of the mtDNA. Haplotypes 1 and 3 do not necessarily indicate hatchery-derived fish in Southern California streams, although there is a higher probability that hatchery rainbow trout will possess this haplotype rather than haplotype 5 or 8.

Microsatellites are short repeated units of DNA from the nucleus (inherited from both male and female), which can be highly variable. Dr. Nielsen examined ten different microsatellite locations (ten loci). Microsatellite analysis is a more recently-developed tool, and one that is showing great promise. For example, recent microsatellite work by Dr. Nielsen (pers. comm., 1998b) has found that hatchery fish in Southern California are more similar to Central Valley stocks. Using these markers, Dr. Neilsen has also found high levels of genetic diversity in southern steelhead (Malibu Creek and Santa Ynez River) (J. Nielsen 1998 manuscript).

The mtDNA data from the Santa Ynez River indicated an upper and lower basin substructure, with the notable exception of Salsipuedes Creek which grouped with the upper basin fish populations (Figure 2 in Neilsen 1998, *Appendix F*). The lower basin mtDNA group included Hilton Creek, Alisal Creek (from above the small reservoir), Long Pool, and Cachuma Reservoir (mtDNA haplotypes 1 and 3 most common). The upper basin mtDNA group included Salsipuedes/El Jaro creeks, and upper basin creeks such as Alder, Fox, Franklin, and Devil's Canyon (mtDNA haplotypes 5 and 8 most common). Jameson Reservoir data showed close similarities and gene flow with these upper basin creeks.

The microsatellite data provided slightly different information from the mtDNA data (Figure 3 in Neilsen 1998, *Appendix F*). There were two main groupings of the Santa Ynez based on microsatellites. Alisal Creek, San Miguelito Creek (only one fish), and Devil's Creek (three fish) made up one group, while Hilton Creek, Salsipuedes Creek, the Long Pool, and Malibu Creek made up the other. It is interesting to note that the samples in the first group came from above passage impediments, while the samples from the other group came from streams with access to the ocean. All Santa Ynez and Malibu Creek samples were more similar to each other than samples from Whale Rock Reservoir (a hatchery near Morro Bay that is thought to be derived from steelhead landlocked in the reservoir) or Northern California coast steelhead. Our ability to draw further conclusions about basin population structure is limited due to the lack of microsatellite data from the upper basin (only three fish from Devil's Creek), and variable and small sample sizes in our samples. Small sample sizes are especially problematic for microsatellite data, since there is more variation to contend with (ten different loci that can vary, as opposed to one locus for mtDNA). Microsatellites have proven to be valuable markers that can make finer discriminations among steelhead when samples sizes are larger.

Additional data from the upper headwaters would be very helpful to determine if resident fish harbor relic gene pools that would be appropriate for supplementation of anadromous native

Santa Ynez stocks. Dr. Neilsen recommended more samples (sample sizes 30 to 40 per location), collected systematically to answer genetic questions, and coordination among the groups conducting genetic studies in the basin.

The results of these genetic studies indicate that native southern steelhead haplotypes persist in the Santa Ynez River basin. The mtDNA data suggests some sub-basin structure for above and below Bradbury Dam, although Salsipuedes/El Jaro fish grouped more closely with fish from the upper basin than with fish from other lower basin streams. Hilton Creek fish were similar to fish from the Long Pool and Lake Cachuma. Inferences based on the limited available microsatellite data suggest that fish from streams with ocean access may be more similar to each other than to fish above passage impediments (Neilsen *et al.*, 1997). It is worth noting that the microsatellite tree grouped Hilton Creek and Long Pool fish (which were predominantly mtDNA haplotypes 1 and 3) with Salsipuedes fish (which were predominantly mtDNA haplotypes 5 and 8) and Malibu Creek fish (other work has indicated that Malibu fish are dominated by mtDNA haplotypes 5, 8 and 4 [Nielsen *et al*. 1997]); all were more similar to each other than to northern steelhead. The similarity of the mtDNA between the upper basin fish and Salsipuedes fish suggests that these upper basin fish may be appropriate source stocks if stocking or trap-and-truck measures are considered for the lower basin, although additional microsatellite studies of upper basin rainbow trout are recommended to further investigate this.

3.1.2 PROPOSED ACTION

Two measures have been identified to offset the potential genetic effects of stocking northern rainbow trout in Lake Cachuma and the mainstem below Gibraltar Dam, while continuing the current recreational fishery. The first proposed action is to replace the northern-origin rainbow trout currently used for stocking in Lake Cachuma and any other upper basin localities with an equal quantity of rainbow trout with a genetic profile more typical of Southern California steelhead. The second action would be to replace the fish currently stocked with an equal quantity of sterile rainbow trout or a sterile brown trout-rainbow trout hybrid. The current stocking program contributes to a valuable recreational fishery, and one of the objectives of this action is to continue the fishery's current level of success. The objective of this option is to preserve the genetic integrity of the local steelhead and rainbow trout population by minimizing introgression by foreign stocks.

3.2 ESTABLISHMENT OF A SOUTHERN STEELHEAD HATCHERY

3.2.1 BROODSTOCK DEVELOPMENT

The Southern California rainbow trout/steelhead broodstock would be developed from trout collected in the upper basin above Gibraltar or Jameson reservoirs. Creation of a broodstock begins with identifying a population of rainbow trout with genetic profiles similar to Southern California steelhead. Within the Santa Ynez watershed, this can potentially be found in the populations above Gibraltar and Juncal Dam (mid and upper sub-basins). Genetic studies of fish from Jameson Reservoir and tributaries such as Fox, Alder, Franklin, Indian and Devil's Canyon creeks support this conclusion (reviewed in *Appendix III* of Nielsen 1998).

In order to be assured enough genetic material to begin the broodstock, eggs and sperm must be collected from at least 500 females and 500 males (M. Haynie, CDFG, pers. comm.). Typically, the adults are captured in tributaries as they are migrating upstream to spawn. They are either spawned immediately or kept in live pens on site for several days until they are ready to spawn. Once all the adults are spawned, they are released back into the tributaries.

Field investigations and/or review of existing data will be needed to determine which tributaries to target and the appropriate locations for trapping operations on these tributaries. The selected tributaries will need to contain a population of genetically desirable adults large enough to withstand the removal of genetic material from 1,000 individuals. These fish would likely need to be collected from more than a single location (S. Chubb, pers. comm.). Additionally, the tributaries must be accessible during the spawning season and suitable for the operation of traps and holding facilities for individuals.

Prior to collection of spawning material, a hatchery facility must be available for fertilizing eggs and rearing the fish (potential facilities are discussed in the next section). The hatchery would require an appropriate water supply, method of aeration, backup system and manpower. In addition, any water quality issues relating to hatchery wastewater will need to be negotiated with the Regional Water Quality Board, particularly if a new facility is constructed.

It is anticipated that it will take eight to ten years to establish a suitable broodstock. The resulting progeny would need to be raised to a size of between three to five fish per pound in order to meet the needs of the stocking program. In order to obtain fish of this size, it currently takes the domestic stocks seven to eight months of rearing. It may take as long as two years for a wild stock to reach this size at the hatchery, depending on how the new broodstock responds.

3.2.2 HATCHERY FACILITIES

3.2.2.1 Existing Hatchery Facilities

The Upper Basin Work Group explored the possibility of developing and maintaining a broodstock in one of the existing hatcheries, as discussed below.

- ***Fillmore Hatchery* –** The Fillmore Hatchery is currently supplying half of the fish used to stock the Santa Ynez River. It is currently a rearing facility and lacks the capabilities and capacity for the development and maintenance of a broodstock. In addition, its remaining capacity may be used by the Department of Water Resources for reservoir stocking programs. For this facility to be used, a water treatment system would have to be developed to provide water of suitable temperature and quality for spawning and rearing rainbow trout. Systems and protocols would have to be developed to maintain strict separation between fish derived from southern stocks and the northern stocks currently employed. The capacity of the Fillmore Hatchery would need to be increased to maintain the southern broodstock.

- ***Whitney Hatchery*** – The Whitney Hatchery is currently involved in the Golden Trout stocking program. The golden trout is also a listed species, so the Whitney hatchery has substantial experience in dealing with the issues of rearing a listed species. The Whitney golden trout program includes the development and maintenance of a wild golden trout broodstock. The broodstock is kept in five different ponds in Northern California rather than on site. The trout are captured and spawned annually in order to rear the stock. Use of the Whitney Hatchery, however, has several problems that make it unlikely that it could be used for the proposed program. First, it has an ongoing problem with whirling disease, which is difficult to eradicate and could endanger the existing steelhead and rainbow trout populations in the Santa Ynez River if infected fish were released. Second, Whitney Hatchery is located in the Owens River basin, which has a substantially different climate than the Santa Ynez River. The difference in climate would likely result in different selective pressures. Over time, the fish reared there would become more adapted to the conditions and climate of the hatchery rather than of the Santa Ynez River, which would not meet the program objectives.

- ***Several other hatcheries*** were discussed, including Whale Rock, Hot Creek, Shasta-Pit and Lassen. These facilities seemed unlikely to serve the purposes of the *Santa Ynez River Fish Management Plan*. In most cases, the problems of hatchery size, climate and distance from the river seemed too great to warrant further investigation.

3.2.2.2 Construction of a New Hatchery Facility

Due to the difficulties associated with using an existing hatchery, it is likely that the construction of a new hatchery facility would be required to pursue this action. Ideally, a southern steelhead hatchery would be developed within the ESU to best emulate the environmental conditions of the Santa Ynez basin. A new facility would require a substantial investment to design and construct. The location of such a facility would require a water source with appropriate temperature, quality and reliability for spawning rainbow trout and rearing them to release size. Additional issues will involve obtaining the appropriate permits for the construction of such a facility and the resulting water discharge of its operation.

3.2.3 Additional Information and Monitoring

Several monitoring programs should be conducted to determine the success of the program. These include:

- population surveys of rainbow trout populations in the upper basin to determine appropriate locations where broodstock might be obtained;
- genetic monitoring of the fish used for stocking in order to maintain a genetic profile similar to Southern California rainbow trout/steelhead;

- creel surveys to determine if the fish are returning to the creel; and
- genetic monitoring of the fish within Lake Cachuma to determine whether there is a beneficial genetic shift.

3.2.4 Evaluation

3.2.4.1 Technical Feasibility

The development and maintenance of a broodstock from Santa Ynez resident rainbow trout is, apparently, technically feasible. Based on the review of existing information, populations above Gibraltar and Juncal dams can likely provide 1,000 spawners without serious adverse affects on the resident population (S. Chubb, U.S. Forest Service [USFS], pers. comm.). However, it would be difficult to get the number of fish needed from a single tributary. A review of the existing hatcheries indicates that they have significant problems which would likely prevent their use. Therefore, it will probably be necessary to build a new hatchery for this purpose. If this program is pursued, it will be necessary to:

- acquire access to hatchery facilities suitable to the needs of the program or research the feasibility of building a new hatchery, including supporting the hatchery for eight to ten years during the development of the broodstock; address environmental issues regarding water supply and discharge involved with the construction of a hatchery facility;
- confirm the genotype of all fish collected for the purpose of developing a broodstock; and
- monitor the genetics of the hatchery stock in order to maintain genetic integrity.

3.2.4.2 Biological Concerns

It will be necessary to remove spawning material from 500 females and 500 males in order to create the broodstock. Sara Chubb (USFS) has indicated that the trout populations above Gibraltar and Juncal dams are likely sufficiently large and healthy enough to support this effort, although there would be difficulty in capturing such numbers in only a few locations without excessively depleting the population. Surveys should be conducted to identify areas where rainbow trout could be captured and spawned.

Once broodstock have been collected, founder effects and the selective forces in the hatchery environment will begin pushing the genetics of this hatchery population toward those individuals with the greatest fitness for conditions in the hatchery. As the purpose of this hatchery population is to serve the recreational fishery (not to supplement the wild population) a reasonable amount of "genetic drift" may be acceptable. However, in order to prevent excessive genetic drift, it will be necessary each year to collect additional spawning material from wild trout for combination with the hatchery broodstock. This infusion of new genetic material will help maintain genetic similarity with the southern genotype. The proportion of wild fish that would need to be incorporated each year to offset genetic drift must be determined.

The fish produced by this program will likely be more adapted to conditions in the Santa Ynez River than the northern fish currently stocked. These fish would therefore have a higher probability of survival if they avoid the creel, and they may compete more strongly with wild fish. These fish may interbreed with wild fish and introduce their hatchery-influenced genome into the wild population, to the extent that the genetic drift cannot be offset. The greater number of survivors (compared to northern derived fish) may result in a higher degree of mixing, and therefore the protection of downstream populations may not be complete. However, this mixing is less likely to reduce the fitness of the native stock than the current practice because of the genetic similarity of the southern steelhead hatchery fish, and therefore it will have a beneficial impact on the protected population over the current stocking practice.

3.2.4.3 Institutional Concerns

The proposed action is consistent with the management objectives of the CDFG and the Santa Barbara County Fish and Game Commission (County) for both steelhead management and the recreational fishery in the upper basin. CDFG has indicated that restoration of native and wild stocks is the highest priority for steelhead management, including maintaining genetic variability in wild stocks (Farley 1997). CDFG has also stated that artificial production, rearing, and stocking programs shall be managed to have minimal interference with natural salmonid stocks. The proposed action supports both goals. CDFG and the County also manage a valuable recreational fishery in Lake Cachuma and the Santa Ynez River between Bradbury and Gibraltar dams. Recreational fishing will not be hindered since stocking programs will be continued, albeit with southern-origin fish substituted for northern origin. This substitution will protect the genetic integrity of the native rainbow trout/steelhead stocks in the upper basin, consistent with CDFG's steelhead management objectives.

NMFS should have no objection to this action because stocks above Bradbury Dam are not included in the listed population. Additionally, the action has significant potential to protect the listed population below Bradbury Dam.

3.2.5 CONCLUSIONS

The proposed measure has the potential to preserve the genetic integrity of Southern California steelhead in the Santa Ynez basin by reducing or eliminating the potential for introgression from the northern derived stocks currently being planted in the river, although the influence of hatchery pressures could not be completely removed from the broodstock. The genetic analyses indicate that populations of rainbow trout exist in the Santa Ynez River basin with genetic profiles similar to southern steelhead and are available for use in the development of a broodstock.

This action, while technically feasible, would entail a long-term investment of effort to bring it to fruition. Existing hatcheries are at or near capacity or face other problems that would eliminate them from consideration for use. Constructing a new hatchery would also be a lengthy process, and would likely be quite expensive given land and water values in Southern California. The group recommends that development of a southern steelhead hatchery to support the put-and-take fishery in Lake Cachuma and the mainstem below Gibraltar Dam be put aside pending further investigation of population size and genetics of resident rainbow trout populations in the upper basin.

3.3 STOCKING STERILE TROUT

The second action that might be implemented 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 mainstem below Gibraltar Dam with sterile rainbow trout or sterile brown trout-rainbow trout hybrids.

DFG is currently working on the development of a brown trout-rainbow trout hybrid (brown-bows) at their Mt. Whitney Hatchery (M. Seefeldt, pers. comm.). While this program has met with only partial success to date, Mr. Seefeldt feels it will be successful in the long run. According to Mr. Seefeldt, hybrid stocking programs are in place in several other states using a brook trout-brown trout hybrid known as a “tiger trout.” This strain is very aggressive and cannibalistic and thus would be unsuitable for use in the Santa Ynez River. CDFG is currently considering using this strain only in areas where a controlled predator is needed, such as in alpine lakes where fish growth is stunted by over-population. The brown-bow trout hybrid is less aggressive and will likely be more suitable in situations with sensitive species.

These programs would require larger numbers of eggs to produce the same number of fish, as the hybridization process is less viable than standard single species reproduction. The extra effort involved would require additional funds provided to the hatcheries implementing the program.

The third option in developing a sterile trout for planting would be to use a process which produces triploid fish. These fish have an extra set of chromosomes (the material on which genes are coded) that makes these fish sterile. The process which produces triploidy is simple, but success is highly variable (M. Seefeldt, pers. comm.). In some batches of fish, nearly 100% the fish will be triploid, while in the next batch only 50% will be triploid. Until the reliability of this process can be improved, it would not be suitable for use in this program, as there is not a simple way of determining whether a given fish is diploid or triploid.

3.3.1 Evaluation

3.3.1.1 Technical Feasibility

The proposed stocking of sterile trout does not appear to be technically feasible at this time, although the development of brown-bow hybrid may be feasible in the near future (M. Seefeldt, pers. comm.). Once the technology has been adequately developed, there will be an additional delay involved in getting this technology geared up to a production level capable of producing the desired number of fish. The hybridized eggs are not as viable as single species eggs, and therefore a greater starting pool of eggs will be required to obtain a similar number of fish. There will be additional cost associated with producing these hybrid fish.

3.3.1.2 Biological Concerns

The tiger trout are highly aggressive and predatory and therefore do not meet the objective of this action. The brown-bow strain is believed to be less aggressive and may be more suitable for use in this application, but their behavior has not been well studied. Either of these strains may exhibit spawning behavior even if they are sterile. There is a possibility they may compete with native rainbow trout and steelhead for suitable spawning sites. However, the brown-bow are the progeny of fall spawning brown trout and fall spawning rainbow trout. Therefore the hybrids would likely exhibit fall spawning behavior, and the competitive pressure for suitable spawning sites would be alleviated.

The brown-bow hybrids are being developed at the Mt. Whitney Hatchery which has a whirling disease problem. If brown-bows were to be planted in Lake Cachuma and the Santa Ynez River, these fish should be produced at a facility without this parasite, to avoid infestation in this watershed, where it currently does not occur.

3.3.1.3 Institutional Concerns

There are no known institutional constraints to this program. The brown-bow hybrids are being developed by CDFG. The fish are sterile, so they pose no genetic threat to native trout stocks. However the behavioral characteristics of this hybrid are poorly understood.

3.3.2 Conclusion and Recommendations

This measure, while still technically infeasible, has the potential to avoid possible genetic introgression with steelhead and support the continuation of the Lake Cachuma fishery. This measure would also avoid any potential adverse genetic effects associated with the development of a broodstock program. Based on the likely need to construct a new hatchery for southern steelhead if a southern steelhead broodstock were to be developed, the brown-bow hatchery program could likely be attained at a considerable cost savings. There may also be a substantial time savings involved depending on the progress of the hybrid development and the actual time needed to adapt this process into a production mode facility. It is recommended that the

SYRTAC keep abreast of the progress of this research and consider implementation of this option if it proves technically feasible.

3.4 Summary of Genetic Protection

The current practice of stocking northern rainbow trout strains into Lake Cachuma and the mainstem below Gibraltar Dam has the potential to adversely affect the protected steelhead population below Bradbury Dam. However, this practice supports a unique and valuable fishery, the likes of which cannot be found elsewhere in Santa Barbara County. This fishery should be continued and enhanced. The upper basin work group recommends that CDFG pursue stocking practices that will not jeopardize the genetics of the protected steelhead population. Two options have been investigated, each of which presents substantial biological and technical challenges. Based on feasibility of the development of a new hatchery and the potential problems associated with any hatchery, the work group recommends that the development of a southern steelhead hatchery stock be shelved. The work group further recommends that the SYRTAC and DFG stay abreast of current research on the development of sterile trout strains for use in put-and-take fisheries, and as this research becomes applicable, use it to replace the current stocking practice in Lake Cachuma and the upper mainstem below Gibraltar Dam.

4.1 BACKGROUND

As discussed in Section 2, the area above Bradbury Dam historically provided much of the good steelhead spawning and rearing habitat in the basin. Due to the current passage barriers, steelhead do not have access to this area of the basin.

The actions evaluated are intended to provide steelhead access to the historical spawning and rearing habitat in the upper basin. In order for the progeny of steelhead transported into the upper basin to complete their life history cycle, however, it will also be necessary to provide smolts downstream passage around Bradbury Dam so that they can reach the ocean. Section 5 addresses trap-and-truck operations for downstream transport of smolts from the upper basin.

Four alternatives were considered to provide passage around Bradbury Dam: (1) a fish ladder at Bradbury Dam, (2) a fish ladder from Hilton Creek to Lake Cachuma, (3) a bio-engineered fish passage channel that would pass fish around or into Lake Cachuma, and (4) trap-and-truck operations to move returning adult steelhead from below Bradbury Dam into the upper basin. Each of these actions are described in more detail in the following sections.

4.2 LADDER AT BRADBURY DAM

4.2.1 PROPOSED ACTION

Fish ladders are often used to allow upstream migrating fish to travel over a dam or other passage barrier and gain access to spawning and rearing habitat in the portion of a watershed above that barrier. Fish ladders also allow outmigrating fish downstream passage around a barrier to gain access to the ocean. This option discusses the construction of a fish ladder from the mainstem Santa Ynez River over Bradbury Dam. The type of ladder proposed for this action is an Alaska Steeppass ladder, which is a style of Denil fishway. Implementation of this style of fish passageway involves not only the construction of the ladder portion, but also modifications to the dam for the necessary outlet structure.

According to guidelines suggested by Bates (1997), an Alaska Steeppass can achieve a slope of about 25%, and they have been tested up to a slope of 33%. The standard length of ladder sections is 30 feet, with a 10-foot-long resting pool between sections. Thus, for every 40 feet of ladder and pool, a rise of 7.5 to 10 feet would be achieved. Bradbury Dam, therefore, would require a total ladder length of 1,116 to 1,488 feet. The ladder would need to be a self-supporting structure that is connected to Bradbury Dam. It must be capable of withstanding seismic activity and must not jeopardize the stability of the dam itself. The outlet structure at the ladder's upstream end would need to be designed to accommodate variable lake levels so that a continuous flow from the lake to the ladder could be maintained.

4.2.2 TECHNICAL FEASIBILITY

Constructing a ladder from the mainstem presents serious technological challenges, according to fish passage experts (G. Heise [CDFG] and J. Pisamente, pers. comm. to C. Fusaro; W. Trihey, ENTRIX pers. comm.). Bradbury Dam is a 279-foot tall earthen dam. This is more than twice as high as the highest locations where successful ladders have been constructed. The outlet structure at the top would need to accommodate variable lake levels. Such an outlet structure would require flow control gate structures and would represent a major engineering modification to the dam. This would greatly increase the complexity and cost of the fish ladder. Because this action is technically infeasible, it has been dropped from further consideration.

4.3 FISH LADDER FROM HILTON CREEK TO LAKE CACHUMA

4.3.1 PROPOSED ACTION

Some of the technological problems of constructing a fish ladder at Bradbury Dam (Section 4.2) would be reduced by constructing the ladder from the top of Hilton Creek. Hilton Creek is a small tributary located just below Lake Cachuma. During winter flows, rainbow trout/steelhead swim up Hilton Creek to spawn (SYRTAC 1997a). The portion of the creek on U.S. Bureau of Reclamation (Reclamation) property extends approximately 2,980 feet from the Santa Ynez River (elevation approximately 550 feet) up to the Reclamation property boundary (elevation 680 feet). Under this action, Hilton Creek would be used to gain some elevation, and a fish ladder would be constructed from the upper end of Hilton Creek near the property boundary to Lake Cachuma.

Currently, a partial passage obstruction exists on the creek at an elevation of 625 feet, approximately 1,380 feet upstream from the confluence with the Santa Ynez River. Plans are currently underway to correct this impediment (*Appendix D - Hilton Creek Enhancement*). Modification of this passage impediment would allow fish to reach an elevation of 680 feet (Reclamation property boundary).

Passage into Lake Cachuma would then require a fish ladder 86 feet high and approximately 349 to 459 feet in length. As discussed earlier, the type of ladder proposed for this action is an Alaska Steeppass ladder, which is a style of Denil fishway. Implementation of a fish ladder would require an appropriate outlet structure to address the variable water surface elevation within the lake, as discussed above, so that a continuous flow from the lake to the ladder could be maintained.

4.3.2 TECHNICAL FEASIBILITY

Although this approach is technologically more feasible than a larger ladder from the mainstem Santa Ynez River, it would still be a long ladder that may be difficult for adults to successfully negotiate. Furthermore, the ladder would require an appropriate outlet structure to address the variable water surface elevation within the lake which, as discussed above, would require substantial modifications to the dam. Such an outlet structure would require flow control gate structures and would represent a major engineering modification to the dam. This would greatly increase the complexity and cost of the fish ladder.

4.3.3 Biological Concerns

A fish ladder alone would not allow steelhead to complete their life cycle because it would likely be ineffective at providing downstream passage for outmigrating smolts and for any adults that may be returning to the ocean. Outmigrating smolts would have to navigate through Lake Cachuma in order to find the entrance to the fish ladder. Lake Cachuma is a large reservoir (3,000+ acres) which has negligible flow throughout most of the year. As a result, it is unlikely that smolts would be able to negotiate a way through the reservoir to find the relatively small outlet into the fish ladder. Also, the numerous warmwater predatory fishes in Lake Cachuma would prey on the smolts during their migration. The only other way for juvenile fish to migrate downstream would be to go over the face of the spillway in large storm events. These opportunities occur in about one out of three years, and the trip down the spillway would likely result in injury and possible mortality.

Because juvenile fish would likely be unsuccessful in migrating through Lake Cachuma to the lower basin, any plan to get upstream migrants into the upper basin would have to be accompanied by a downstream migrant trapping program, like the one described in Section 5.

4.3.4 Institutional Concerns

Allowing the federally listed steelhead to enter Lake Cachuma by any means would have serious regulatory consequences for the recreational fishery in the lake. CDFG currently manages the lake as a fishery for bass, catfish and stocked rainbow trout. Lake Cachuma is the largest lake in the area available to local fishermen. The presence of steelhead would essentially prohibit fishing in the lake and in the mainstem and tributaries between Bradbury and Gibraltar dams, thus significantly impacting the opportunity for recreational fishing within the county. Therefore, allowing steelhead above the dam would raise institutional conflicts with the County.

Allowing steelhead above Lake Cachuma would also impact private landowners in this area. The land management practices of these owners may be restricted by the presence of an endangered species.

These concerns could be mitigated if NMFS designated the translocated fish an experimental population and therefore not subject to ESA protections.

4.4 Bio-Engineered Fish Passage Channel

4.4.1 Proposed Action

This option would construct a bio-engineered fish channel to allow steelhead to pass around the dam and the lake. This would be a structure with a lower gradient than a fish ladder, but would likely be several miles in length. Continuous water flow would have to be maintained throughout the entire channel to allow fish to swim upstream. Based on a review of topographic maps, the most likely course for such a canal would be up Santa Aqueda Creek to the headwaters of Happy Canyon Creek and then into Lake Cachuma in the vicinity of Cachuma Creek.

4.4.2 Technical Feasibility

This option would be technically infeasible because the headwaters of Happy Canyon Creek are over 90 feet above the elevation of Lake Cachuma. Thus continuous "downstream" flow could not be maintained through the constructed channel. Due to the technical infeasibility of this option, the biological and institutional concerns are not discussed.

4.5 Trap-and-Truck Transport of Adult Steelhead

4.5.1 Proposed Action

This option would trap adult upstream migrant steelhead below Bradbury Dam and release them into suitable spawning habitat in the upper basin. An advantage of a trap-and-truck operation over a fish ladder is that it has the potential to allow steelhead access to habitat throughout the upper basin, depending on the selected release site. The ladder or fish channel would allow fish to pass over Bradbury Dam, but these fish would be blocked at Gibraltar Dam and thus would not have access to habitat available above this point. Steelhead would also be limited to habitat on the tributaries below any passage barriers.

Trapping of adult steelhead would be conducted using the same methods as the current SYRTAC studies of the lower basin. For several years, the SYRTAC has been conducting trapping operations in the lower Santa Ynez River and its tributaries as part of a migration monitoring program. The program has trapped both upstream and downstream migrating adults and juveniles.

A fyke trap with a weir portion constructed after the Alaskan style A-frame weir would be placed across the stream to collect fish migrating upstream. Monitoring of traps and transport of steelhead would occur daily throughout the operation period. Trapping can be conducted only at relatively low flows. During high flows, the trapping equipment must be removed from the river or stream to prevent its loss. More permanent trapping stations able to withstand higher flows could be designed and constructed. Possible trapping sites include Hilton Creek, which is on Reclamation property, or the mainstem or Salsipuedes Creek, which would require permission from the landowner.

Captured adults would be transported in an aerated tanker truck to the upper basin. The fish would be released in Los Padres National Forest above Gibraltar Dam or Juncal Dam, and/or suitable tributary habitat above Gibraltar Dam. Access to this area would be difficult with a tanker truck. Once accessible areas have been identified, habitat data will need to be reviewed to determine the best spawning areas to release adults. Potential release sites include Blue Canyon, Indian, Mono, Fox, and Alder creeks in the middle sub-basin, and Juncal Creek in the upper sub-basin.

4.5.2 TECHNICAL FEASIBILITY

Trapping in the lower basin would likely be technically feasible, although the number of fish captured would be limited by the inability to operate the traps during high-flow events. The primary technical issue in upstream transport is vehicular access in the upper basin to suitable release sites. The roads that currently exist are not passable during the winter and spring months when transport would occur. It would be necessary to improve existing roads so that they are passable by a medium-sized tanker truck during these months.

4.5.3 BIOLOGICAL CONCERNS

Trap-and-truck operations involve a substantial amount of fish handling which can result in stress and in some cases mortality of individuals. Specific points of stress include the transfer of fish from the trap to the truck, transport (truck ride) to the upper basin, and release into the upper tributaries. Measures will need to be incorporated in order to minimize the amount of handling and therefore stress of steelhead.

Biologically, it may be desirable to move some adult steelhead into the upper basin to keep the anadromous life history strategy alive in this area of the Santa Ynez River. The current population has been landlocked for many generations; and fish exhibiting an anadromous tendency would tend to be selected against, as they may pass over the dams and be lost to the upstream population. By introducing adult steelhead into the upper basin and keeping the anadromous tendency alive in this area, a buffer may be provided that could be used as a source for anadromous southern steelhead genome, even if no assistance were provided to allow outmigrant juveniles to reach the sea.

In order for the progeny of steelhead transported into the upper basin to complete their life history pattern, it will be necessary to provide them access to the ocean. This would likely be accomplished with a trap-and-truck operation of outmigrating smolts from the upper basin tributaries to below Bradbury Dam (discussed in detail in Section 5). Such an operation would need to be conducted every year during the outmigration season (about March to June). It will be necessary to identify suitable trapping sites and construct traps in the upper basin tributaries. Additionally, suitable release sites in the lower basin will need to be identified in order to increase the likelihood of smolts reaching the ocean.

In the short-term, trapping-and-trucking adult steelhead could have negative impacts on the population below Bradbury Dam. It would move the production of any fish transported from the lower basin to the upper basin. Given their relatively low numbers, this would likely have a significant effect on the population. In addition, as steelhead can spawn more than once, adult steelhead moved over the dam would not be able to return to the ocean; and once moved above the dam, these fish would be forced to reside in one of the reservoirs or tributaries unless successfully recaptured and transported back downstream (see Section 5 below). This would likely reduce their potential lifetime production. However, other enhancement measures currently being pursued by the SYRTAC are designed to increase the population of steelhead in the lower basin. The success of these additional measures would result in a "surplus" of adult steelhead returning to the lower basin to spawn. A surplus of fish is a number of fish larger than the appropriate habitat to support them, or a larger number of fish than needed to fully saturate the available habitat for subsequent life stages. As these populations increase, the biological impacts of moving adults to the upper basin will be reduced and, therefore, its feasibility will increase.

4.5.4 Institutional Concerns

Proposed trap-and-truck operations raise serious concerns for state and federal agencies. CDFG policies state, "trap-and-truck operations, because of their history of failure to fully mitigate for loss of habitat, will not be considered as mitigation for proposed water projects, except where already approved." (T. Farley CDFG 1997). NMFS has recommended that other options be considered and implemented before trap-and-truck proposals be pursued, due to the lack of success achieved in other regions (Hogarth 1998). NMFS would prefer to see if conservation measures in the lower basin are successful at enhancing steelhead production before engaging in trap-and-truck measures.

Transporting federally listed steelhead into the upper basin would potentially have consequences for recreational fishing and private landowners, but not to the degree that a fish ladder would, as discussed earlier in Section 4.2.4. This is because the adults could be selectively released above Gibraltar Dam in Los Padres National Forest. A fish ladder would release steelhead into Lake Cachuma, where they could create regulatory conflicts with the existing fishery. Again, the concerns about endangered species regulations could be mitigated if NMFS designated the translocated fish an experimental population and therefore not subject to ESA protections.

Trap-and-truck operations could potentially affect other protected species in the upper basin, principally California red-legged frog (federally listed as threatened) and the southwestern arroyo toad (federally listed as endangered). Both species move around and are present on roadways in the winter. Increased vehicular traffic during this time of year could result in increased mortality to these species. If a trap-and-truck operation were put into place, measures would need to be taken to prevent harming these species during their spring movements. Consultation with the U.S. Fish and Wildlife Service (USFWS) would be required to develop appropriate mitigation measures and to obtain an incidental take permit.

4.6 Conclusions and Recommendations

The Work Group reviewed several options for getting adult steelhead into the available habitat in the upper basin. The options of a fish ladder from the mainstem Santa Ynez River or a bio-engineered fish channel are technically infeasible and do not warrant further investigation. A fish ladder from upper Hilton Creek is technically questionable, very expensive and presents serious biological concerns. This measure would also endanger the valuable recreational fishery in Lake Cachuma and the upper mainstem below Gibraltar Dam. Trapping adults in the lower basin and transporting them via truck to the upper basin is the most feasible option for upstream passage. All of these options fail to provide adequate passage for outmigrating smolts from the upper basin, therefore, a trap-and-truck operation for outmigrants is a necessary complementary measure for any upstream passage measure. Simply providing adult steelhead passage in an upstream direction may help keep the anadromous life history pattern alive in the upper basin, which may provide a source of suitable genes for supplementing the population of southern steelhead at a later date should it become necessary.

The Upper Basin Work Group recommends that a fish ladder over Bradbury Dam not be considered because of the lack of certainty that the ladder would be successful, the difficulty of getting juvenile fish back downstream of the dam, and the presence of the valuable fishery of Lake Cachuma and the mainstem below Gibraltar Dam, which is the single most important freshwater fishing opportunity in Santa Barbara County.

Trap-and-truck operations for upstream migrants still face several technical and institutional challenges to implementation, including:

- access to suitable release sites in the upper basin over poor roads in winter;
- permission for establishing trapping sites on tributaries in the lower basin (not an issue if trapping is conducted at Hilton Creek on Reclamation property);
- measures to minimize take of red-legged frogs and Arroyo toads during transport;
- providing downstream access for outmigrating smolts to the ocean (discussed further in Section 5);
- short-term loss of steelhead production in the lower basin due to transport of adults into the upper basin for spawning; and
- resistance by CDFG and NMFS to trap-and truck operations.

In the face of these challenges, the upper basin work group recommends that the proposed habitat rehabilitation and enhancement efforts below Bradbury Dam be carried out and monitored to see how the population responds. The Adaptive Management Committee will continue to investigate opportunities to provide passage for steelhead around Bradbury Dam.

5.1 BACKGROUND

As described earlier, steelhead and resident rainbow trout are members of the same species but with different life history strategies. Steelhead are anadromous (fish mature in the sea, and return as adults to spawn in freshwater), while resident rainbow trout spend their entire lives in freshwater. As members of the same species they can interbreed within a given aquatic system and form a single cohesive population. Adults exhibiting either life history pattern may produce offspring exhibiting either life history pattern. Since the construction of Bradbury Dam, anadromous steelhead have been prevented from migrating upstream into the upper basin. Furthermore, the only life history strategy that the population upstream of Bradbury Dam can express is freshwater residency.

Some proportion of resident rainbow trout progeny are expected to exhibit anadromous traits by becoming smolts and attempting to migrate downstream to the ocean. Currently, smolts from the upper basin cannot migrate downstream past the dams. One way to enhance the anadromous population of the lower basin would be to provide a mechanism by which these "anadromous" progeny could successfully reach the ocean. These fish, if they successfully smolt, would grow to maturity and return to the Santa Ynez River, thereby boosting the population.

The objective of the proposed action is to enhance steelhead production in the lower basin by providing additional outmigrants with access to the ocean.

5.2 PROPOSED ACTION

This action will provide passage around Bradbury Dam for outmigrating smolts that are produced in the upper basin, thereby providing access to the ocean. Fish that are migrating downstream from the tributaries in the middle or upper sub-basins will be trapped, transported downstream via an aerated tanker truck, and released in the river near the upper end of the estuary. This location was selected for release to minimize the chance that any of these fish might residualize (remain in freshwater) and out compete an individual that might eventually exhibit an anadromous life history strategy.

Trapping would likely be conducted using the same methods as currently used in the SYRTAC studies of the lower basin. A fyke trap with a weir portion constructed after the Alaskan style A-frame weir would be placed across the stream to collect fish migrating downstream. Monitoring of traps and transport of young fish would occur daily throughout the operation period. Trapping can be conducted only at relatively low flows. During high flows, the trapping equipment must be removed from the river or stream to prevent its loss. More permanent trapping stations able to withstand higher flows could be designed and constructed. Possible trapping sites include Blue Canyon, Indian, Mono, Fox, and Alder creeks in the middle sub-basin, and the mainstem above Juncal Dam, Juncal Creek and North Fork Juncal Creek in the upper sub-basin.

Another potential type of downstream migrant trap is a "fish gulper." The fish gulper facility would require a reasonably stable channel reach that could be completely screened, probably with removable screens. The collection mechanism involves placing a screen (1/4-inch mesh or smaller) diagonally across the stream channel, which will funnel fish down into the narrow apex. The "fish gulper" is a pipe at the apex of the funnel. Water velocity increases as the water is funneled down, so the fish are sucked into the gulper and carried through a pipe to a holding tank. The water is then bypassed or pumped back to the river. The collected fish would then be transported via a tanker truck to a release site downstream of Bradbury Dam.

Prior to implementing trap-and-truck operations, review of existing data and/or surveys would be necessary to identify likely trapping sites in the upper basin. The issues to consider in selecting suitable trapping sites include juvenile production of the tributary, manageable flow rates, debris loads, and vehicle accessibility. In order to obtain fish of southern steelhead genetic lineage, trapping would occur only in tributaries in the middle or upper sub-basins.

5.3 EVALUATION

5.3.1 TECHNICAL FEASIBILITY

As discussed in Section 4.5, trapping of downstream migrants would likely be technically feasible, although the number of fish captured would be limited by the inability to operate the traps during high-flow events. Since steelhead and rainbow trout juveniles generally move during these high flows, only a small portion of the available migrants is likely to be captured. In addition, during high flows, the trapping equipment must be removed from the river or stream to prevent its loss.

A fish screen and fish gulper would be most applicable and likely to succeed where the streamflow and debris load is very predictable (*e.g.*, in a water diversion facility). Such a facility is not well suited for the flashy debris-laden flows of the Santa Ynez River. The approach velocity of fish screens is typically less than .5 feet/second, which means that any appreciable flow would require a great length of screen. A rough cost estimate is $1,000 per linear foot of screen (4 to 5 feet tall). High-flow events and debris would seriously damage the screens. One solution to this problem would be to remove screens when flows are high. However, anadromous fish like steelhead typically use the high flows to migrate downstream. Therefore, the fish gulper would be most effective in years with low or moderate flow, but not in years of high flow. A fish gulper facility would require continuing maintenance during the spring migration season for the removal, cleaning, and installation of screens, as well as supervision of fish capture and transfer. Information to be sought if the feasibility of a fish gulper is to be considered further would be the duration and magnitude of high flows, typical debris loads, and a survey of the channel to find a suitable site.

Another technical challenge is vehicular access in the upper basin. The roads that currently exist are not passable during the winter and spring months when transport would occur. It would be necessary to improve existing roads so that they are passable by a medium-sized tanker truck during these months.

5.3.2 Biological Concerns

Some of the juveniles translocated downstream of Bradbury Dam may remain resident within the system. These individuals may displace young steelhead already present. This may have a detrimental effect on these young fish. To reduce this possibility, the traps would be placed so that they capture only fish that are actively moving downstream out of a tributary (*i.e.,* outmigrants), this being a sign of potential anadromy. To further reduce the risk of residualization, juveniles moved downstream would be placed near the upstream end of the estuary so that they are less likely to enter a tributary stream where they might displace native fish.

It is currently unknown how many juveniles might be actively migrating downstream in the upper basin, or how important these individuals are to the local populations. These factors should be investigated before this action is implemented.

Trapping and transport activities could result in stress and mortality of the captured juveniles. Additional stress and mortality may be experienced in the receiving stream due to low flows, poor habitat conditions and/or unsuitable temperatures in the receiving stream. These problems can be addressed through proper transport procedures and release site selection.

5.3.3 Institutional Concerns

Proposed trap-and-truck operations raise serious concerns for state and federal agencies. The CDFG policies state, “trap-and-truck operations, because of their history of failure to fully mitigate for loss of habitat, will not be considered as mitigation for proposed water projects, except where already approved.” (T. Farley CDFG 1997). NMFS has recommended that other options be considered and implemented before trap-and-truck proposals be pursued, due to the lack of success achieved in other regions (Hogarth 1998). NMFS would prefer to see if conservation measures in the lower basin are successful at enhancing steelhead production before engaging in trap-and-truck measures.

Trap-and-truck operations could potentially affect other protected species in the upper basin, principally California red-legged frog (federally listed as threatened) and the southwestern arroyo toad (federally listed as endangered). Both species move around and are present on roadways in the winter. Increased vehicular traffic during this time of year could result in increased mortality to these species. If a trap-and-truck operation were put into place, measures would need to be taken to prevent harming these species during their spring movements. Consultation with USFWS would be required to develop appropriate mitigation measures and to obtain an incidental take permit.

5.4 CONCLUSIONS AND RECOMMENDATIONS

The objective of this option is to supplement the steelhead population in the lower basin. In at least some wet years, there appears to be sufficient production of juveniles. In other years, production in the lower basin may be reduced and it may be desirable to increase the number of smolt going out to sea. However, other enhancement measures currently being pursued by the SYRTAC are designed to increase the habitat available in the lower basin. It may be advisable to evaluate the need for supplementing production in the lower basin after we see the results of planned actions there.

This action appears to be feasible from a technical basis. Impacts to rainbow trout populations would likely not be a concern because the rainbow trout in the upper basin, while genetically similar to southern steelhead, are not part of the protected population under the ESA. There may be adverse impacts to the steelhead population downstream of Bradbury Dam, however, if some of these fish residualize and occupy habitat that otherwise could be used by juveniles that will become anadromous steelhead. The juvenile rainbow trout trapped for this program, however, would be in a migratory phase which will increase the likelihood that they would smoltify and go to sea. Additionally, these fish would be released near the upper end of the estuary where they are unlikely to enter the tributary stream and displace local rainbow trout or steelhead.

Based on the lack of knowledge about the need for the action, the potential benefit of the action (how many additional smolt would be produced), and the potential effects of the action on steelhead populations in the protected reach below Bradbury Dam and the rainbow trout populations in the area where the juveniles would be collected, the Upper Basin Work Group recommends that these questions be investigated and that this action be revisited when more is known.

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MOLECULAR GENETIC POPULATION STRUCTURE IN STEELHEAD/RAINBOW TROUT FROM THE SANTA YNEZ RIVER 1994- 1997

Appendix F

Prepared for:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

Prepared by:

Dr. Jennifer Nielsen

November 20, 1998

Molecular Genetic Population Structure in Steelhead/Rainbow Trout (Oncorhynchus mykiss) from the Santa Ynez River, 1994-1997

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INTRODUCTION

A total of 95 *Oncorhynchus mykiss* fin clips taken from fish collected in the Santa Ynez River, 1994-1997, were analyzed for molecular genetic population structure in my laboratory at Hopkins Marine Station for the Santa Ynez River Technical Advisory Committee (SYRTAC). For this study we amplified D-loop nucleotide sequence (188 base pairs) and ten nuclear microsatellite loci from DNA extracted from each fin sample. Previously published/reported genetic data for Santa Ynez steelhead/rainbow trout are summarized in Appendix lII.

These genetic markers represent two different molecular systems found in the salmonid genome with potentially different selection mechanisms reflected in their genetic diversity. Mitochondrial DNA (mtDNA) is a maternally inherited, extra-nuclear locus which has been used extensively for studies of conservation genetics and genetic diversity in vertebrates since the early 1980's. The D-loop sequence used in this study has been well documented in the published literature as one of the most diverse regions of DNA sequence available from teleost fishes (including salmon and trout) due to its relatively fast mutation rate (Lee et al. 1995; Nielsen et al. 1998). The term "relatively" should be taken at the correct scale, however. Most mtDNA divergence leading to unique haplotypes as described in this report is thought to have occurred during the mid- to late-Pleistocene, or 70,000 to 250,000 years ago (Avise 1994).

Pleistocene glaciation had unprecedented impacts on the ecology and genetic structure of North American vertebrate species (Pielou 1991). Fish species suffered long term disruptions due to glacial cover of freshwater habitats, formation and failure of ice dams, drainage shifts, and sudden emptying or flooding of ice-margin lakes. Much of the current species diversity is thought to have evolved from glacial refugia found at the edge of ice sheets or in areas protected from the glacial advance (Pielou 1991; Nielsen in press). Species from glaciated regions have been shown to have reduced levels of intraspecific divergence and genetic diversity (Bernatchez et al. 1989). Recolonization from diverse refugia has led to a complex zoogeographic history for many fish species, including salmon and trout. Recent developments in genetic technology allowing thorough investigations of mtDNA lineages have given us a better understanding of the number and location of glacial refugia in wild populations of fish and their colonization trends through modern times. A strong biogeographic cline in-mtDNA haplotypes has been shown for coastal steelhead in California (Figure 1; Nielsen et al. 1994a & b, 1997a &b, 1998).

Microsatellites are short, tandemly repeated units of DNA that have been shown to be highly polymorphic in plants and animals. Fast mutation rates leading to high levels of variation and a broad genomic distribution have made microsatellites important genetic markers for studies of parentage, genetic linkage, and population structure in many organisms (Jarne and Lagoda 1996). Mutation rates in microsatellites have been shown to be on an order of magnitude faster than most mtDNA markers making them important in studies of evolution that has occurred since the Pleistocene. Recent estimates of divergence times for microsatellites in humans by Goldstein et al. 1995b, place allelic changes on the scale of tens-of-thousands of years, a period covering most of the recent tectonic uplifting activity along the coast of California. This level of divergence makes these markers appropriate for question of genetic diversity involving recent anthropomorphic manipulations of fish populations such as hatchery propagation or habitat alteration due to dams and urbanization of river channels (see Nielsen 1996; Nielsen et al. 1997a & b).

Molecular genetic comparisons using these two different molecular systems were made among sample populations and other reference populations of California steelhead/rainbow trout analyzed for the same markers in the past in my laboratory. I used comparisons of allelic and haplotype frequency data, genetic distance measures, and analyses of population independence to compare genetic markers among subgroups from the SYRTAC samples and between the SYRTAC samples and other California *O. mykiss* populations.

MATERIAL and METHODS

Sample Collections

Ninety-five *O. mykiss* fin clips collected by SYRTAC were sent to our laboratory in 1997. These fish included samples collected 1994-1997 from Alisal Creek (N=17); Hilton Creek (N=36); Long-pool/spill basin (N=10); Salsipuedes Creek (N=31); and San Miguelito Creek (N=1; Table 1).

Fish collected from Alisal Creek, San Miguelito Creek, Devils Creek, and the Whale Rock Hatchery were collected above passage barriers. Comparison collections available in our laboratory for the same molecular markers included in analyses of population independence and genetic distance analyses were *O. mykiss* samples collected from Hilton Creek in 1995 (N=11) by the California Department of Fish and Game (CDFG); samples taken by Giles Manwaring from southern steelhead in Malibu Creek in 1992-93 (N=13); rainbow trout samples collected by the USFS in Devil's Creek

Figure 1. Map showing biogeographic cline in mtDNA haplotypes along California's Pacific coast (from Nielsen in press).

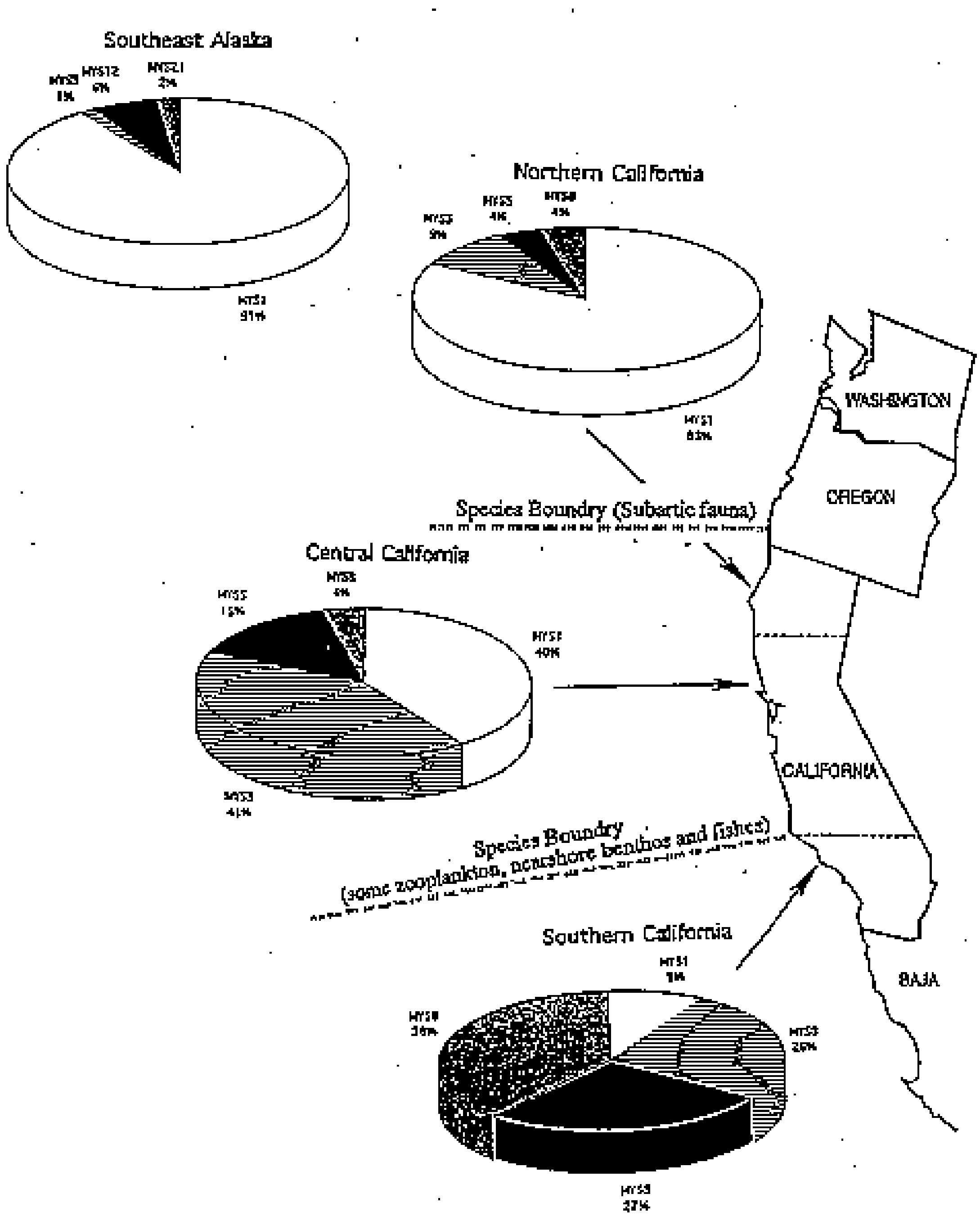


Table 1. General sample collections and the number of steelhead/rainbow trout used in these analyses.

Population	Sample year (s)	Sample count (N)	Above passage barrier
SYRTAC			
Alisal Creek	1995	17	Yes
Hilton Creek	1994	1	No
	1995	24	No
	1997	11	No
Long pool/spill basin	1997	10	No
Salsipuedes Creek	1995	3	No
	1996	3	No
	1997	25	No
San Miguelito Creek	1997	1	Yes
subtotal (SYRTAC)		95	
Reference collections			
Hilton Creek (CDFG)	1995	11	No
Devils Creek (USFS)	1995	7	Yes
Malibu Creek	1992-93	13	No
Whale Rock Reservior	1992	33	Yes
North coast streams	1992-93	27	No
subtotal (reference)		91	

from the upper Santa Ynez watershed in 1995 (N=7); putative “landlocked” steelhead from Whale Rock Reservoir collected in 1992 (N=33); and steelhead/rainbow trout fin clips collected from nine northern California coastal drainages, 1992-93, (Albion River, Cottoneva Creek, Garcia River, Gualala River, Howard Creek, Middle Fork Eel River, Navarro River, Usal Creek, and the Van Duzen River; N=27). For the purposes of these analyses we pooled all of the north coast samples into one population and used this as the outgroup for our genetic distance analyses of the SYRTAC samples.

North coast steelhead microsatellite data given in Appendix I have been previously published in part by JLN (Nielsen et al. 1997a & b). Other raw genetic data from the reference collections used in this report remain the property of the collecting agency and are not included here. These data may be available upon request from the collecting agency. The reference collections are offered here as comparisons made among sample populations taken recently in the same general geographic area as the SYRTAC samples. They are especially useful for microsatellite analyses where limited data on California's *O. mykiss* have been published to date (Nielsen et al. 1997a & b).

Mitochondrial DNA

Total genomic DNA was extracted from *O. mykiss* fin clips using Chelex-100 (BioRad) and/or cesium chloride purifications (Nielsen et al. 1998; Carr and Griffith 1987). Amplification of mitochondrial DNA (mtDNA) control-region sequence according to methods given in Nielsen et al. (1994a) were successful in all fin clips from the SYRTAC collection. Primers used in this study (P2 and S-phe) are known to allow the amplification of a highly variable segment of mtDNA control region in salmonids (Nielsen et al 1994a & b; Nielsen et al. 1997; Nielsen et al. 1998). This segment of mtDNA contains 188 base pairs (bp) of the O. mykiss control region and 5 bp of the adjacent phenylalanine tRNA gene. Primer sequences, amplification and sequencing protocols, and the complete sequence amplified in this region in O. mykiss are given in Nielsen et al. 1994a.

Nomenclature for mtDNA control region haplotypes follow those given in Nielsen et al. 1997a. I used an unbiased estimate of the Fisher's exact test based on a Markov chain adaptation of row-by-column contingency tables (GENEPOP V2.0; Raymond and Rousset 1995a) to test for independence in mtDNA haplotype frequencies found among steelhead/rainbow trout populations used in this study. This test provides the probability of being wrong when Ho (i.e. rows and columns are independent) is rejected (Raymond and Rousset 1995b). Haplotype frequency analysis was done using ARLEQUIN 1.0 (Schneider et al. 1997 http://anthropologie.unige.ch/arlequin) and a genetic distance tree for linearized Fst values among sample populations (SYRTAC and reference data) was calculated using PHYLIP (Felsenstein 1993).

Microsatellite Loci

Ten microsatellite loci developed by other research laboratories were chosen for these analyses based on their high level of polymorphism in previous studies of steelhead/rainbow trout done in our laboratory. The Omy-series of microsatellites was developed specifically for *O. mykiss*; the Oneμ-series was developed for sockeye salmon (*O. nerka*); Ots-series microsatellites were developed for chinook salmon (*O. tshawytscha*); and the Ssa-series was developed for Atlantic salmon (*Salmo salar*). Amplification of microsatellite loci follow methods given in Nielsen et al. 1997a, except that each 7.15 μl PCR reaction contained 67 μM Tris-HCL (pH 8.8), 6.7 μM $MgCl_2$, 16.6 μM $(NH_4)_2SO_4$, 10 μM β-mercaptoethanol, 1 μM each of dGTP, dATP, dTTP, and dCTP, 1 μM of each primer, 0.15 units of Taq polymerase, and μl of Chelex-100 extracted DNA.

For each locus polymerase chain reaction (PCR) conditions and the color of the fluorescently labeled reverse primer are listed in Table 2. Microsatellite alleles were run on a 6% polyacrylamide gel. Prior to loading the gel, 1μl PCR product was added to 4 μl of loading buffer

Table 2. Polymerase chain reaction (PCR) conditions used to amplify 10 microsatellite loci in Santa Ynez River steelhead/rainbow trout. Primer concentrations were 1μM for all reactions. Loci are listed by fluorescent labeled reverse primer.

*Tan °C/cycle	6Fam-blue	Tet-green	Hex-yellow
52°/30	Oneμ14 Omy27	Ots1	Oneμ11 Ssa289
52°/32	Omy77 Oneμ2	Ssa14	Omy325 Oneμ8

*Tan = annealing temperature

containing 1 μl 50 mg/ml Blue Dextran, 2.5 μl diformamide, and 0.5 μl ABI Genescan 500 (Applied Biosystems). All microsatellite gels were run on an ABI 373 automatic sequencer adapted for microsatellite analysis.

Microsatellite gels were read using ABI Prism's GENOTYPER software (1996). Microsatellite loci were run individually in separate PCR reactions to determine the maximum allelic size distributions found in Santa Ynez steelhead/rainbow trout. Allele sizes for each locus were established following an analysis of variance in allele size estimates derived from GENOTYPER. The size reported here for each microsatellite allele was equal to the size of the total product amplified (including amplified primer sequence). Known *O. mykiss* samples and commercial size standards were rerun on each gel for size standardizations among gels.

Tests for population independence using microsatellite allelic frequencies were performed using GENEPOP. Fisher's exact tests were run on all possible pairs of fish populations for each locus and for all loci combined. Statistical significance levels (initial $\alpha = 0.05$) were set using sequential Bonferroni tests (Rice 1989). Pairwise genetic distance matrices were calculated using the measure $\delta\mu^2$ (delta mu squared; Goldstein et al. 1995a), using MICROSAT V 1.4 available from Dr. E. Minch, Department of Genetics, Stanford University (http://lotka.stanford.edu/distance.html).

This distance measure assumes a linear expectation of the average squared distance for each locus (assuming no correlation between mutation rate and repeat score) and uses the arithmetic average of mutation rates across loci. This statistic is equivalent to a general analysis of variance using the sum of squares of differences in allelic size within each locus for each population, and the average squared difference between all possible pairs of populations. These estimates are used to obtain an estimate of variance in allele size in the total population. Goldstein's distance measure maintains an estimate of mutation rates under an expectation of a strict, single-step (± one repeat unit) shift for each mutation event. Fst and mean heterozygosity for the 10 microsatellite loci were calculated using MICROSAT with expected equilibrium values developed for the stepwise mutation process.

Distance data were used to generate an unrooted consensus neighbor-joining tree using NEIGHBOR81 and CONSENSE applications from PHYLIP (Felsenstein 1993) comparing the SYRTAC collection with our reference populations. One thousand replicate microsatellite distance trees were generated to obtain bootstrap estimates based on locus removal with replacement in the MICROSAT program. Bootstrap values given as percentiles were used to assess reproducibility of branching patterns found in the consensus genetic distance tree.

RESULTS

Mitochondrial DNA

Six mtDNA haplotypes were found in the Santa Ynez River samples sent to my laboratory by SYRTAC (Table 3). Haplotype frequency distributions varied among the subsample populations in this collection (Table 4). Fisher's exact tests indicated significant independence for mtDNA haplotype frequency distributions between all paired comparisons made among the SYRTAC Santa Ynez River populations (excluding the San Miguelito Creek sample where N=1), with the notable exception of the haplotype frequencies found in Hilton Creek and the adjacent long pool/spill basin (Fisher's $p = 0.16$). In year-to-year comparisons significant differences in haplotype frequencies were found between SYRTAC's Hilton Creek samples collected in 1995 and 1997 (Fisher's $p = 0.0025$).

In comparisons with available reference mtDNA collections (Appendix III; populations where N<3 were excluded) a lack of significant independence (Fisher's $p > 0.05$) was found in comparisons of Salsipuedes Creek and with Devils Creek ($p = 0.62$). SYRTAC Hilton Creek samples (all years combined) and CDFG Hilton Creek samples (all years combined) lacked significant independence for mtDNA haplotype frequencies ($p = 0.06$). This trend in mtDNA frequency continuity for independent collections of Hilton Creek trout held for year-to-year comparisons as well where Fisher's $p = 0.36$ (CDFG and SYRTAC 1995); $p = 0.15$ (CDFG and SYRTAC 1997).

No significant differences in mtDNA haplotype frequencies were found between Hilton Creek samples and those collected in Lake Cachuma (SYRTAC samples $p = 0.20$; CDFG samples $p = 0.11$). Mitochondrial DNA haplotype frequencies in Devils Creek fish were not significantly different from those found in the SYRTAC Hilton Creek samples ($p = 0.19$). The long pool/spill basin samples lacked mtDNA frequency independence from Lake Cachuma ($p = 0.06$) and Devils Creek ($p = 0.23$). Lake Cachuma trout lacked mtDNA independence in comparison with Devils Creek trout ($p = 0.23$). Jameson Reservoir fish and the collection made in Franklin Creek lacked significant mtDNA frequency differences in comparison with adult fish collected in the Santa Ynez River (1993-94; Jameson Reservoir $p = 0.36$; Franklin Creek $p= 0.08$).

Table 3. Mitochondrial control region variable sites and nucleotide changes (bold) found in relation to MYS1 in the upper Santa Ynez River steelhead/rainbow trout 1994-1997.

mtDNA type	base pair no. 1021	1086	1103	1106	1109	1147 Digby et al.'92
MYS1	T	T	A	A	G	G
MYS3	T	T	A	A	A	G
MYS5	T	C	G	C	G	A
MYS8	T	C	A	C	G	A
MYS12	T	C	A	C	G	G
MYS14	C	T	A	A	A	G

Table 4. Mitochondrial haplotype frequencies found in Santa Ynez River steelhead/trout samples, 1994-1997.

Population		Year	mtDNA type 1	3	5	8	12	14
Alisal Creek		1995		17				
	total		0	17	0	0	0	0
Hilton Creek		1994				1		
		1995	9	13		1		1
		1997	2	2		5	2	
	total		11	15	0	7	2	1
Long pool/spill basin		1997	1	5		2	2	
	total		1	5	0	2	2	0
Salsipuedes Creek		1995	1	2				
		1996			1	2		
		1997		3	4	18		
	total		1	5	5	20	0	0
San Miguelito Creek		1997		1				
	total		0	1	0	0	0	0
	overall total		13	43	5	29	4	1

Estimates of Nm (used as a surrogate for recent gene flow among populations) calculated from haplotype frequencies by ARLEQUIN were very high in comparisons of SYRTAC Hilton Creek with CDFG Hilton Creek (Nm = 99), long pool (Nm was infinite), Cachuma Reservoir (Nm was infinite), and the 1993-94 mainstem collection by SYRTAC in the Santa Ynez mainstem (Nm was infinite). High gene flow estimates occurred between: Cachuma Reservoir and CDFG's Hilton Creek sample Nm = 23.6; Cachuma Reservoir and the Santa Ynez 1993-94 mainstem collection (Nm = 64.1; Jameson Reservoir and Alder Creek Nm = 39.45; and Fox Creek and Alder Creek Nm = 14.51. All other estimates of geneflow were less than Nm = 10, the maximum threshold suggested as appropriate for estimating connectivity in populations from geographically proximate subpopulation within a basin (Mills and Allendorf 1996).

Genetic distance analyses based on haplotype Fst values calculated by sample population for all mtDNA reference collections and SYRTAC sample locations in the Santa Ynez River (populations with 2 or less individual samples were not included) ranged from Fst = 0 (comparisons made among the long pool, Cachuma Reservoir and both Hilton Creek samples) to Fst = 7.8 (El Jaro/Salsipuedes and Alisal Creek). A mtDNA consensus neighbor-joining tree (PHYLIP) derived from linearized Fst values calculated by ARLEQUIN is given in Figure 2.

Microsatellite Loci

The 10 microsatellite loci used to test population structure in the Santa Ynez River trout were highly polymorphic (Table 5). The number of alleles ranged from 6 (Oneμ11) to 33 (Oneμ2), with an average of 15 alleles per locus in the Santa Ynez samples collected by SYRTAC (see Appendix I for allelic distributions found in SYRTAC samples compared to northern CA coastal collection. Allelic sizes ranged from 87 bp (Omy325) to 308 bp (Oneμ2). Mean Fst for the 10 loci combined was 0.11 (range: 0.03 (Omy27) to 0.21 (Oneμ8)). Average heterozygosity for the 10 loci was 0.62 (range: 0.45 (Omy27) to 0.80 (Oneμ2)).

Fisher's exact tests of population independence were performed on paired comparisons among the SYRTAC samples and the northern California reference collection using 10 microsatellite loci (Table 6). One fin clip collected by SYRTAC in Hilton Creek, 1994, represented the only fish from the SYRTAC collection that showed significant lack of independence for all 10 loci in comparisons with north coast steelhead (mean Fisher's p = 0.44; see Table 6). Year-class variation for the 10 microsatellite loci

Figure 2. Consensus unrooted neighbor-joining tree (PHYLIP) derived from genetic distance estimates based on pairwise Fst values for mtDNA haplotype frequencies using ARLEQUIN in trout populations from the Santa Ynez River. The number of samples (n) follows each site location.

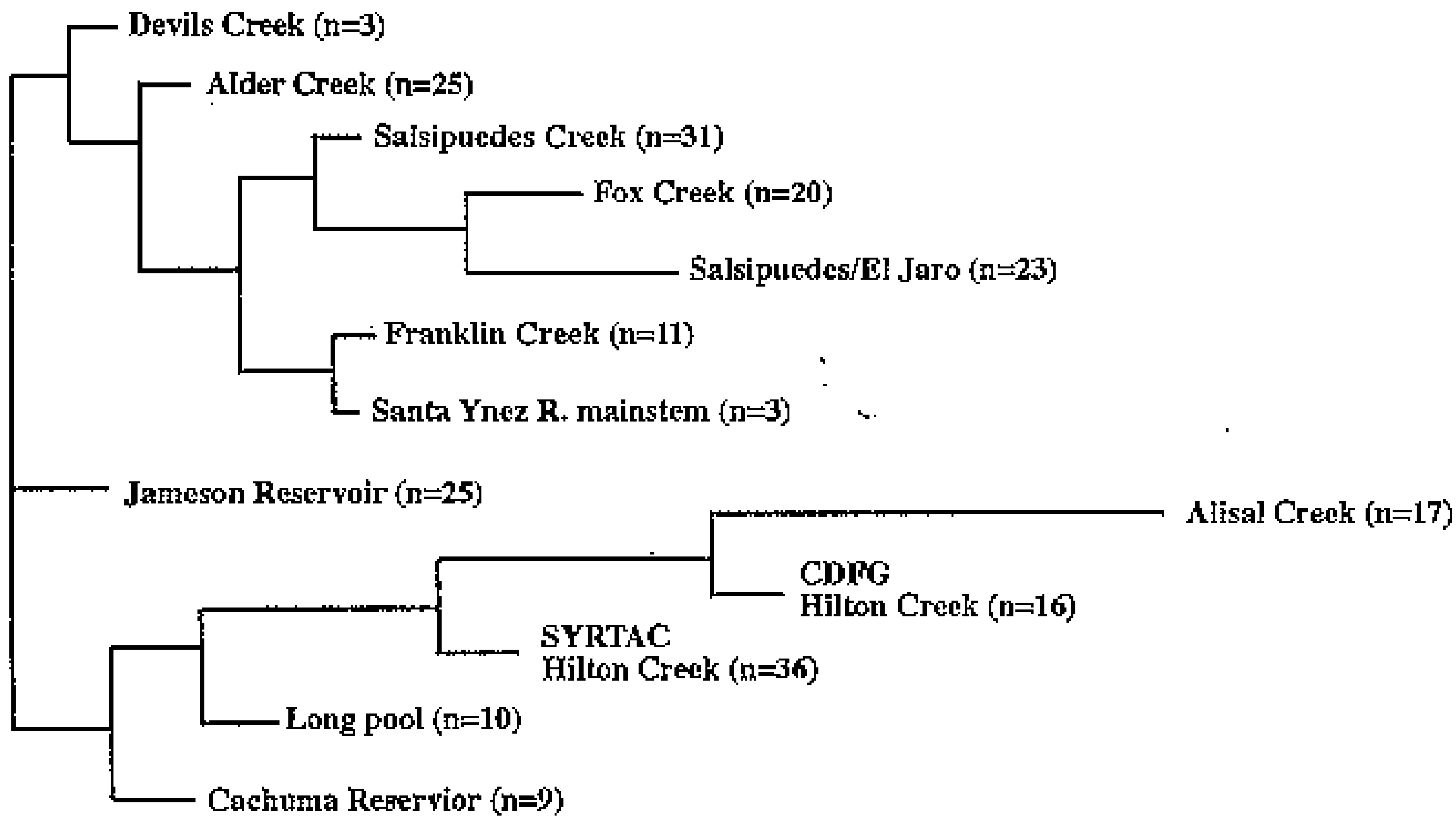


Table 5. List of 10 microsatellite loci and their source publications amplified from Santa Ynez steelhead/rainbow trout, 1994-1997, and north coast steelhead populations. Size S.D. represents the mean standard deviation calculated for allelic size estimates made at each allele for each locus amplified from all steelhead/rainbow trout samples used in this study.

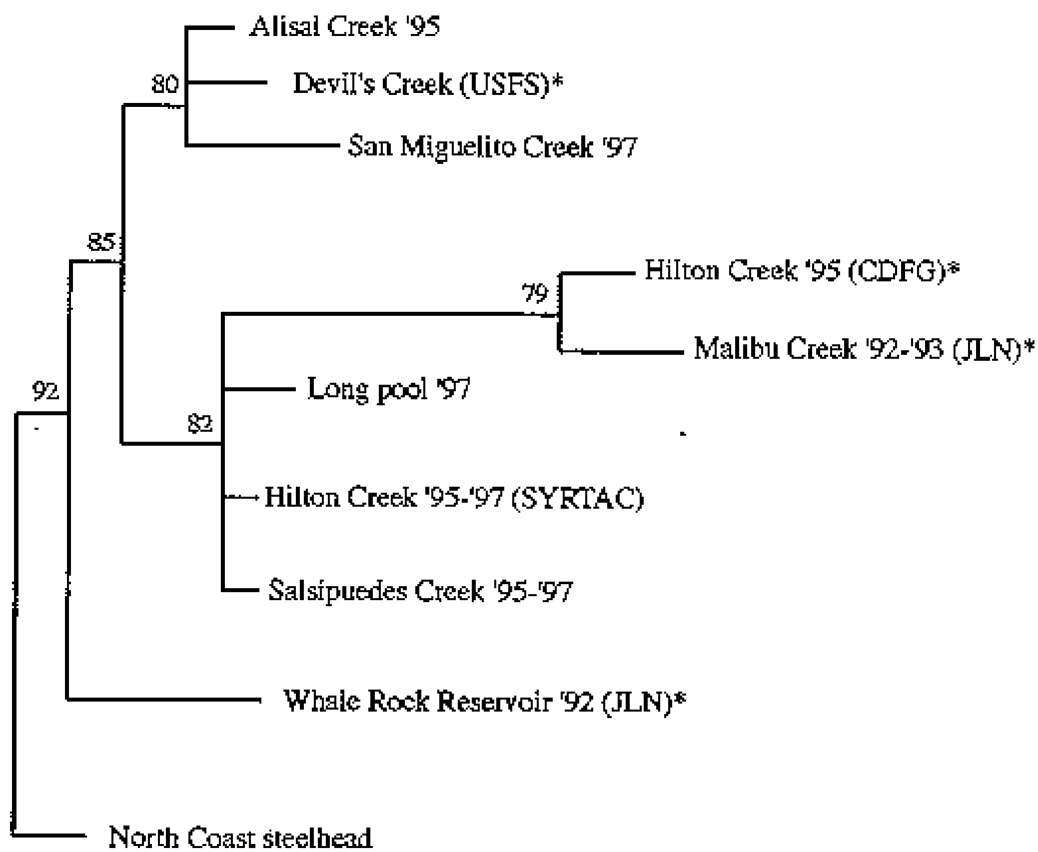
Locus	Source	Number Alleles	Allelic Size (bp)	Size S.D.(bp)
Omy27	M. O'Connell pers. comm.	10	97-115	0.24
Omy77	Morris et al. 1996	28	93-153	0.26
Omy325	M. O'Connell pers. comm.	22	87-145	0.36
Oneμ2	Schribner et al. 1996	34	204-308	0.22
Oneμ8	Schribner et al. 1996	16	146-190	0.36
Oneμ11	Schribner et al. 1996	6	141-153	0.17
Oneμ14	Schribner et al. 1996	9	145-171	0.20
Ots1	M. Banks pers. comm.**	17	151-243	0.24
Ssa14	McConnell et al. 1995	14	126-166	0.21
Ssa289	McConnell et al. 1995	8	108-124	0.26

*M. O'Connell, Guelph University, Ontario Canada
**M. Banks, University of California, Davis

Table 6. Genetic distance values ($\partial\mu 2$) calculated using Goldstein et al. (1995) on 10 microsatellite loci in paired comparisons of the SYRTAC steelhead/rainbow trout samples and north coastal California steelhead samples are given below the diagonal. Above the diagonal are the numbers of microsatellite loci showing significant ($p<0.025$) independence between paired comparisons based on GENEPOP's Fisher's exact tests.

	Population									
Population	1	2	3	4	5	6	7	8	9	10
1) Alisal Creek '95	-	1	10	8	2	9	6	5	9	10
2) Hilton Creek '94	13.38	-	0	1	0	0	0	0	1	0
3) Hilton Creek '95	4.14	14.00	-	2	0	1	0	0	9	9
4) Hilton Creek '97	7.28	4.75	4.83	-	1	1	2	5	8	7
5) San Miguelito Creek '97	4.26	16.03	8.19	13.22	-	0	0	0	1	1
6) Long pool '97	5.40	9.00	2.38	1.15	11.19	-	0	2	9	8
7) Salsipuedes Creek '95	18.23	14.71	11.31	5.81	30.41	7.95	-	0	2	4
8) Salsipuedes Creek '96	18.97	19.58	15.84	17.15	18.48	14.13	37.70	-	0	6
9) Salsipuedes Creek '97	3.62	7.19	5.68	3.92	7.39	3.39	17.50	9.00	-	8
10) North coast streams '92-93	3.40	8.85	3.11	6.03	3.80	5.34	17.40	14.56	4.44	-

Figure 3. Consensus neighbor-joining tree derived from genetic distances ($\partial\mu 2$) for 10 steelhead/rainbow trout populations surveyed at 10 microsatellite loci (see text). Bootstrap values (% of 1,000 trees) less than 75% were collapsed due to small sample sizes in many of these populations.



* Data used to analyze these populations remain discretionary and the property of the collecting agencies.

amplified from fins collected in 1995 and 1997 in Hilton Creek was not significant (Fisher's combined $p = 0.15$). Large differences in sample size prevent legitimate statistical year-class comparisons among the other SYRTAC fish populations.

Delta mu ($\delta\mu^2$) genetic distance analyses among the SYRTAC trout populations ranged from $\delta\mu^2 = 37.70$ (Salsipuedes Creek 1995 and 1996 samples) to $\delta\mu^2 = 1.15$ (long pool/spill basin 1997 and SYRTAC's Hilton 1997 samples; Table 6). Neighbor-joining analysis of the $\delta\mu^2$ distance measures including all of the reference collections, demonstrated two genetic groupings with separation supported by 85% of the bootstrap trees (Figure 3). Alisal Creek, San Miguelito Creek, and Devils Creek (USFS) made up one group, while both Hilton Creek samples (SYRTAC combined year-classes and CDFG), Malibu Creek, long pool, and Salsipuedes Creek (SYRTAC combined year-classes) made up the other.

DISCUSSION

Comparisons of SYRTAC sample populations by site locality and year showed the important influence sample size can have on these types of analyses. Most statistical theory and data simulation studies suggests 40-60 individuals/population for best results when analyzing population structure with microsatellite loci (see Takezaki and Nei 1996 and literature therein). The largest Fst and $\delta\mu^2$ distance values were calculated in comparisons where at least one population contained only a few individual suggesting significant sample-size effects. Combining samples across years for individual tributary or stream populations gave better results in our neighbor-joining analyses.

The controversy over mitochondrial vs. nuclear (i.e. microsatellite) DNA analyses continues in the genetics community. The evolutionary mechanisms in repeat DNA remain unknown and, therefore, the assumptions built into their analyses are controversial. I have published significantly using both methods given here (see literature cited). Results documenting population genetic structure within the Santa Ynez River basin were not congruent for these two markers. This could result from several conditions or constraints on the data. In this study both methods were applied to different population sets since most of the mtDNA reference populations have not been analyzed for microsatellite diversity at 10 loci (see Figures 2 and 3). It is difficult to support variation in genetic structure based on differences in mutation rates between the two markers or sexually dimorphic gene-flow (i.e. more straying of males within the basin). As mentioned above sample size is a problem at many of the locations used for this study. Errors resulting from low sample number will, however, tend to have more effect in microsatellite analyses than in mtDNA sequence data due to their variable mutation rates. I anticipate increased sample sizes (at least 40 fish per sample location per year) would bring congruence between these two genetic markers in their depiction of within basin population genetic structure.

Two issues concerning the microsatellite analyses were important enough for me to give them computational consideration. First, recent studies of microsatellite loci have shown null alleles (Omy77 and Oneμ14) and size homoplasy (Oneμ11) in bottlenecked populations of *O. mykiss* in Alaska (JLN and W. Ardren, unpublished data). I ran $\delta\mu^2$ genetic distance analyses on the SYRTAC samples without each of these loci and without all three loci combined to analyze the relative contribution of each locus on the overall findings. These analyses did not change the architecture of the resulting genetic distance tree or the relative relationships found among the Santa Ynez River samples. Variation found at each locus acted on all populations with equal effect. Similar results for these loci in other studies on going in my laboratory show similar effects (Nielsen in press; Nielsen et al. submitted). Tree branch lengths did change, however, due to the shifts in analysis of variance contributed by each locus. These changes would typically affect an interpretation of deep evolutionary nodes, but the Santa Ynez River populations are so closely related that branch lengths~were~not considered significant in either case (with or without the questioned loci).

I used a second method of analysis of genetic distance for microsatellite data (Nei's chord distance) that is based on the infinite allele model of evolution as opposed to $\delta\mu^2$'s single-step model. Nei's measure ranged from 0 - 1.17 in the Santa Ynez samples, but was generally directly correlated to the $\delta\mu^2$ values given here, suggesting that the mutation model is not as important in recently diverged populations as in analyses involving more distantly diverged populations (see Takazaki and Nei 1996). Nei's mean Fst for these 10 microsatellite loci was 0.12, very similar to the value calculated by $\delta\mu^2$ (Fst = 0.11).

It was interesting that I was unable to differentiate the one fish caught in Hilton Creek (1994) that carried mtDNA haplotype MYS8 (most commonly found in southern California steelhead) from north coast steelhead for any of the 10 microsatellite loci. This shows the error that can easily be made using genetic analyses without consideration of the sampling properties inherent in the system of markers used to define subgroups of fish as independent populations (see Cummings et al. 1995). While mtDNA haplotype MYS8 dominated the Whale Rock Reservoir population collected in 1992, these fish clearly had a mixed ancestry when we looked at the nuclear genome (Nielsen et al. 1 997b). These examples show the importance of looking at sufficient sample sizes for both mtDNA and nuclear markers when examining genetic population substructure within a basin.

Due to a natural genetic heritage primarily derived from Sacramento River rainbow trout, hatchery trout in California are dominated by two haplotypes MYS1 and MYS3. It is important to note, however, that haplotypes MYS1 and MYS3 do not necessarily indicate hatchery-derived fish in southern California streams. Despite the fact that their frequency of occurrence declines in southern streams, these haplotypes have been found throughout the species range as far south as Baja California (Nielsen 1998). A wild-caught fish cannot be determined to be hatchery derived simply by exanination of their mtDNA haplotype. The probability of hatchery origins increases in fish carrying MYS1 or MYS3 haplotypes, but wild origins cannot be ruled out in these lineages, even in southern California. My laboratory is working on a series of microsatellite loci that seem to contain diagnostic alleles for the Mount Shasta, Hot Creek, and Whitney Hatchery rainbow trout strains. Completion of this work (expected in early 1999) will provide tools for hatchery vs. wild comparisons within California coastal rainbow trout populations and allow estimates of the level of introgression by hatchery fish among stocks subjected to supplementation over time.

Genetic distances calculated between the 1995 (N=3) and both the 1996 (N=3) and 1997 (N=25) samples collected in Salsipuedes Creek were quite high ($\delta\mu^2$ = 37.7 and 17.5 respectively). Despite small sample sizes for 1995 and 1996, this seems to indicate year-class structure or sampling problems in this tributary. Year-class structure and/or sampling problems were also found in SYRTAC's 1995 (N=24) and 1997 (N=11) Hilton Creek collections. For all year-classes combined we found no significant differences between the SYRTAC Hilton Creek collections and those sent to my laboratory by CDFG with both Hilton Creek collections occurring on the same branch in Fst distance analysis, only 64% bootstrap support for separation in the microsatellite neighbor-joining tree, and high Fisher's combined tests p-values among the various Hilton Creek collections.

Fst distance analyses of haplotype frequencies showed upper and lower basin substructure for mtDNA with the notable exception of Salsipuedes Creek which claded with the upper basin fish populations (Figure 2). Two well supported genetic clades based on nuclear microsatellite allelic structure shown in the lower Santa Ynez River trout samples gave support for genetic associations among Malibu Creek steelhead and trout from Hilton Creek, the long pool, and Salsipuedes Creek. Alisal Creek, San Miguelito Creek, and Devil's Creek trout were significantly different in microsatellite allelic structure from known anadromous steelhead populations in Malibu Creek. No

Santa Ynez River reservoir fish were included in these microsatellite analyses, but a previous study of Cachuma and Jameson Reservoir samples for three microsatellite loci showed closer genetic affinity between reservoir fish and trout from habitats currently closed to ocean access due to dams (Nielsen et al. 1997b).

The difference in genetic substructure found for the two molecular markers could be due to variation in life histories (i.e. time since anadromony) above and below dams, or to hatchery introgression sometime in the recent past that has affected some habitats more others. Hatchery introgression may have resulted in significant males genetic contribution in reservoirs and downstream tributaries (as represented by microsatellite data), with limited female gene flow leading to the preservation of population substructure in the Santa Ynez River based on mtDNA analyses. It is also possible that two distinct lineages (i.e. independent steelhead and rainbow trout populations) co-occur naturally within the basin. The lack of "diagnostic" alleles fixed for either of these two life histories, however, argues against this last hypothesis.

Sample sizes analyzed for genetics were small for many of these populations and prevent my making any further speculation on the cause of population differentiation using either marker. I would suggest that a broader overview of the population genetic structure for *O. mykiss* in the Santa Ynez River would be very helpful in resolving the effects of past hatchery supplementation, the development of supplemental broodstocks for enhancement, and in dosing of an appropriate conservation plan for this basin. We especially need additional genetic data and samples from the upper headwaters of this basin to determine if relic gene-pools found in resident fish in the waters can provide material for supplementation of anadromous stocks in the Santa Ynez River. A follow up study with sample sizes on the order of 40-60 fish per putative population or sample site (i.e. tributary or mainstem locations) would give sufficient statistical rigor to address this issue using microsatellites. Such a study should be done cooperatively between the diverse agencies involved in the recovery of southern steelhead in this area.

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APPENDIX I - Microsatellite allelic frequencies for SYRTAC samples and north coast steelhead.

Locus = Omy27

	97	99	101	103	105	107	109	111	113	115	Total
Alisal95	0	0	0	0	6	28	0	0	0	0	34
Hilton94	0	0	0	0	0	2	0	0	0	0	2
Hilton95	0	6	0	0	15	19	2	4	1	1	48
Hilton97	0	0	7	0	0	13	2	0	0	0	22
Miguel	0	0	0	0	0	2	0	0	0	0	2
Pool97	0	0	4	0	2	12	1	0	0	1	20
Salsi95	0	0	0	0	3	3	0	0	0	0	6
Salsi96	0	0	0	0	3	3	0	0	0	0	6
Salsi97	2	0	0	0	9	37	1	1	0	0	50
NCAstld	0	0	5	3	9	23	14	0	0	0	54
Total	2	6	16	3	47	142	20	5	1	2	244

Locus = Omy77

	93	95	97	99	101	103	105	107	109	111	113	115	117	121	125	127	129	131	133	135	137	139	141	143	147	149	151	153	Total
Alisal95	0	0	10	4	0	2	7	1	2	5	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	34
Hilton94	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Hilton95	0	0	3	8	11	0	1	1	2	2	0	1	0	1	0	2	8	2	2	0	0	2	2	0	0	0	0	0	48
Hilton97	0	0	2	2	2	0	5	0	1	1	0	0	0	1	0	0	3	1	1	0	0	3	0	0	0	0	0	0	22
Miguel	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pool97	0	0	1	2	2	0	3	0	2	1	2	0	0	0	0	0	2	3	0	0	0	2	0	0	0	0	0	0	20
Salsi95	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	6
Salsi96	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	6
Salsi97	0	0	0	0	7	6	21	1	0	0	0	0	0	0	0	2	3	0	0	0	6	4	0	0	0	0	0	0	50
Malibu	0	0	0	0	0	1	0	0	0	0	0	0	0	7	3	0	5	0	0	2	0	0	0	0	1	6	1	0	26
Hilton	0	0	2	5	4	0	1	0	1	2	0	2	0	2	2	1	6	0	2	0	0	0	2	0	0	0	0	0	32
WhaleRock	0	0	1	11	21	2	2	3	9	1	0	0	9	0	0	0	0	0	0	2	0	0	0	0	0	2	0	3	66
NCAstld	2	1	0	11	0	14	1	2	1	4	1	0	0	0	1	2	0	0	5	4	0	1	0	2	2	0	0	0	54
Total	2	1	19	43	49	25	45	10	18	16	3	3	9	11	6	8	30	7	11	8	8	15	4	2	3	8	1	3	369

APPENDIX I (cont.)

Locus = Omy325

	87	99	101	103	105	107	109	111	113	115	117	119	121	123	125	127	131	135	137	139	143	145	Total
Alisal95	0	0	0	0	1	0	0	3	8	2	0	18	0	0	0	1	0	0	0	0	0	1	34
Hilton94	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Hilton95	0	0	3	0	0	8	1	2	12	4	0	3	1	2	0	12	0	0	0	0	0	0	48
Hilton97	0	0	0	0	0	3	0	0	1	5	0	0	1	5	0	7	0	0	0	0	0	0	22
Miguel	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Pool97	0	0	1	0	0	1	0	0	1	3	0	0	0	5	1	7	0	0	0	0	1	0	20
Salsi95	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	6
Salsi96	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	4	0	0	0	0	0	0	6
Salsi97	0	0	0	0	11	0	0	0	0	4	5	5	0	0	0	15	0	1	5	4	0	0	50
Malibu	0	0	0	1	2	0	0	0	10	1	1	2	0	0	0	2	1	0	0	0	0	0	20
Hilton	0	0	2	1	1	0	1	0	10	4	0	0	1	1	0	2	1	0	0	0	0	0	24
WhaleRock	0	0	0	1	11	0	0	0	6	8	0	8	0	0	0	4	0	0	0	0	0	0	38
NCAstbd	1	1	3	7	8	2	0	11	3	1	4	4	1	2	4	2	0	0	0	0	0	0	51
Total	1	1	9	10	34	16	2	16	54	35	11	41	4	15	5	58	2	1	5	4	1	1	326

Locus = Omy2

	194	204	206	306	208	308	210	212	312	224	226	230	232	234	236	238	240	242	244	246	248	250	252	254	256	258	260	262	264	266	268	270	274	282	Tot.
Alisal95	0	0	0	0	0	0	0	0	0	0	0	2	6	0	0	3	0	3	7	1	2	0	0	3	0	0	2	0	0	4	1	0	0	0	34
Hilton94	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Hilton95	1	0	3	1	1	1	9	7	3	0	2	0	1	0	2	4	0	1	3	0	0	0	0	2	2	0	0	0	0	0	1	3	0	1	48
Hilton97	0	0	2	0	2	0	2	0	0	0	0	0	2	0	2	7	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	22
Miguel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Pool97	0	0	1	0	0	0	3	1	0	0	0	0	3	0	0	5	0	0	0	0	0	0	2	0	1	0	0	0	0	2	1	1	0	0	20
Salsi95	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6
Salsi96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	6
Salsi97	0	0	0	0	0	0	0	0	0	0	0	16	2	0	0	0	0	3	11	1	0	0	0	9	1	0	5	0	2	0	0	0	0	0	50
Malibu	0	0	0	0	0	0	0	0	0	1	0	0	1	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Hilton	0	0	5	0	1	0	4	0	0	0	0	0	2	2	2	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
WhaleRock	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	1	0	0	2	0	0	1	0	0	0	0	1	0	10
NCAstbd	0	1	1	0	0	0	0	0	0	2	0	0	1	1	3	2	4	5	4	2	5	3	3	1	4	1	1	0	1	0	1	2	0	0	48
Total	1	1	12	1	4	1	22	8	3	3	2	19	18	6	13	26	8	14	30	5	7	4	5	16	12	2	9	2	3	6	7	6	1	1	278

APPENDIX I (cont.)

Locus = Oneμ8

	146	148	152	154	156	158	160	162	164	168	170	172	174	176	178	190	Total
Alisal95	0	0	3	0	0	21	0	0	0	0	10	0	0	0	0	0	34
Hilton94	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Hilton95	0	0	2	0	0	35	5	0	0	1	2	2	0	1	0	0	48
Hilton97	0	0	0	0	2	14	6	0	0	0	0	0	0	0	0	0	22
Miguel	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
Pool97	0	0	0	0	0	14	4	0	0	0	1	1	0	0	0	0	20
Salsi95	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	6
Salsi96	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	6
Salsi97	0	0	0	0	0	26	24	0	0	0	0	0	0	0	0	0	50
Malibu	0	0	0	0	0	2	10	0	0	0	0	0	0	0	0	0	12
Hilton	0	0	0	0	0	1	18	2	0	0	1	0	0	0	0	0	22
WhaleRock	0	0	0	2	0	10	19	0	0	0	0	0	0	0	8	1	40
NCAsbd	4	1	0	0	0	16	15	10	2	0	0	1	1	0	0	0	50
Total	4	1	5	2	2	153	103	12	2	1	14	4	1	1	8	1	314

Locus = Oneμ11

	141	143	145	147	149	153	Total
Alisal95	0	0	9	2	0	23	34
Hilton94	0	0	2	0	0	0	2
Hilton95	0	0	22	17	6	3	48
Hilton97	0	0	14	5	1	2	22
Miguel	0	0	1	1	0	0	2
Pool97	0	1	5	8	2	4	20
Salsi95	0	0	1	3	0	2	6
Salsi96	0	0	3	3	0	0	6
Salsi97	0	0	25	19	1	5	50
Malibu	1	0	8	5	0	0	14
Hilton	0	0	12	8	2	0	22
WhaleRock	0	0	32	2	6	0	40
NCAsbd	0	2	32	15	1	0	50
Total	1	3	166	89	19	39	316

APPENDIX I (cont.)

Locus = Oneμ14

	145	147	151	153	155	157	159	161	171	Total
Alisal95	0	11	1	1	10	0	0	11	0	34
Hilton94	0	0	2	0	0	0	0	0	0	2
Hilton95	0	1	8	6	16	12	0	5	0	48
Hilton97	0	2	0	11	0	6	3	0	0	22
Miguel	0	0	0	2	0	0	0	0	0	2
Pool97	0	2	3	4	4	6	0	1	0	20
Salsi95	0	0	0	0	4	2	0	0	0	6
Salsi96	0	0	0	0	2	4	0	0	0	6
Salsi97	1	0	1	2	10	17	5	0	0	36
Malibu	0	0	8	2	0	4	0	0	0	14
Hilton	0	0	4	5	3	12	0	0	0	24
WhaleRock	0	0	2	0	24	8	0	0	0	34
NCAstbd	0	14	10	11	0	8	0	1	2	46
Total	1	30	39	44	73	79	8	18	2	294

Locus = Ots1

	233	237	239	241	243	151	155	159	161	163	165	167	169	171	175	183	185	Total
Alisal95	0	0	1	4	0	17	0	1	0	7	4	0	0	0	0	0	0	34
Hilton94	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2
Hilton95	0	1	2	3	1	2	0	0	2	19	15	2	0	0	1	0	0	48
Hilton97	1	0	0	0	1	6	1	0	0	4	8	1	0	0	0	0	0	22
Miguel	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Pool97	2	0	0	1	0	6	1	0	1	4	5	0	0	0	0	0	0	20
Salsi95	0	0	0	1	0	0	0	0	0	3	2	0	0	0	0	0	0	6
Salsi96	0	0	0	0	0	3	0	0	0	1	2	0	0	0	0	0	0	6
Salsi97	0	0	0	0	0	9	1	0	0	6	28	6	0	0	0	0	0	50
Malibu	0	0	0	1	0	0	0	1	0	6	7	0	0	0	0	0	1	16
Hilton	0	0	0	0	0	0	2	0	0	12	5	2	1	0	1	1	0	24
WhaleRock	0	0	0	0	0	0	0	0	0	12	13	0	0	1	0	0	0	26
NCAstbd	0	0	0	0	0	0	0	7	0	27	14	1	1	1	0	0	1	52
Total	3	1	3	10	2	44	5	9	3	102	105	12	2	2	2	1	2	308

APPENDIX I (cont.)

Locus = Ssa14

	126	128	130	134	136	140	142	144	146	148	150	152	158	166	Total
Alisal95	0	0	2	0	0	0	0	0	1	2	22	7	0	0	34
Hilton94	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Hilton95	0	0	2	6	7	5	0	2	10	0	5	10	1	0	48
Hilton97	0	0	1	3	2	1	0	0	1	0	3	11	0	0	22
Miguel	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Pool97	0	0	2	2	4	0	0	0	3	0	2	7	0	0	20
Salsi95	0	0	0	0	1	1	0	0	2	0	1	1	0	0	6
Salsi96	0	0	0	0	5	0	0	0	0	0	1	0	0	0	6
Salsi97	0	0	0	0	11	0	0	0	4	0	22	13	0	0	50
Malibu	2	1	0	0	0	0	0	0	1	0	5	1	0	0	10
Hilton	0	0	0	7	2	1	0	1	1	1	4	5	0	0	22
WhaleRock	0	0	7	1	0	0	0	0	0	0	7	1	0	0	16
NCAstbd	0	0	2	5	2	3	4	7	2	1	9	13	1	1	50
Total	2	1	16	24	34	11	4	10	25	4	82	72	2	1	288

Locus = Ssa289

	108	110	112	114	116	120	122	124	Total
Alisal95	0	21	10	0	0	2	1	0	34
Hilton94	0	1	0	0	0	0	1	0	2
Hilton95	1	13	11	5	0	11	6	1	49
Hilton97	0	2	7	6	0	1	5	1	22
Miguel	0	0	0	0	0	2	0	0	2
Pool97	0	2	5	7	0	3	3	0	20
Salsi95	0	2	0	2	0	1	1	0	6
Salsi96	0	5	0	0	0	1	0	0	6
Salsi97	0	44	4	0	0	2	0	0	50
Malibu	0	10	5	1	2	2	0	0	20
Hilton	0	11	5	1	0	4	2	1	24
WhaleRock	0	19	17	0	0	0	8	18	62
NCAstbd	0	4	23	4	6	3	6	8	54
Total	1	134	87	26	8	32	33	29	350

APPENDIX II - List of SYRTAC samples by basin and collection code with mtDNA haplotypes.

ation	Inventory #	Fish #	mtDNA
l 1995			
	82	A-05	3
	90	A-13	3
	81	A-04	3
	99	A-22	3
	88	A-11	3
	96	A-19	3
	87	A-10	3
	83	A-06	3
	85	A-08	3
	89	A-12	3
	94	A-17	3
	84	A-07	3
	80	A-03	3
	91	A-14	3
	30	A-02	3
	92	A-15	3
	93	A-16	3
n Cr. 1994			8
n Cr. 1995			
	2	H-02	1
	5	H-05	1
	12	H-12	1
	14	H-14	1
	17	H-17	3
	19	H-19	1
	15	H-15	14
	21	H-21	1
	23	H-23	8
	26	H-26	1
	37	H-29	1
	28	H-23	3
	45	H-37	3
	40	H-32	3
	47	H-39	3
	54	H-46	3
	56	H-48	3
	57	H-49	3
	62	H-54	3
	64	H-56	3
	68	H-60	3
	72	H-64	3
	78	H-68	1
	N/A	H-?	3

Population	Inventory #	Fish #	mtDNA
Hilton Cr. 1997			
	N/A	H-01	8
	N/A	H-02	3
	N/A	H-03	1
	N/A	H-04	1
	N/A	H-05	12
	N/A	H-06	12
	N/A	H-07	8
	N/A	H-08	3
	N/A	H-09	8
	N/A	H-10	8
	N/A	H-11	8
Long Pool/ Spill Basin 1997			
	N/A	41094E4913	3
	N/A	41094960M	12
	N/A	4109650057	8
	N/A	41090D0C2E	3
	N/A	410961517D	8
	N/A	4109512565	3
	N/A	41073A5B6C	12
	N/A	410955DA5C	3
	N/A	40070C2C46	1
	N/A	41095F5901	3
Salsipuedes 1995			
	31	S-01	3
	32	S-02	3
	79	S-04	1
Salsipuedes 1996			
	N/A	SU-01	8
	N/A	SU-02	8
	N/A	SD-02	5
Salsipuedes 1997			
	N/A	SD-02	5
	N/A	SU-02	8
	N/A	SD-03	8
	N/A	SU-04	5
	N/A	SD-04	8
	N/A	SU-05	8
	N/A	SU-09	8
	N/A	SD-05	8
	N/A	SU-11	8
	N/A	SU-26	8
	N/A	SU-15	3
	N/A	SU-16	3
	N/A	SU-18	8

Population	Inventory #	Fish #	mtDNA
Salsipuedes 1997 (cont.)			
	N/A	SD-06	8
	N/A	SD-08	5
	N/A	SD-09	8
	N/A	SD-10	3
	N/A	SU-22	8
	N/A	SU-21	8
	N/A	SU-25	8
	N/A	SU-29	8
	N/A	SU-33	3
	N/A	SU-01	8
	N/A	SU-10	8
	N/A	SU-31	8
San Miguelito 1997			
	N/A	SMD-01	3

APPENDIX III - List of previously published or reported mtDNA haplotypes found in streams of the Santa Ynez basin.

Study	Location	Year	Age	mtDNA haplotypes 1	3	5	6	8	9	10	12	13	14	total
Nielsen et al. 1994b	Alder Creek	1993	juv	2	1	6		6	4			6		25
	Franklin Cr.	1993	juv	2		4	5							11
	Fox Creek	1993	juv			2		12			4	2		20
CDFG (unpub. data)	Hilton Creek	1993	adult					1						1
	Hilton Creek	1993	1+	1	1					1			1	4
	Hilton Creek	1995	1+	5	3			1					2	11
JLN (unpublished data)	Peachtree Cr.	1993	YOY		2									2
ENTRIX (unpub. data)	Jameson Res.	1993	1+	4	7	13		1						25
ENTRIX, Inc. Fish Tech. Report for EIS/EIR Cachuma Project	Hilton Creek	1993	adult	1	2			1		1			1	6
	L. Cachuma	1993	na	3	3	1		2						9
	Santa Ynez R.	'93-'94	adult	1		2								3
	Salsipueses & El Jaro Crs.	1994	juv			12		11						23
USDA FS (unpub. data)	Indian Creek	1996	1+			1								1
	Devil's Creek	1995	1+		1			2						3
Total count				19	20	41	5	37	4	2	4	8	4	144

A REVIEW OF EFFECTS OF WARM WATER TEMPERATURE ON STEELHEAD/RAINBOW TROUT

Appendix G

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

October 2, 2000

Page

List of Figures .... G-ii

1.0 Introduction G-1-1

2.0 Literature Review G-2-1

2.1 Metabolism of Cold-Blooded Organisms G-2-1

2.2 Mortality G-2-2

2.3 Behavior and Performance G-2-2

3.0 Discussion G-3-1

4.0 Conclusions G-4-1

5.0 Literature Cited G-5-1

Page

Figure 2-1. Schematic Depiction of the Range of Thermal Tolerance. G-2-1

Coastal rainbow trout, *Oncorhynchus mykiss*, (but called *Salmo gairdneri* in most of the older literature) has both anadromous and non anadromous populations. Steelhead, an anadromous fish, spawns in freshwater and migrates to the ocean to mature and grow. The non-anadromous populations of this species are called resident rainbow trout. Expression of the anadromous life history strategy is flexible: steelhead can give rise to progeny that go to sea or remain in their natal stream, and the same is true of resident rainbow trout. Also, steelhead and resident trout can be found together in a given stream that is open to the ocean, and are indistinguishable as juveniles. Steelhead trapped behind impassable barriers, such as a dam, can revert to a freshwater-resident lifestyle.

Steelhead return to their natal stream to spawn. For example, fish from Oregon rivers tend not to interbreed with fish from more distant California streams. Over time, differences can evolve among populations. The National Marine Fisheries Service (NMFS) has defined 15 population groups of western United States steelhead, called "Evolutionarily Significant Units" (ESUs), on the basis of geographic range, life histories, and genetic studies. In 1997, the NMFS listed many of these ESUs for protection under the Endangered Species Act. The Southern California ESU, which extends from the Santa Maria River south to Malibu Creek and includes the Santa Ynez River, was listed as an endangered species. Southern California steelhead are presumed to be more tolerant of warm water than steelhead from more northerly stocks because they evolved at the southern limit of trout distribution in North America. This has led to suggestions that steelhead/rainbow trout in southern California should be managed differently than fish of more northern stocks, as regards its thermal tolerances.

Studies by the SYRTAC have shown that summer water temperatures in the main-stem Santa Ynez River and portions of the tributaries can reach temperatures close to levels that are thought to be stressful or lethal to rainbow trout/steelhead (SYRTAC 1997). Water quality guidelines, based on general knowledge of the temperature relations of this species, were proposed with upper limits of 20°C average daily temperature and 25°C daily maximum as providing acceptable habitat conditions. Men daily water temperatures of 22 °C were considered stressful. In SYRTAC studies, these guidelines have been used to evaluate habitat suitability and to identify potentially stressful situations. Rainbow trout/steelhead in the Santa Ynez system, however, have been observed at temperatures around 25°C, which has led to suggestions that these fish could thrive and be healthy at temperatures higher than the proposed guidelines.

Understanding the relationship between water temperature and fish health will be important to the successful management of steelhead/rainbow trout in Santa Ynez River.

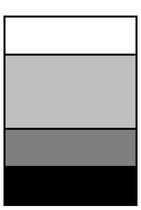
The purpose of this document is first to describe the relationship between temperature and metabolism in cold-blooded animals such as trout. We then review the scientific literature upon which the thermal guidelines were based, and finally examine the possibility of prudent alternatives. This information will be used as the SYRTAC develops a the fish management plan for the Santa Ynez River which will propose management measures and indicate areas where these would be most effective. Water temperature constraints will play an important role in assessing potential benefits to rainbow trout/steelhead of various management actions.

2.1 METABOLISM OF COLD-BLOODED ORGANISMS

Fully aquatic organisms such as fish cannot make their bodies cooler than the surrounding water. There is generally an intermediate range of temperature at which growth and other functions are optimized, and then as temperature rises further, first sublethal deleterious effects occur, and finally upper limits of temperature beyond which the species cannot exist (see, e.g. Fry 1947, 1971, Brett 1956) (Figure 2-1). Fish have widely ranging upper lethal temperatures. For example, some arctic species are known to die at upper temperatures as low as 5°C, whereas many temperate and tropical fishes can survive at temperatures approaching 40°C (Fry 1971). All salmonids (the family that includes salmons, trouts, charrs, and their close relatives) fall between these extremes of upper lethal temperatures.

Cold-blooded animals adapt to changing temperatures by complex biochemical adjustments to cellular membranes, enzymes, etc. An animal allowed to adjust (acclimate) to a warmer temperature can survive to a higher temperature. Within the limits of temperature tolerated by a given species, there are also non-adaptive changes to systems that simply are controlled by temperature. For example, the work of Fry and others showed that both the resting and active metabolic rates of an animal, as measured by oxygen consumption, would generally increase until the upper incipient lethal temperature was reached (the temperature at which half of a group of animals dies). This means that the animal's food requirements similarly increase, to the point that unnaturally high food rations are required to keep the animal from starving at high ambient temperatures. This introduces the concept of thermal resistance, or resistance to lethal temperature. To quote Fry (1947), "(an) animal can exist, often for substantial periods of time, at a temperature level beyond the zone of tolerance, and may frequently do so, particularly during (daily) fluctuations." So for a number of reasons, casual observations of trout living and feeding at temperatures in the range of 24-25°C do not necessarily mean that fish are thriving at these temperatures. The following sampling of the literature on this subject employs experimental and highly structured observational evidence to define upper limits and daily average temperatures likely to be tolerated by steelhead/rainbow trout in the Santa Ynez system.

Lower temperatures <--> Higher temperatures



Optimal range - temperatures for best growth and reproduction
Tolerance range - fish can survive but experience some stress, may not grow and/or may fail to reproduce
Stressful - sublethal deleterious effects occur
Lethal (both upper and lower limits) - fish dies

Figure 2-1. Schematic Depiction of the Range of Thermal Tolerance.

Response to high temperature can be measured by criteria that involve the death of the fish, some behavioral or performance parameter, or a biochemical measure. Studies of temperature-related increases in general stress indicators (Strange *et al*. 1977) or more specific heat-induced proteins in fish blood (Thomas 1990) are not well-enough advanced for the present purpose. Therefore, in the following review, various mortality and behavioral/performance indicators will be examined. Emphasis will be on laboratory studies of rainbow trout/steelhead in which oxygen concentration was maintained at high values, and fish of defined size and age were acclimated to well-defined, high temperatures. Field studies will be mentioned where they are most appropriate to our purpose. Studies of other salmonids are mentioned but not emphasized in this brief review.

2.2 MORTALITY

A common mortality-based measure of upper thermal tolerance is the incipient lethal temperature, or ILT, calculated as the temperature at which half of a group of experimental fish will die. Because fish have a limited ability to adapt to gradually increasing temperature, ILT's increase slightly with acclimation temperature up to an upper limit. This measure of high-temperature tolerance has not been found to vary much within a given species. For example, Bidgood and Berst (1969) tested juveniles of four populations of rainbow trout that homed to different streams in the Great Lakes region. Despite their presumed genetic isolation, all four populations, acclimated to 15°C, had ILT's between 25 and 26°C under the experimental conditions.

A similar set of experiments involved juveniles of a warm-water-adapted rainbow trout and two hatchery strains (Kaya 1978). The warm-water strain were the descendants of rainbow trout planted in the Firehole River in Yellowstone Park, were isolated from other populations, and were known to inhabit reaches of the river where temperatures in summer exceeded 25°C for a few days each summer. Although the Firehole fish tolerated elevated temperatures longer than the two hatchery strains at intermediate acclimation temperatures, the ILT's of all fish acclimated to 21 and 24.5°C were identical at 26.2°C.

2.3 BEHAVIOR AND PERFORMANCE

Fish can be stressed or impaired by a number of factors, including temperature, at levels that do not actually kill the fish but that are outside the envelope of normal performance and positive growth. Given the chance, fish will select a combination of conditions of temperature, oxygen concentration, food availability, depth, etc., that is the best available compromise for survival and growth (Baltz *et al*. 1987).

A west-coast complement to the observations of Kaya is the work of Nielsen *et al*. (1994), who studied juvenile steelhead in streams where warm summer temperatures reached levels normally considered to exceed healthy conditions for this species. In Rancheria Creek (tributary to the Navarro River), where deep stratified pools offered cooler water with high oxygen content, foraging in the main stem decreased and aggressive behavior increased as temperatures rose to 22°C. At that point, fish of all sizes would take refuge in the cooler pool habitat for the warmest part of the day, returning to the main stream when ambient temperature there fell back below 23°C. However, in the Middle Fork Eel River, where stratified pools existed but had low oxygen content, juvenile steelhead were observed actively feeding in 24°C water rather than taking refuge in the cooler pools. These observations are in accord with the results of Cech *et al*. (1990), who showed that hypoxia depressed rainbow trout metabolism at 15°C, but killed the trout at 20°C.

In a classic study, Fry (1948, re-presented in Brett 1956) showed that oxygen consumption in rainbow trout increased up to an ILT of 26°C. The higher oxygen consumption implies greater energy requirements, which must be met by increased food consumption if the fish are to continue to grow. More recently, Myrick and Cech (1996) tested two strains of rainbow trout as well as Kern River golden trout (*Oncorhynchus aguabonita*). These studies, using modern equipment, found lower oxygen consumption in resting fish at 25°C than at 19 or 22°C, perhaps indicating the onset of physiological dysfunction. Follow-up work (Myrick, personal communication) showed that these same fish, when held at 25°C and fed to satiation, did not grow over a 30-day period.

Myrick and Cech (1996) did not measure ILT, but did find that all three strains of trout had identical critical temperature maxima (CTM). The CTM is a useful measure of thermal tolerance in circumstances where large numbers of fish are not available to be sacrificed. Rather than gradually approaching a lethal endpoint, the temperature is raised more rapidly, and the temperature at which half the fish lose equilibrium is noted. In another study employing CTM, Lee and Rinne (1980) found that thermal tolerances of five trout species (rainbow, brown *Salmo trutta*, brook *Salvelinus fontinalis*, Arizona *Oncorhynchus apache*, and Gila *O. gilae*) were all essentially the same. Lee and Rinne also tested these five trout species in fluctuating temperature regimes, wherein the temperature cycled by 6°C over a 24-hr period, and both minima and maxima were raised by 1°C every 48 hrs until all fish lost equilibrium. The rainbow, brown, Arizona, and Gila trout all tolerated a maximum fluctuating regime of 21-27°C, the brook trout, 22-28°C. So in both these studies, where trout species from southern geographic locations might have been expected to be more tolerant of high temperatures, they were found not to differ from other salmonids as regards CMT.

Cherry *et al*. (1975, 1977) performed experiments in which several species of fish, including rainbow trout and two other salmonids (brown trout and brook trout), were acclimated to various temperatures and then introduced into an apparatus where the fish were allowed to choose a temperature. Like ILT, the preferred temperatures of all species tended to rise as acclimation temperature increased. However, all three of the salmonids, when acclimated to temperatures above 20°C, preferred temperatures below the acclimation temperature. The highest non-lethal acclimation temperature for salmonids was 24°C (the next highest acclimation temperature used, 27°C, killed all three species).

Short-term experiments of thermal tolerance and thermal preference all leave out important aspects of ecology and physiology that are essential to real-world trout stream management. To contribute to the maintenance of a population, young fish must not only survive, but also grow and mature. A measure of performance that is most applicable to fisheries management is yield of a population, defined as the net balance between growth and mortality. Hokanson *et al*. (1977), in a series of 50-day experiments with juvenile rainbow trout, concluded that the highest constant temperature at which growth and mortality effects would just cancel was 23°C. They also performed tests in which temperature was caused to fluctuate daily ±3.8°C about a mean. At an average fluctuating temperature of 22°C, growth was not significantly different from zero, and all fish died within ten days. The authors further noted that reports of increased trout mortality at above-optimum (for growth) temperatures were common in the literature.

Some of the increased mortality of rainbow trout exposed to high temperatures is manifested as delayed mortality after brief exposures. For example, Coutant (1973) demonstrated increased susceptibility to predation in rainbows that had been exposed to high temperatures for only 20% of the time necessary to cause observable disorientation and at only 10% of the exposure time that resulted in 50% mortality in the range from 26 to 30 °C. Predation was not a factor in the experiments of Hokanson *et al*. (1977), so presumably other deleterious effects of temperature, such as susceptibility to pathogens or stress-related illness, lead directly or indirectly to death over expended exposure periods.

This sampling of the extensive literature on salmonid thermal biology can be summarized this way:

1. Steelhead/rainbow trout, regardless of acclimation temperature, will not select water warmer than 22°C when given the choice of suitable forage and oxygen content at lower temperature.

2. This species, including those stocks from warm environments, has not attained an incipient lethal temperature (ILT) greater than 26.2°C.

3. The metabolic rate of active rainbow trout (as well as other fish) increases at high temperature, invoking high energy demands that may not be sustained in field situations.

4. There is no evidence that a steelhead/rainbow trout population can experience a net yield (positive growth minus mortality) at daily average temperatures > 22°C.

Southern steelhead live, almost by definition, at the southern extreme of the range of the species along the west coast of North America. It has been suggested by Bennett (1987, cited in Nielsen *et al*. 1994) that high summer temperatures limit the range of all salmonids in California. Similarly, Cech *et al*. (1990) speculated that rainbow trout would not occur where stream temperature exceeded 25°C. In this review we searched for evidence that southern steelhead, or any other genetic isolate, might possibly have evolved greater thermal resistance than other strains of the species. Kaya (1978) did show that at intermediate acclimation temperatures, the Firehole River rainbows had increased resistance times to elevated temperatures compared to hatchery fish. However, the difference vanished at higher acclimation temperatures. In other words, the Firehole fish, when held at temperatures of 17°C or higher, had no advantage over the hatchery fish when exposed to temperatures ≥ 26°C. Southwestern trout species, Kern River golden trout (Myrick and Cech 1996) and Arizona and Gila trout (Lee and Rinne 1980), were not found to have increased resistance to high temperature.

Based on evidence from controlled experiments, it seems reasonable to suggest that steelhead/rainbow trout observed actively feeding at temperatures ≥ 23°C are fish living at the outer edge of their survival envelope. These fish are probably not growing, and in fact are likely experiencing higher rates of mortality from direct and indirect effects of elevated temperature.

SYRTAC have shown that summer water temperatures in the mainstem Santa Ynez River and portions of the tributaries can reach temperatures close to levels that are thought to be stressful or lethal to rainbow trout/steelhead (SYRTAC 1997). Southern California steelhead are often presumed to be more tolerant of warm water than steelhead from more northerly stocks because they evolved at the southern limit of trout distribution in North America. Rainbow trout/steelhead have been observed feeding at temperatures above 25°C in the Santa Ynez system (SYRTAC 1998 and Carpanzano 1996). These observations suggest that steelhead/rainbow trout in southern California have different temperature tolerances than fish of more northern stocks, however, these observations have not been confirmed with laboratory studies. In the physiological studies of temperature tolerance and CTM for trout, increased resistance to high temperatures was not evident in rainbow trout even those living in very warm environments (Lee and Rinne 1980; Myrick and Cech 1996; and Kaya 1978). These studies strongly suggest that the upper lethal temperature for southern California rainbow trout/steelhead may not be greater than that of other steelhead stocks (26.2°C), although southern fish may be better able to tolerate temperatures slightly lower than these lethal limits.

To contribute to the maintenance of a population, young fish must not only survive, but also grow and mature. A fish's metabolic rate increases in warmer water, resulting in increased energetic demands for oxygen and food until the upper incipient lethal temperature is reached (Fry 1948 in Brett 1956, Brett 1971, Fausch 1984). In studies of juvenile rainbow trout, Hokanson *et al*. (1977) concluded that the highest constant temperature at which the effects of growth and mortality balance out was 23°C. They also performed tests in which temperature was caused to fluctuate daily ±3.8°C about a mean. At an average fluctuating temperature of 22°C, growth was not significantly different from zero, and all fish died within ten days.

Water temperature guidelines, based on general knowledge of the temperature relations of this species (e.g. Hokanson *et al*. 1977, Raleigh *et al*. 1984), have been proposed as 20°C mean daily and 25°C daily maximum as acceptable habitat conditions. Based on Hokanson *et al*. (1977), a mean daily temperature of 22°C may be a threshold between acceptable and unsuitable from a long-term metabolic perspective. In the SYRTAC studies, these guidelines have been used to evaluate habitat suitability and to identify potentially stressful situations, such as in the mainstem several miles below Bradbury Dam (SYRTAC 1997).

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COMMENTS ON THE DRAFT FISH MANAGEMENT PLAN (APRIL 10, 1999)

Appendix H

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

October 2, 2000

STATE OF CALIFORNIA-THE RESOURCES AGENCY

GRAY DAVIS, *Governor*

DEPARTMENT OF FISH AND GAME

South Coast Region
4949 Viewridge Avenue
San Diego, California 92123
(619) 467-4201
FAX (619) 467-4299

June 25, 1999

Ms. Jean Baldrige, Senior Fisheries Consultant
Entrix
590 Ygnacio Valley Road, Suite 200
Walnut Creek, California 94596

Dear Ms. Baldrige:

The California Department of Fish and Game (Department) has reviewed the Santa Ynez River Fish Management Plan (Plan). The Department offers the following comments for your consideration.

Overall, the plan describes numerous options that will facilitate meeting the Department's goal of restoring the Santa Ynez River's steelhead population. The Department strongly supports those options providing for restoration and enhancement of habitat conditions in the main stem Santa Ynez, and its tributaries downstream from Bradbury Dam. We encourage continued evaluation of those options that would reestablish steelhead populations upstream of Bradbury Dam. We understand the above dam options have various institutional and technical issues. These issues must be addressed before the above dam option can be considered a viable, integral component of steelhead restoration in the Santa Ynez River (SYR). The Department does not, however, support using artificial means to supplement steelhead populations, such as hatchery programs and spawning channels. The following is detailed discussion of the alternatives we believe would best serve our steelhead restoration goals. We have provided a summary chart of our comments on options 1-36 at the end of this letter.

HILTON CREEK

Restoration and enhancement of steelhead rearing habitat, especially during the warmer spring, summer and fall periods, would substantially increase the potential for steelhead restoration in the SYR. Flow augmentation in Hilton Creek is an achievable, effective means of directly increasing the quality and quantity of rearing habitat downstream from Bradbury Dam. Eliminating existing barriers to fish passage within Hilton Creek would compound the benefits obtainable from flow augmentation by potentially linking spawning habitat with increased rearing habitat effecting increased steelhead production. As such, we have identified flow augmentation and barrier removal in Hilton Creek as high priority alternatives.

MAIN STEM : Flow augmentation and Channel restoration

Flow augmentation and channel restoration in the main stem is another management action potentially improving the quantity and quality of spawning habitat. The flow regime and water availability required to achieve the intended improvements, and the technical and institutional means of providing the necessary regime, will require further evaluation. Such evaluations should be integral components of the Fishery Management Plan.

HABITAT ENHANCEMENT

Habitat enhancement alternatives, specifically alternative numbers 8, 9 and 10 ,should be considered high priority actions. These actions would not only increase habitat diversity and complexity, but also substantially increase the potential benefits associated with increased flows. As such, we recommend that alternative number 8 be added to the Plan. Riparian restoration would strengthen banks, providing structure necessary to develop pools, undercuts and rootwad type habitats, and develop sources of terrestrial based food supplies and woody debris. While this alternative may not directly improve habitat by shading such a wide river and reducing water temperatures, a healthy riparian forest could provide sufficient shading when flows are low and follow the stream bank. A healthy riparian corridor is essential to the integrity of a healthy fluvial system and should be targeted in a plan intended to improve instream habitat conditions, and overall system health. The Bureau of Reclamation(BOR) WR94-5 Vegetative Management Study (not yet released) would provide some of the analysis needed to develop riparian vegetation enhancement possibilities.

Steelhead spawning and rearing habitat may also be increased by extending the channel of lower Hilton Creek, as represented in alternative number 33. If feasible, the channel extension would further capitalize on flow augmentation in Hilton Creek. As a participant in the Hilton Creek Working Group, the Department supports the concept of a channel extension but also acknowledges that ongoing evaluations need to be completed to determine if sufficient surficial flow of suitable quality can be maintained in either of the proposed channel alignments to provide the desired habitat benefit for steelhead. As such, we have given this management alternative a conditional high priority status.

Fish passage is another critical component of anadromous fish habitat. Removing barriers in tributaries presently or potentially possessing suitable rearing and spawning habitats is an effective, direct means of increasing habitat availability, per the discussion above on Hilton Creek. A discussion of the other tributaries downstream from Bradbury Dam, relative to potential restoration, including barrier removal should be included in the Plan. The Department has provided extensive input on which tributaries might be suitable, and as a part of the Working Group will continued to help develop this option.

Low flow conditions in the main stem can present passage problems to both upstream and downstream migration. Flow augmentation could minimize or eliminate most fish passage problems in the main stem downstream of Bradbury Dam.

Fish passage around Bradbury Dam (Alternative 17) should be considered a viable option pending the outcome of the following considerations: 1) actions taken downstream, 2) evaluation of the technical feasibility of providing successful passage, and 3) evaluations of the potential impact of reintroducing steelhead into the upper system. Trapping and trucking fish over an existing impediment to migration such as Bradbury Dam is not considered to be in conflict with the Department's Steelhead Policy, per the California Steelhead Management Plan. Of the five trap and truck options (Alternative 35,36,39,40 and 46), however, there is some confusion on our part as to how these differ, and why some are acceptable and others are not. For the discussion of trap and truck options to go further, it will be important to distinguish among each of these alternatives, with the advantages and disadvantages clearly delineated.

Thank you for the opportunity to review this document. If you have any questions regarding our comments, please contact Ms. Morgan Wehtje, Department of Fish and Game, 1933 Cliff Drive, Suite 9, Santa Barbara , California 93109, or by telephone at 805-491-3571.

Sincerely,

C F Raysbrook

C. F. Raysbrook
Regional Manager

cc: Department of Fish and Game

Ms. Morgan Wehtje
Santa Barbara

Mr. Dwayne C. Maxwell
Long Beach

Mr. Bill Snider
Sacramento

Mr. Rob Titus
Sacramento

Mr. Maurice Cardenas
Santa Barbara

Alternative	Comment
1	Agree. Conjunctive use of water rights releases and Fish Reserve Account water will provide an increase in year-round spawning and rearing habitat.
2	Agree. Direct recharge of ground water will have uncertain benefits for fish habitat.
3	Agree. Managed flood controlled spills will have low biological benefit
4	Agree. Additional mainstem flow releases from the Fish Reserve Account will have an overall benefit to aquatic resources.
5	Agree. Reservoir surcharge will provide additional water for habitat maintenance
6	Agree. Purchase of water rights has limited potential
7	Agree. Option to recirculate water is not feasible
8	See specific comments in text. Should be included as an alternative
9	Agree. Option needs some discussion of possible drawbacks or habitat parameters of subject pools.
10	See number 9
11	Agree. Option should recognize future possibility of adding spawning gravels under a set of well defined conditions.
12	Agree. Conservation easements would require landowner participation.
13	Should include all known barriers on the lower SYR mainstem and extent of impediment to migration.
14	Agree. Breaching of SYR lagoon will have low biological benefit, and undetermined affects.
15	Agree. A fish ladder is not feasible at this time.
16	See 15
17	See specific text. Relocation while not in conflict with DFG policy may have "institutional" obstacles
18	See 17
19	DFG does not consider this option feasible. Wholescale removal would have the potential to harm Steelhead, and would have, at best, a temporary effect on targeted warmwater species. All requests to remove fish species from the SYR should be reveiwed by NMFS, USF&WS, and DFG.
20	Refer to current DFG angling restrictions on the SYR

21	Not an acceptable option. DFG policy on native trout populations needs to be addressed prior to planning this management alternative.
22	Broodstock supplementation should not be considered at this time.
23	See 22
24	Currently in review by NMFS and DFG to determine feasibility.
25	Agrees. Purchase of water rights for resource needs would have low success potential.
26	DFG is currently evaluation operation limits of pumping water from Cachuma into Hilton Creek. DFG supports the watering of Hilton Creek by the siphon method.
27	Agree.
28 .	Agree.
29	The plan should identify tributaries and their proposed instream structures or enhancement benefits. The proposed structures should be prioritized based on cost benefit or other considerations. A streambed alteration agreement will be required for these proposals.
30	Agree. Refer to number 29 for additional comments
31	Supports conservation easement participation by landowners
32	Refer to Number 29
33	Refer to Number 24
34	Refer to Number 24
35	See specific text.
36	Agree
37-46	See specific text.

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June 29, 1999

VIA FACSIMILE

Jean Baldridge
Entrix, Inc.
590 Ygnacio Valley Road, Suite 200
Walnut Creek, CA 94596

Re: Comments on Draft Lower Santa Ynez River Fish Management Plan

Dear Jean:

The City of Lompoc submits the following comments on the draft Lower Santa Ynez River Fish Management Plan:

Volume I: Management Plan

No comments at this time.

Volume II: Appendices

Page B-1-1: The last bullet point should be amended as follows:

> ". . . maintain groundwater recharge requirements as set forth in WR 89-18 and WR 94-5, or as amended by the SWRCB (downstream water rights)."

Page B-2-1: Table 2-3 should provide some quantification or definition of the terms "relatively abundant," "relatively common" and "present but in low numbers."

Page B-3-3: The discussion in Section 3.3 on Downstream Water Rights needs to be rewritten as it mischaracterizes the downstream water rights and WR 89-18. The following must be deleted from the report as it misstates the nature and origin of the downstream water rights:

> "Current water rights for users downstream of Lake Cachuma were set forth by the SWRCB in 1973 (WR 73-37), as amended in 1989 (WR 89-18). These water rights and their associated releases from Lake Cachuma are principally structured by creating two accounts, and accruing credits (storing water) for the above and below Narrows areas in Lake Cachuma."

The downstream water rights are appropriative and overlying groundwater rights that were acknowledged by the State Water Resources Board ("SWRB") in Decision 886. Neither the SWRB nor the SWRCB has conferred any water rights on the downstream water right holders. WR 73-37 and WR 89-18 are orders that require Reclamation to release water to protect the existing downstream water rights.

Please inform me if Lompoc's comments and changes are not acceptable and if they are not to be included in any future version of the Fish Management Plan. In the meantime, please do not hesitate to contact me if you have any questions regarding this matter.

Very truly yours,

Donald B. Mooney
Attorney

DBM:sb

cc: Gary Keefe
Sharon Stuart
Stuart L. Somach
Paula Landis

Ed Henke
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June 21, 1999

Ms. Jean Baldrige, Project Coordinator
Santa Ynez River Fisheries Technical Advisory Committee
Entrix, Inc.
590 Ygnacio Valley Road, Suite 200
Walnut Creek CA 94596

Subject: COMMENTS REGARDING TAC'S LOWER SANTA YNEZ RIVER FISH MANAGEMENT PLAN, VOL. 1 MANAGEMENT PLAN AND VOL. 2 APPENDICES, APRIL 10, 1999

Dear Ms. Baldrige:

My wife and I just returned from the coast, and your letter of June 2 and enclosures were among over two weeks of accumulation. Thank you for your kind acknowledgement of my letter and enclosure to you regarding what I determined to be the general public's invitation to comment on your group's recommendations for the restoration of the historical cold-water aquatic resources of the Santa Ynez River System, both flora and fauna.

Again, time constraints and other will not allow me to comment fully and directly to the voluminous amount of information you forwarded to me on June 2, 1999. I am just completing months of comment work on CRITICAL HABITAT DESIGNATIONS for the National Marine Fisheries Service. Please consider all comments made in my EIS for the **Cachuma Project** forwarded to you on May 18, which has great relevance, as well as the following very generalized outline statements developed after a cursory run-through of your two voluminous amounts of your stated management alternatives, etc., forwarded to me on June 2, 1999...

Generalized Comments and Statements

- There will be "hard **science**" challenges to your alleged assumption that the "Fish Management Plan" alternatives as proposed will not adversely affect listed "**threatened**" or "**endangered**" **species**... I would join such "**hard science**" challenges regarding such an assumption.
- The "**fish reserve account**" violates present/prior Public Policy decisions, the most obvious being **Section 5937 of the California Department of Fish and Game Code.**
- There's nothing in the two documents that, through "**hard science**" scrutiny, can justify the so-called water flow release regimens as recommended from Cachuma Dam (Bradbury) that will guarantee the restoration or prevent extirpation of "**threatened**" or "**endangered**" cold-water aquatic resources of the Santa Ynez River, flora and fauna. It would not pass muster or fit within the guidelines of "**conservation**" as defined under **Section III-3** of the Federal Endangered Species Act: quality, quantity, temperature, pulse flows, etc.
- I found no quality mitigation and restoration efforts proposed regarding the Santa Ynez River's historical and extensive estuarine system. Under the **Federal Clean Water Act** and its "**303-D Impaired Water Body Standards**," one would no doubt find the Santa Ynez River estuarine system receiving a failing grade.

RECEIVED

JUN 18 1999

ENTRIX, INC.
(FRONT DESK)

E.D.C.
ENVIRONMENTAL
DEFENSE CENTER

June 17, 1999

Robert Almy
Santa Barbara County
Water Agency
123 E. Anapamu Street
Santa Barbara, CA 93101

Jean Baldridge
ENTRIX, Inc.
590 Ygnacio Canyon Road
Suite 200
Walnut Creek, CA 94596

Dear Rob and Jean:

The Environmental Defense Center (EDC) appreciates the opportunity to provide input into the development of the Lower Santa Ynez River Fish Management Plan. We have reviewed the draft Plan, and submit the following comments for your consideration, response, and incorporation into the final version of the Plan as appropriate. The comments are intended to improve the Plan and facilitate successful restoration of steelhead in the river.

Executive Summary

In the third paragraph, the Plan tries to express the broad public and agency involvement and consensus in the Consensus Committee process, the MOU, and development of the Plan. It should be noted in the Plan, however, that while there has been broad involvement, that there has been substantial disagreement over basic key issues such as what "providing a reasonable balance" means or if that is appropriate, whether or not the upper basin should be analyzed for its potential to help protect and recover the steelhead population, whether the goal should be to study and maintain the species or to restore it, and whether or not 2,000 acre feet per year (AFY) is adequate to accomplish either goal.

Therefore, we would suggest some minor edits to the third paragraph on page EX-1. Specifically, the text should state which entities are signatories to the MOU, and which entities (including the EDC and other environmental groups) selected not to sign the MOU but have been involved by "closely monitoring the process."

In the second paragraph under Steelhead and Their Habitat on page EX-2, we suggest the following changes (proposed additions are underlined):

"<u>Other than the area fed by the Lompoc Wastewater Treatment Plant,</u> there is often little or no flow in <u>segments of</u> the mainstem below Cachuma Reservoir and in <u>the lower reaches of</u> the tributaries below Bradbury Dam from August until the onset of the rainy season."

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Please note that most of the river above Cachuma Reservoir is perennial, and long reaches of the tributaries above Cachuma are also perennial. It may also be important to state that, while at times there is no flow, there are segments of the river and tributaries that sustain isolated pools without flows connecting them.

"Even before construction of the dams in the basin, portions of the mainstem below the dam typically dried during the summer. As a consequence, steelhead historically used the lower mainstem as a migration corridor to reach spawning habitat in the mid and upper basin, and in portions of tributaries that maintained perennial flow."

In the next paragraph at the top of page EX-3, the first sentence should be augmented by the phrase "in more northerly streams." The thermal criteria referenced were largely developed through studies of more northerly steelhead populations.

The end of this paragraph should have the following clause added: "yet steelhead/rainbow trout have survived under these conditions." Otherwise this portion of the Plan makes it sound like the fish cannot survive in these locations when in fact they have.

The following paragraph discusses the purpose of the Plan. It "responds to concerns about providing a balance ..." It would be more accurate to state that the Plan "responds to concerns about the failure to maintain habitat conditions to keep steelhead in good condition, and to prevent the extirpation of the Santa Ynez River steelhead run." These were the concerns raised by CalSPA in its various challenges of the water rights permits held by the Bureau and south coast water agencies, and it is these challenges that the plan is ultimately being developed to respond to. We recommend that the same sentence continue to state: "as well as evaluates and recommends flow and non-flow related actions that reduce the Cachuma Project's impacts to fish and fish habitat."

Instead of "provide a high benefit," page EX-3 of the Plan should state in the same paragraph "offset impacts of the Cachuma Project."

We fail to see why the Plan needs to state that the management actions "are consistent with water supply availability" when it says that all management actions are "nonflow-related." The plan does include flow related options.

One option that must be included but is not is water conservation. Water conservation increases the amount of water available for fish restoration, and thus makes more options "consistent with water supply availability." Why does the Plan not include water conservation as an option for fish habitat improvement, and can it be added?

In the Executive Summary on page EX-5, the section entitled Create New Habitat would be more appropriately titled Restore Habitat. In this section, reference is made to the provision of

2,000 AF in years when the reservoir holds more than 100,000 AF, and less than 2,000 AF when there is less than 100,000 AF of storage. The County and Entrix should be aware that, in terms of environmental review under CEQA for this project, the baseline condition is the condition at the time environmental review is initiated. (CEQA Guidelines Section 15125) In this case, an EIR is being initiated currently, and therefore the current baseline conditions are those existing now. The current conditions include 2,000 AFY of water pursuant to the MOU. Thus, the provision of 2,000 AFY, in terms of CEQA, is not a beneficial impact for steelhead. Similarly, the provision of less than 2,000 AFY would be a detrimental impact under CEQA pursuant to the recently amended CEQA Guidelines addressing baseline conditions.

Surcharging of the reservoir means that there will be fewer spills to facilitate steelhead migration. How many less spills will occur as a result of surcharging the reservoir by .75 feet, by 1.8 feet and by 3 feet, and how will this affect steelhead? Also, the duration and magnitude of spills will be reduced. How will this affect steelhead? A detailed hydrological analysis of these issues is warranted before a decision is made to surcharge the reservoir by increasing the height of the flashboards or otherwise modifying the dam. Once a hydrological assessment is made, a biological impact analysis of the reduced flows on steelhead must be undertaken to understand if, in an effort to improve conditions for steelhead, adverse impacts may result. Raising the height of a dam and in the process reducing the frequency, duration and magnitude of the spill events (that have enabled steelhead to survive) in an effort to benefit steelhead may have the opposite effect.

A variation on this measure would allow for some spill to occur at elevation 750', but in a controlled manner that allows surcharging to occur concurrently with the spill event. This may be the best of both worlds - not preventing the spill from occurring and at the same time storing water for future fish releases. W suggest that this modified surcharge scenario also be analyzed in the environmental review document for any changes to the permit conditions pursuant to WR 94-5 (i.e. the upcoming EIR) as an alternative or as a mitigation measure to reduce the impacts of reduced spill events on steelhead.

On page EX-6, under Improve Existing Habitat, the Plan should specify what structural improvements are contemplated to increase the amount and quality of steelhead habitat. Just below this, the Executive Summary addresses improving access to habitat. Number 3b discusses the cascade on Hilton Creek, but the Plan does not discuss modifying the Highway 154 bridge on Hilton Creek. This structure also may partially or completely block steelhead migration to several miles of suitable steelhead spawning and rearing habitat, and should be addressed in the Plan.

The next page, EX-7, discusses increasing public awareness. One way to do this is to increase enforcement. By increasing enforcement against poachers and landowners and agencies that violate relevant environmental laws, funding can be brought in to do more public outreach and restoration. Enforcement actions typically require violators to improve habitat as a means of offsetting impacts, so increased enforcement can facilitate restoration actions on private and other lands. Additionally, by publicizing every citation issued and fine levied, fewer people may be willing to risk the repercussions of illegally fishing for steelhead in the watershed and modifying streams without permits.

Under Implementation on Page EX-7, the Plan states that a Fish Reserve Account can be established immediately, however, this has already been done. As noted above, the baseline conditions for the purposes of CEQA are those that exist now, and this includes the 2,000 AFY.

On the last page of the Executive Summary, "the remaining management actions" that will be completed are listed in the last three bullets on the page. Unfortunately, by including the wording "and / or," the text currently states that not all of these actions may be taken. The word "or" should be deleted from the text in the final version of the Plan.

The final paragraph in this section, immediately above Funding, describes conservation easements along El Jaro Creek, and states that the easements will protect 6 to 8 miles of the creek. Please explain how the conservation easements would protect these creeks which are already protected by a host of local, state and federal regulations and policies. For instance, El Jaro Creek and its surrounding riparian buffer area is already protected by mandatory General Plan provisions. Fish and Game Codes prevent the modification of the stream without a Streambed Alteration Agreement and careful review by the DFG. The federal Clean Water Act prohibits discharges into the stream, including the discharge of fill or dredge materials, and the Endangered Species Act precludes activities anywhere near the stream that would threaten to impact steelhead trout. Thus, it is hard to imagine what additional protection for the streams and steelhead conservation easements could provide.

It is true that existing agricultural operations including row cropping and grazing are adversely affecting the streams. This could be reduced if large setbacks were established along the creek's buffer areas. The conservation easements thus, to be effective, must extend well away from the riparian areas and top of banks, perhaps on the order of at least 200 feet, to be effective, and must prohibit the harmful activities stated above. Otherwise, the creeks are fairly well protected now and placing them in conservation easements may not add to the existing protection.

Introduction

On page 1-1, the Plan states that it was developed in a consensus-based process by local, state and federal agencies, environmental groups, landowners and other interested parties. This is not, however, the actual case. For one, our group, while we are very supportive of steelhead restoration, does not support the entire Plan as currently written, and we believe that is true for other groups and likely for some landowners as well. This self described consensus-based process is an attempt to make it appear that all involved believe this Plan is the solution to save steelhead, but that is not the case. The process was and is an attempt at consensus building, but cannot be accurately described as a consensus process because involved interests disagree over the measures and their potential for success. The text should be changed in all appropriate locations to reflect the attempt at consensus, rather than to incorrectly describe the process as a true consensus.

Page 1-3 lists the "organizations and agencies" that, while not MOU signatories, are participants in the SYRTAC. The Plan should specifically state that these groups and agencies selected not to sign the MOU.

In Section 1.2, the goal stated should be expanded to include "reduce the impacts of the Cachuma Project" in addition to benefiting fish and other species. Just below these objectives, the section on constraints and limitation should be augmented. "The opportunities for implementing management actions are constrained by several factors," according to the Plan. In addition to those listed, the more obvious constraints include: 1) the existence of water projects and water diversions in the river; 2) the lack of effective water conservation programs; and 3) the fact that the dam is a major migratory barrier. Implementing management actions would be far less constrained if it were not for these three factors. Therefore, they should be listed in addition to the five included.

In the first paragraph on page 1-4 of the Plan, it is stated that, "Actions on private lands will be implemented only through voluntary participation by private landowners." There are permitting and enforcement cases, however, when regulatory agencies can require certain restoration actions to be implemented on private lands, so the foregoing statement is not entirely accurate. The Plan should also mention the ability of regulatory agencies to take advantage of restoration opportunities through their permitting processes (i.e. permit conditions) and through the enforcement of violations of local policies and zoning ordinances, and state and federal laws, such as the Fish and Game Codes, the ESA and the Clean Water Act. These situations may be the most useful opportunities to get real restoration actions on private lands to benefit steelhead, but the Plan fails to recognize this. The second bullet under Adaptive Management Strategy gets at this issue, but the Plan would be clearer to explicitly express when agencies can and should be involved in restoration on private lands, where a majority of the habitat in the Lower Basin probably exists.

Proposed Management Actions

Some of the options in Appendix A which were not carried further for additional analysis merit closer attention. For instance, Option 2 was discarded because it had "uncertain benefits for fish habitat." For this reason, it should be analyzed in more detail, perhaps in the EIR, to see what those benefits may be. Options 6 and 25 were discounted because there is reportedly not water available for purchase. How much effort was put into attempting to purchase water? These options would have significant benefits for steelhead, and it may be that water is available if the price offered is great enough. Please provide more detail regarding why these options were not pursued further, and an explanation of why no water is available for purchase. Could it be that water would be available if the price per AF was higher?

Options 12 and 13 are not being proposed because of a reported lack of landowner interest. In terms of CEQA review, alternatives cannot be dropped merely because the project sponsor does not own the land (*Citizens for Goleta Valley v. Santa Barbara County*). Based on this, we feel it appropriate to analyze these options in more detail in the Plan or the environmental review document that is forthcoming. Lastly, Option 22 seems to warrant additional investigation. The EDC is aware of no institutional obstacles to this option, and the US Forest Service would likely be supportive of such an approach.

On page 3-1, the statement is made that "The majority of rainbow trout/steelhead habitat is located on private property." While this may be true in the lower section of the river's watershed, mush of the steelhead/rainbow trout habitat in the entire watershed appears to be located on public properties.

The Plan, on Page 3-2, lists the objectives of the management actions. It would be appropriate to include in this list the following: "mitigate impacts of the Cachuma Project." Considering that the Santa Ynez River population of steelhead is endangered largely as a result of Bradbury Dam and the Cachuma Project, mitigating the impacts of the project and the dam in order to maintain and recover steelhead is one of the objectives of the Plan.

Under Types of Actions, on page 3-3 the Plan addresses fish passage in tributaries. The Plan should specify the modification of the barrier at Highway 154 and Hilton Creek just as it specifies the "small cascade" on Hilton Creek. If the Plan is to be specific regarding certain impediments, then it should be consistent and mention other known barriers.

Page 3-4 describes some of the numerous constraints that work against implementation of the management actions. One such constraint that we feel should be specifically called out is the presence of Bradbury Dam. The dam is a limitation on the types of management actions that can be pursued. For instance, if the Cachuma Project were a surface diversion with no impoundment, then management actions dealing with the upper basin would be more feasible. Thus, the presence of the dam should be referred to a major constraint on the types of actions that the Plan deems as feasible.

Page 3-5 makes an interesting distinction between those actions that can be implemented by Reclamation or the water agencies without cooperation from landowners and/or other agencies. While we recognize that, in some cases, it may be easier to implement actions that are solely under the discretion of the Bureau and/or water agencies, that is no reason to make a blanket statement that those actions are higher priority than actions requiring coordination with other agencies. A case in point is the set of actions that deal with upstream sections of the watershed. The US Forest Service is a very willing and cooperating agency. Yet since actions that involve the Forest Service are defined as lower priority because they require cooperation with other agencies, they may not be pursued.

The distinction between actions that can be done by the Bureau or water agencies and those that require additional coordination is an artificial distinction that in some cases may work against the ultimate goal of the Plan. Each action should be considered on its merits and individual feasibility. A more appropriate classification system is as follows: Actions that require coordination with unwilling or uncooperative landowners or agencies are lower priorities because of the difficulty of getting everyone to agree. Actions that require coordination with cooperative agencies or landowners would become higher priorities. If actions that require coordination with others are feasible and effective, they should be placed as high priorities.

An example is the modification of the Highway 154 culvert at Hilton Creek, which requires coordination with CalTrans. It is an important restoration action that should not be a low priority merely because it requires coordination with CalTrans, especially when CalTrans would likely be supportive. Another example is the downstream transport of outmigrating juvenile from the upper basin. This option may help achieve the goals of the Plan because the relatively healthy population of the species from above the dam could be tapped to augment the small population below the dam, and possibly increase the anadromous population. It only requires coordination with the cooperative US Forest Service, and thus should not be classified as a low priority, but should be vigorously pursued if analysis (in the EIR or elsewhere) shows it has merit. While the working group for this option suggests a wait and see approach, EDC believes it would be fruitful to tag and transport native fish from above the dam to below, to see if they move to ocean and back and augment the anadromous portion of the population.

Conjunctive Use of Water Rights Releases and Fish Reserve Account
The term "improve" is used extensively throughout this section of the Plan, implying that this management option will result in better conditions for steelhead. However, the term improve is relative to the baseline condition against which change is measured. As stated previously, the baseline conditions for CEQA purposes are as they exist today. This includes the 2,000 AFY of the MOU. This management option envisions allocating less than 2,000 AFY during 29.3 % of the years. That means that this management option will degrade conditions for steelhead as compared to the CEQA baseline conditions almost one third of the time, representing an adverse impact compared to CEQA baseline conditions. This option also includes providing more than the existing 2,000 AFY for fish and the river about one third of the years. Therefore, on average, this option essentially maintains the status quo for steelhead and the river compared to baseline conditions. In some years there will be more water than is currently allocated and in some years there will be less available than is currently required by the MOU. The use of the word "improve," while perhaps accurate if comparing the proposed action to the pre-MOU historic conditions, is not applicable when speaking in terms of the CEQA baseline conditions. Similarly, the statement on page 3-12 that "this flow will substantially increase the amount and quality of habitat in this reach," is only correct if the pre-MOU baseline is used as the benchmark. Since these options will be analyzed in a CEQA document, we believe that the CEQA baseline must be used.

This option also includes the Reservoir Surcharging component, which as described above, has the potential to adversely affect steelhead by reducing the frequency, magnitude and duration of spill events. Additionally, by providing releases of water, this option will benefit non-native fish which compete with prey upon steelhead. Thus, an analysis of the relative impacts and the relative detriments to steelhead is necessary to ascertain what the net residual impact will be after the positive and negative effects are weighed.

Table 3-2b illustrates the release rate under different reservoir storage scenarios. Do these figures include the leakage from the dam, which is an important factor and part of the baseline conditions which have enabled steelhead to survive in this system despite construction of Bradbury Dam? Inclusion of the leakage in these figures would represent a decrease in the amount of water available for steelhead, since the existing 2,000 AFY allotment does not include the leakage, and leakage is part of the existing baseline. Please specify the relationship of the leakage to the proposed release schedule.

On page 3-9, the Plan states that Hilton Creek has "much better habitat for steelhead" than the mainstem does between the dam and Hilton Creek. While this section of the mainstem has non-native predators, it also has factors which make it potentially better habitat for steelhead than Hilton Creek. Specifically, it has a healthy riparian canopy, shading, plentiful food sources, gravel and pool habitats. Please explain in more detail why the first and second priorities were assigned as they were.

Hilton Creek Habitat Enhancement
The modification of the potential migratory barrier at Highway 101 involves coordination with CalTrans, but would open up substantial, quality habitat for steelhead on some private property and in the National Forest, where the stream is perennial. This action may be one of the most productive actions that we can take to restore steelhead below Bradbury Dam. It is imperative that this action be specified in the Plan. Modification of the CalTrans structure, if appropriate from a biological standpoint and technically feasible, should not be considered low priority, and is an essential component of steelhead restoration in the river drainage. Table 3-3 mentions this barrier, but the text, on page 3-32, fails to mention correction of it. This is a glaring omission that should be corrected in the final Plan.

The extension of Hilton Creek may create more habitat for steelhead, but at the same time, it may reduce the flow of water into the River in the section between the existing confluence and the proposed confluence, and this could adversely affect steelhead habitat in that section of the river. A full analysis of the adverse impacts, as well as the beneficial impacts should be undertaken, perhaps in the context of the EIR, to determine its relative benefits for steelhead. In any case, if it is pursued as a viable, beneficial option, then there needs to be some sort of mechanism, such as a steelhead-friendly cascade, to prevent movement of bass and catfish into Hilton Creek.

Removal of Predatory Fish

This restoration action is only considered as part of the fish rescue action, however it is a stand alone option that should be called out as an independent action and be recommended as part of the Plan. This action would have benefits that would be realized with or without fish rescue operations. In 1992, hundreds if not thousands of young of the year (YOY) steelhead were observed in the mainstem below the stilling basin and below the long pool, in an area infested with bass and catfish. This information was ultimately reported to the SYRTAC. Loss of steelhead YOY by predatory relationships with non-native fish is recognized as a problem for the existing steelhead population in the river according to the biological studies in the SYR Consensus Committee compilations reports. Therefore, whether or not fish rescue is implemented, the removal of predatory fish in select areas of the mainstem may have profound benefits for steelhead. This action needs to be put forth independent of fish rescue because it does not rely on fish rescue to be successful.

Fish Rescue Relocation Sites

In terms of fish rescue, sites in tributaries below the dam should be considered and mentioned in the Plan. Currently the Plan states that "the most likely relocation site is the Long Pool and mainstem between Bradbury Dam and the Long Pool. These areas do have non-native predatory fish that would need eradication or removal. However, other tributaries, such as Quiota and Miguelito, where relocation has occurred in the past, and upper Hilton and San Lucas Creeks in the Los Padres National Forest contain good habitat on public lands where no predatory fish exist. Therefore, the Plan should be modified to refer to "tributaries below Bradbury Dam" as potential relocation sites.

Public Outreach and Education

This category of actions to aid in the recovery of steelhead on the river should also include increased enforcement of existing laws and policies. It is not difficult to identify numerous unpermitted private projects such as streambed alterations, water diversions, and land use operations that do not comply with local zoning and Comprehensive Plan policies, Fish and Game Codes, and federal laws such as Section 404 of the Clean Water Act. Increased enforcement of these violations is imperative to the well being of southern steelhead in the watershed. While regulatory agencies may not be able to access private land unless there is reason to believe a violation is occurring, frequent aerial photographs can be taken of key areas to try to identify illegal actions that threaten steelhead and their habitat. Therefore, we believe that increased enforcement should be included in this section of the Plan, or as a stand alone action.

Actions in Cooperation with Other Agencies and Landowners

As stated above, the distinction between actions that can be undertaken by the Bureau and / or water agencies and those that require coordination with other agencies or landowners, and the high priority placed on the first category of actions does not serve to promote the best options for steelhead restoration. Certain actions that may be very viable have automatically been placed as low priorities solely because they require additional coordination. Perhaps a better distinction would be between those actions that require coordination with an unwilling agency or landowner, and those that require coordination with a willing landowner or agency. This is an important distinction. Such projects like modification of the Highway 154 barrier on Hilton Creek would likely be in the latter category, and should be high priority actions, while those with clearly unwilling landowners should be placed lower on the scale of feasibility, and pursued only in light of a permit condition placed on the landowner or agency, as part of an enforcement action in case there was a violation identified, or when and if the landowner/agency becomes willing.

Conservation Easements
To be effective at protecting and improving steelhead habitats in tributaries, conservation easements must include relatively wide swaths of land bordering tributary streams because the streams and riparian habitats are already protected. Stating that the water agencies or COMB has purchased or will purchase conservation easements along 6 or 8 miles of a steelhead stream sounds good, but the practical benefit for steelhead is minimal if there is little or no change in the level of protection afforded that area. The significant impacts to steelhead from erosion and sedimentation associated with agriculture must be dealt with in the areas surrounding creeks, not only within the creeks themselves. We suggest that the water agencies- and COMB-funded voluntary easements be as wide as possible and restrict grazing and cultivated agriculture where those activities are contributing sediment to steelhead streams, or those that may in the future support the species.

Riparian Enhancement
As noted above, all actions on private lands do not necessarily require landowner cooperation when they are imposed as permit conditions, or to mitigate the impacts of identified violations. Thus, actions such as riparian restoration, barrier removal, etc., should be imposed as permit conditions whenever landowners propose and gain approval for actions in or near creeks that could impact the creeks or steelhead.

Tributary Passage Barrier Removal
EDC staff has witnessed steelhead jump the concrete apron at the Highway 1 bridge over Salsipuedes Creek under moderately high flow conditions (estimated at several hundred cfs). "Correction" of this "barrier" should not be viewed at an important restoration action because it is passable, although perhaps not during lower flow conditions when steelhead may or may not be moving upstream. Instead, known complete barriers blocking access to substantial habitats should be removed/modified. Efforts should focus on those likely to have the most benefit to steelhead. The Highway 154 culvert at Hilton Creek is not mentioned in the text, but is likely to be a severe limiting factor for steelhead once the cascade on Bureau property is modified for fish passage. This culvert should be mentioned other than just in Table 3-3. Merely because some of passage barrier projects may require coordination with agencies, and in <u>some</u> cases landowners; these actions should not be classified as lower priorities than those actions that the Bureau or water purveyors can take themselves. They should be high priority actions because they hold much potential benefit and because coordinating agencies, such as

Santa Barbara County Roads Division, as stated in the Plan, have already committed to working with the Bureau and SYRTAC.

Genetic Protection of Southern Steelhead Stock

The options of stocking Cachuma Reservoir with native fish and/or stocking it with sterile trout should be more closely examined in the EIR to determine the feasibility and benefits of such a program. Continuing the practice of planting non-native trout in the reservoir will continue to adversely affect the steelhead population through genetic dilution. Similarly, the downstream relocation of juvenile native landlocked steelhead to below the dam should be evaluated as an alternative or component thereof at a project level of detail in the EIR to assess the relative benefits and impact reduction potential.

Evaluation of Potential Impacts and Benefits

The last sentence on page 4-1 states that the "proposed conjunctive use operations will likely provide a substantial benefit to the rainbow trout/steelhead population relative to historic conditions." On page 4-12, however, it states that "the Fish Reserve Account and the downstream water right account have been used conjunctively since 1993." Conjunctive use, in fact, is not a proposed new action, but is part of the existing set of conditions that water and resource management actions have resulted in. For the purposes of CEQA review, which any changes to the permit will be subject to, the baseline is the existing condition, not the "historic conditions." Therefore, while there may be some benefit to steelhead relative to the pre-1993 conditions, compared to the existing conditions, conjunctive use is merely maintaining the status quo, and no beneficial impact can be claimed as a result of it.

Since the FRA exists, the only potential benefit to steelhead and the river associated with increased flows would come from additional, new surcharging, and as described herein, surcharging has the impact of reducing winter/spring flows necessary to cue and facilitate steelhead migration and spawning. The net biological impact of surcharging, whether adverse or beneficial, is still an open question that requires further analysis in the EIR. Surcharging will add to summer and fall flows at the expense of winter and spring flows. Creating a less flashy runoff regime may benefit non-native predators and competitors as much as or more than it helps steelhead.

Additionally, ramping up and down of flows has also been implemented for the past several years, and is part of the baseline. Since this practice was adopted prior to the NOP for the EIR for any changes to permit conditions, it is part of the CEQA baseline. Thus, while it is an important strategy to reduce stranding and fish mortalities, it cannot be claimed as a CEQA beneficial impact.

The Plan, on page 4-2, states that there would be "increased riparian growth," and portrays this as beneficial. However, on page 4-14, the Plan clarifies that the outcome may be "a reduction of riparian vegetation to levels similar to pre-project implementation." Thus, this too is not a beneficial impact in terms of CEQA, and the causation of new or increased flood control projects and their associated environmental impacts is an adverse impact of the Plan's implementation that needs to be considered in the draft EIR that this Plan's recommended actions will soon be subject to.

With regards to passage facilities, on page 4-3 the Plan lists Hilton Creek enhancements. It leaves out retrofitting of the CalTrans culvert under Highway 154. This glaring omission substantially weakens the Plan and threatens to prevent the Plan from accomplishing its objective of enhancing fish resources in the Lower Santa Ynez. The Plan plays up the benefits of opening up 2,800 feet of habitat (which requires supplemental watering) for steelhead below the highway. It fails to mention that above the highway, there is approximately three miles of medium to high quality southern steelhead habitat (over a mile of which is in the public and largely inaccessible Los padres National Forest) that would be made available by the omitted facilitation of passage under the highway. This section of the creek requires no supplemental watering. There is approximately six to seven time the lineal habitat above 154 as there is below it, and the quality above the highway is far superior to that below. For this Plan to pass muster, it must address this important restoration action: modification of the CalTrans culvert beneath Highway 154.

On page 4-4, the Plan refers to predator removal, which is an important restoration action that should be undertaken regardless of what other options are pursued, and is one that can largely be done in Phase 1. However, this action is again only listed in the context of being done with fish rescues, as if it would have no benefit if fish rescues were not also done. Predator control is a stand alone option that needs to be pursued independently of fish rescues because there will be juvenile steelhead in the river regardless of whether they are relocated there or occur naturally. They will be subject to predation and competition, but this can be reduced by predator removal, a beneficial action that is not currently taking place in any organized fashion.

Page 4-5 discusses the Tributary Passage Barrier Modifications, but again fails to refer to the more important restoration actions that could occur in this category. Please modify the text to refer to the Highway 154 culvert at Hilton Creek. It may be appropriate to refer to the modification of this barrier as a Phase 2 action which should be pursued following the successful implementation of the modification of the chute and cascade which currently may limit steelhead movement up to the highway. Additionally, this paragraph should discuss the Alisal dam which blocks several miles of excellent steelhead habitat above the reservoir it forms. Perhaps unlike Bradbury Dam, this structure could be fitted with a fish ladder to accommodate steelhead passage. Steelhead have moved into this creek below the dam in recent years, and should be afforded the opportunity to navigate the structure to the middle and upper watershed.

On page 4-7, the Plan inaccurately states that providing access for steelhead above Bradbury Dam would reintroduce anadromous life history into "resident rainbow trout populations that have been isolated for over 70 years." It is our understanding that the native landlocked steelhead have been isolated for only 45 years.

The statement on page 4-8 that "juvenile production in the lower basin have been good during the current wet cycle," is a relative statement. "Good" compared to what? Compared to drought years post Bradbury construction, this statement may be true. The statement needs to be qualified in terms of the baseline for comparison. Production has been relatively god considering the fact that Bradbury Dam blocks migration and decreases flows.

Section 4.2 leaves out an important discussion of the impacts to other "sensitive species." Specifically, western pond turtles and two-striped garter snakes are State Species of Special Concern, and are impacted by the Plan's recommendations. Positive and detrimental impacts to these species should also be discussed. This sections does describe how the existing water releases benefit bullfrogs, and states that this could adversely affect red-legged frogs. In addition, it should refer to the adverse impacts bullfrogs have on the aforementioned Species of Special Concern and steelhead. Bullfrogs eat all of these species, and benefits to bullfrogs equal detriments to native aquatic species. The overall impact of the releases may be detrimental to native species, and a detailed analysis of this issue is needed in the EIR.

On page 4-10, the Plan should include a discussion of the impacts of the surcharging on terrestrial vegetation, such as oak trees and chaparral.

The section beginning on page 4-12 and titled Effects on Water Supply raises the baseline issue again. The Plan states that the Fish Reserve Account takes water from the Project yield, however, this is part of the existing baseline, and will not be viewed as an adverse impact in the CEQA document.

It is unclear why the member Units would expect and accept more frequent shortages since the 2,000 AFY is part of the MOU and part of the existing conditions. If surcharging provides more water for fish, then this would not cut into the Project yield. The use of figures such as 4,200 AF represent the amount of water that the existing Fish Reserve Account (FRA) may, under a worst case scenario, reduce Project yield by, but this is part of the baseline condition since the renewed MOU established the FRA years ago. Thus, this is not a new reduction.

The Plan states that "during dry periods," the Project would expect "substantial shortages under baseline conditions." However, it appears as though the term "baseline" is being used to describe conditions before the MOU was signed, rather than the CEQA baseline which was the set of conditions present at the time the NOP for the EIR was issued (May 14, 1999). While the Plan is not a CEQA document, the section of the Plan on impacts and benefits will be utilized in the upcoming EIR, and should therefore distinguish between the CEQA baseline and historic conditions.

Section 4.4 delves into another CEQA impact category, that of Land Use. While it does not address all relevant land use issues, with regards to transportation, it should be noted that the provision of spanning bridges with no instream structures to replace summer crossings, may benefit transportation, and is a restoration action that, in certain cases, may have some value to steelhead.

Finally, in regards to the Plan Implementation, it is noteworthy that the Fish Reserve Account of 2,000 AFY is in existence, so referring to it as an action that can be implemented immediately is a bit misleading. In fact, it is currently being implemented. The proposed change would add to this amount in wet years and subtract from the existing FRA volume in years of less than 100,000 AF storage. Similarly, conjunctive use is already being done, so this is another action that can be implemented immediately only because it is being done now. The Hilton Creek supplemental watering is also being done, and is part of the baseline conditions for the purposes of CEQA review, as is the fish rescue operation, which was conducted recently. Continuing with these management actions will maintain current conditions for steelhead and should be encouraged in addition to new restoration actions.

As a last note, we suggest that the word "conservation" be replaced with enhancement or restoration on the last line of page 5-5. Conservation, while a noble goal, does not convey the goals of the Plan or of those entities involved in the process which has lead up to this point in time. If we were to only seek to conserve the existing resources, there would be little hope of preserving the Santa Ynez River run due to its rather limited population size and gene pool. Thus, the Plan must state the common intent of restoring or at least enhancing the steelhead resource of the Santa Ynez River.

Thank you for your attention to our comments.

Sincerely,

Brian Trautwein

Brian Trautwein
Environmental Analyst

cc: Jim McNamara, Bureau of Reclamation
Jim Canaday, State Water Resources Control Board
Department of Fish and Game
National Marine Fisheries Service
US Fish and Wildlife Service

ENVIRONMENTAL DEFENSE CENTER

June 17, 1999

RECEIVED
JUN 18 1999
ENTRIX, INC.
(FRONT DESK)

Mr. Jim Canaday
State Water Resources
Control Board
Division of Water Rights
P.O. Box 2000
Sacramento, CA 95818-2000

Mr. Jim McNamara
U.S. Bureau of Reclamation
South-Central California Office
2666 North Grove Industrial Drive, Suite 106
Fresno, CA 93727-1551

Re: Notice of Preparation of Draft Environmental Impact Report for Review of the U.S. Bureau of Reclamation's Cachuma Project Water Rights Permits; Environmental Defense Center Scoping Comments

Dear Sirs:

The Environmental Defense Center (EDC) is a non-profit public interest law firm working to protect public trust resources in Santa Barbara, Ventura and San Luis Obispo Counties. Our organization works extensively on Santa Ynez River issues, such as water rights and Endangered Species Act issues. We are submitting these scoping comments to the Notice of Preparation of Draft Environmental Impact Report for the "Review of the U.S. Bureau of Reclamation Water Rights Permits (Applications 11331 and 11332), to Determine Whether Any Modifications in Permit Terms or Conditions are Necessary To Protect Public Trust Values and Downstream Water Rights on the Santa Ynez River Below Bradbury Dam."

Project Description

As a threshold matter, it is difficult to provide scoping comments at this time because the project description relies on actions to be taken pursuant to a National Marine Fisheries Service (NMFS) Biological Opinion (BO) that is not currently in existence. Because the public and responsible agencies do not know what NMFS will recommend, it is impossible to determine what the project will be. Therefore, we must request that preparation of the Draft EIR not proceed until the project is fully defined based on the NMFS BO.

The project as described is too narrowly drawn. Not only does the project consist of the "development of revised release requirements and other conditions," but the implementation of such conditions as well. The development and implementation of these measures cannot be reviewed separately in a piecemeal fashion, and must therefore be analyzed for environmental impacts in a single CEQA document.

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The project description includes the "other reports called for by Order 94-5." These reports appear to include, among others, (1) a final contract renewal EIS/EIR, (2) the reports or data compilations resulting from the MOU's, including any extensions thereof, (3) a report on the riparian vegetation monitoring program in and along the margins of the Santa Ynez River below Bradbury Dam required by amended condition 6(m) of the subject permits, (4) a study report, or compilation of existing materials, which clearly describes the impacts, or lack thereof, of the Cachuma Project on downstream diverters as compared to conditions which would have existed in the absence of the Cachuma Project. The project description should describe these reports in detail to ensure that the contemplated EIR contains a discussion and analysis of this information.

The project description must include specific defined activities in addition to increased water releases that will be undertaken to protect public trust resources. As presently drafted, much of the restoration work that the Santa Ynez River Consensus Committee proposes to undertake would not be considered part of the project. Without some degree of restoration work, increased releases will be of little benefit to the public trust resources. Therefore, the project description in the NOP must specify what other actions are part of the project, even if this means waiting for the NMFS BO to become available.

Furthermore, the proposed project description does not comply with CEQA guidelines, which require that project descriptions contain "a statement of objectives sought by the proposed project." CEQA Guidelines § 15124. As noted in the Guidelines, a clearly written statement of objectives will help develop a reasonable range of alternatives. The project description currently has no stated objectives and thus the range of alternatives is difficult to evaluate. In light of the listing of southern ESU of Steelhead trout as an endangered species, recovery of the species should be one of the identified objectives of the project and the draft EIR should include a discussion of how to measure success against this objective.

Proposed Alternatives

The first described alternative (the No Project Alternative) represents the conditions at the time of the public trust complaint filed by California Sportfishing Protection Alliance (CALSPA). As such, it does not accurately describe the baseline conditions, which, pursuant to CEQA Guidelines § 15125, are the conditions in existence at the time the Notice of Preparation was published, that is, as of May 14, 1999. As of that date and continuing to present, pursuant to the 1993 Memorandum of Understanding for Cooperation in Research and Fish Maintenance on the Santa Ynez River (MOU) and subsequent MOUs, there exists a Fish Reserve Account that provides 2000 acre-feet of water per year that is dedicated to fish studies and maintenance. This is part of the baseline conditions. Therefore, the No Project Alternative should include the 2000 acre-feet per year that have been available for fish since 1993. The proposed No Project Alternative actually represents less water for public trust resources than is currently available under baseline conditions.

Alternatives 2 and 3 refer to the NMFS BO. However, as described above, the BO is not yet out and therefore is an undefined item containing undefined measures. These alternatives are thus not well defined, and the NOP does not adequately explain what these alternatives will include. Furthermore, since it is very possible that the BO will have the same or very similar provisions to those in the Fish Management Plan, it is unclear, without having the BO available, how those alternatives will differ, if at all. Thus the difference between alternatives 2 and 3 may not be substantial, and the EIR may not include a range of alternatives. Therefore, it is important for the BO to be available before the NOP is issued and the Initial Study process is initiated so that a reasonable range of feasible alternatives are analyzed.

As discussed above, the baseline conditions assumed in the description of the No Project Alternative are incorrect because they do not include the 2000 acre-feet per year that is part of the existing MOU. The actual baseline conditions include this provision of the MOU as part of the physical conditions within the river at the time of initiation of environmental review. Impacts associated with the proposed project and each alternative in the Draft EIR must be based on the proper baseline, and not on the physical conditions in and around the river on November 13, 1987, 12 years before the EIR is prepared.

None of the proposed alternatives looks at more rigorous water conservation efforts as a means to obtain more water for public trust resources. Some sort of conservation plan should be included in the proposed alternatives, as a stand alone alternative and as a component of the other alternatives. This is an obvious, feasible measure that could be undertaken to fulfill the project objectives, which, while not stated in any measurable way, must include the enhancement of public trust resources. Water conservation is a feasible alternative that reduces the significant environmental impacts that this project will have (see below), and should be included within a reasonable range of alternatives in the DEIR.

In a report dated March 11, 1998, and entitled "Santa Ynez River Fisheries Management Alternatives," the Santa Ynez River Technical Advisory Committee identified 46 possible management alternatives to improve the public trust resources and steelhead habitat and survival in the lower Santa Ynez River. At least some of the more viable of these alternatives, including those that are not being recommended in the draft Lower Santa Ynez River Fish Management Plan should be addressed in the draft EIR in addition to the management alternatives ultimately selected for implementation.

Some of the options in Appendix A of the Santa Ynez River Fish Management Plan which were not carried further for additional analysis merit closer attention in the EIR. For instance, Option 2 was discarded because it had "uncertain benefits for fish habitat." For this reason, it should be analyzed in more detail in the EIR to see what those benefits may be. Options 6 and 25 were discounted because there is reportedly not water available for purchase. The DEIR should describe any efforts undertaken to date to purchase water, or efforts that would be required to attempt to purchase water. These options would have significant benefits for steelhead, and it may be that water is available if the price offered is great enough. Failure to analyze a valid alternative from an EIR merely because the resources (in this case the water) is not owned by the project sponsor, is not an adequate reason and does not comply with CEQA. In *Citizens for Goleta Valley v. Santa Barbara County Board of Supervisors* {(2d Dist. 1988) 197 Cal.App. 3d 1167 [243 Cal.Rptr. 410]} the court held that alternative project sites cannot be discounted from consideration in an EIR solely because the project sponsor does not own the site. Similarly, alternatives involving the purchase of water for fish enhancement should not be excluded from the EIR simply because the project proponent does not own the water. Please provide more detail regarding why these options were not pursued further, and an explanation of why no water is reportedly available for purchase. Could it be that water would be available if the price per AF was higher?

Options 12 and 13 should also be analyzed in the EIR, although they are not proposed in the Fish Management Plan because of a reported lack of landowner interest. Again, in terms of a CEQA perspective, alternatives cannot be dropped merely because the project sponsor does not own the land (*Citizens for Goleta Valley v. Santa Barbara County Board of Supervisors*). Based on this, we feel it is appropriate to analyze these options in more detail in the environmental review document that is forthcoming. Lastly, Option 22 seems to warrant additional investigation. The EDC is aware of no institutional obstacles to this option, and believes that the US Forest Service would likely be supportive of such an approach. Therefore, a detailed analysis in the EIR should be included.

Probable Environmental Impacts

It appears that the impact analysis proposes to use an incorrect baseline. As noted above, under the CEQA Guidelines, the baseline is existing physical and biological conditions as of the date the Notice of Preparation is sent out. Thus, the baseline includes the 2,000 acre-feet that currently is set aside in the MOU to maintain fish resources, and any aspect of the project that contemplates less than the currently available 2,000 AFY of water should be evaluated for adverse impacts to steelhead recovery and other public trust resources.

The proposed changes in the amount and/or timing of water released may have the result of benefiting non-native predator and competitor species more than it will benefit steelhead. Therefore, the draft EIR should evaluate whether the alternative water release regimes described therein would have any adverse effects on steelhead and other native fish and amphibians by increasing the numbers of predators and/or competitors. Increased releases may benefit cattail, sunfish bass and bullfrogs more than steelhead, red-legged frogs, western pond turtles, two-striped garter snakes and other native aquatic species, and the net effect may be adverse to steelhead and other native species, whether or not the gross effect is beneficial or detrimental.

The Santa Ynez River Consensus Committee's management plan contemplates obtaining extra water for release for fish by surcharging the dam. To accomplish this, flashboards would be installed to enable a 1.8 foot surcharge. Apparently, a 3-foot surcharge is also contemplated. Both of these levels of surcharge have the potential for impacting terrestrial vegetation around

Cachuma Reservoir's perimeter. Increased saturation of the bank area around the reservoir's lengthy perimeter would detrimentally affect numerous oak trees and other native vegetation species that are not tolerant of wet soil conditions. The proposed project and alternatives, then, would result in the potential killing of a large number of oak trees and other species such as those found in chaparral environments over both the short and long-term. These impacts should be evaluated, and effective mitigation measures, such as habitat restoration and native tree planting must be included to offset these potentially very significant impacts.

Furthermore, the surcharge will cause the reservoir to spill less frequently, for shorter periods of time, and with less magnitude. The draft EIR will need to include hydrological information and a detailed analysis regarding how less frequent spills, reduced spill duration, and reduced spill magnitude will affect the public trust resources below the dam, including upstream and downstream steelhead migration, sand bar breaching, and native fish rearing and spawning.

A variation on the surcharging option should also be evaluated in the EIR in order to minimize potential impacts of the option while also preserving the possible benefits from surcharging. Specifically, the DEIR should analyze an option that would allow controlled spills to occur when the reservoir reaches 750' in elevation, but at the same time would also allow for surcharging to occur. As an example of how this alternative would work, if 5,000 cfs were flowing into the reservoir and the surface water elevation was 750', then 2,500 cfs could be released downstream in attempt to provide important "natural" post-storm flow conditions below the dam and concurrently, the remaining inflow could be surcharged to store water for subsequent releases for steelhead and the river throughout the remainder of the year. This option may provide the best combination of benefits for steelhead; it would provide ample water to cue and facilitate upstream migration in the mainstem and would also surcharge the reservoir with enough water to provide up to 5,500 AF for later release.

The possible relocation of the lower part of Hilton Creek may reduce the amount of water flowing into the section of river between the Long Pool and the existing confluence. This section of the river is important for steelhead, but the proposed action may reduce habitat conditions for steelhead in this reach. This impact needs to be analyzed from quantified hydrological and biological perspective. Additionally, how will the relocation of the mouth of Hilton Creek impact the movement of fish from the Stilling Basin into Hilton Creek or visa versa? Since the mouth would be located further downstream, the EIR should discuss and offer mitigation for (if necessary) any impact to steelhead movement between the Stilling Basin and Hilton Creek.

Mitigation Measures

There is no discussion of possible mitigation measures in the Notice of Preparation. Nonetheless, we would like to express our thoughts regarding some mitigation measures that should be addressed in the draft EIR.

Mitigation should be undertaken to remedy any actions taken that will benefit non-native predators and competitors at the expense of public trust resources such as steelhead and state and federal protected species. Examples of such mitigation would be to develop and implement programs to eradicate bullfrogs, bass and catfish. Such measures should not be tied to fish rescue operations as they are in the Fish Management Plan, but should be independent of rescues and stand alone as mitigation actions for the impact of benefiting predators and competitors at the expense of steelhead.

Mitigation measures should also be undertaken to replace any vegetation that is lost, over the short and long-term, as a result of the contemplated 1.8-foot and possible 3-foot surcharge.

As noted above, a number of management alternatives have been considered, not all of which are intended to be implemented. Some of these alternatives should be considered as measures taken to mitigate for any adverse impacts of the project. For example, any reduction during periods of low reservoir storage (less than 100,000 AF) of the 2,000 AFY now available for fish is an adverse impact using the existing baseline conditions and must be mitigated to ensure that the reduction does not bring the species closer to extinction or cause other impacts to water and biological resources.

Policy Considerations

Section 5937 of the Fish and Game Code requires that fish be maintained in good condition below the dam. While some may disagree about what "good condition" might mean, none can argue that a set of conditions that resulted in a species of fish becoming endangered fulfills the requirements of § 5937. Thus, any discussion of alternatives and the proposed project must evaluate the them in light of the requirements of § 5937. For instance, any alternative, such as merely adding 2,000 acre-feet to a fish reserve account in wet years, should be evaluated in light of the fact that during the six years the use of the 2000 acre-feet, the steelhead population in the Santa Ynez River has continued to decline. This action has not succeeded in bringing the fish back from the brink of extinction.

Similarly, the alternatives and proposed project should be evaluated with regard to their consistency with the State's "Steelhead Restoration and Management Plan." Modification of the existing reservoir bank, through surcharging the reservoir, will require streambed alteration agreements, and the DEIR should disclose this fact. Additionally, any alteration of streams may have adverse impacts that need to be evaluated in the Draft EIR, and would require streambed alteration agreements.

The proposed project and each alternative should also be evaluated in light of their consistency with the Santa Barbara County General Plan, which contains policies that discuss the protection of endangered species, habitats, native trees, water resources and aesthetics. A comprehensive discussion of the project's consistency with adopted plans and policies, including General Plan policies, is required to determine the level of Land Use Planning

Impacts. Such impacts must be evaluated in the Initial Study and Draft EIR pursuant to the CEQA Guidelines Appendix G, the environmental checklist.

As a final matter, because the permits at issue are held by the Bureau of Reclamation, it would appear that a NEPA EIS is also required. It is not clear from the NOP whether an EIR/EIS is contemplated or whether separate CEQA and NEPA processes are being pursued.

Thank you for considering our comments, and for modifying the timing of the preparation of, and the scope of the pending Draft EIR, and its alternatives analysis, impacts and mitigation measures.

Sincerely,

Brian Trautwein
Environmental Analyst

cc: Department of Fish and Game
National Marine Fisheries Service
US Fish and Wildlife Service

Comments to Support Previously Stated Rationale

- B. D. Wood in *Gazetteer of Surface Waters of California*, U.S.G.S. "Water Supply Paper," 297, 1913, p. 195, discusses the Santa Ynez River: ***"Water is diverted above Lompoc, and the present water rights exceeds the low-stage flow of the stream. The basin affords good storage sites. Several reservoirs have already been surveyed whose combined capacity far exceeds the mean annual run-off of the basin"*** [my emphasis].
- *"If Cachuma Dam* [Santa Ynez River] *is constructed it is recommended that:*

  "Adequate provision be made for the passage of fish upstream and downstream past the dam.

  "The outlet tunnel be adequately screened to prevent the passage of fish.

  "A minimum release of 15 cfs [30 AF – 10,950 AF annually] *of water be provided at the dam throughout the year.*

  "If Santa Rosa Dam is built [25 miles from the ocean and 22 below Cachuma Dam] *adequate provision be made for the passage of fish upstream past the dam. A minimum release of 50 cfs* [99 AF – 36,135 AF annually] *of water be provided at the dam throughout the year."* (Leo Shapovalov, Bureau of Fish Conservation, California Division of Fish and Game, October 21, 1945)
- *"To restore runs of steelhead in the Ventura River ... January to March each year, 50 cfs, and April to December each year, 20 cfs. Total: 20,000 AF per year"* (Personal correspondence from George Warner, Chief, Anadromous Fisheries Branch, California Department of Fish and Game, Feb. 20, 1972).
- *"An average monthly post-project stream flow of less than 70% of pre-project levels* is *likely to degrade the fishery and post-project stream flow of less than 30% of pre-project flow is certainly detrimental"* (In *California's Stream Resources*, Vol. 1: "Overview and Assessment" by Charles Hazel, published by the State of California, The Resources Agency, Dept. of Water Resources, Bulletin #215, December 1982).
- Utilizing a U.S. Bureau of Reclamation report, April 1944, I calculated that the entire Santa Ynez River System historically produced an average annual 184,650 AF of water and in the watershed *area* between **Gibraltar Dam** and **Cachuma Dam (Bradbury)** 43.520 AF annually. If we use Charles Hazel's professional evaluation, then 70% of "pre-project levels" equals 30,464 AF, or a "degraded" Salmonid habitat that had already been previously degraded by 4 other upriver dams. To apply the 30% figure, we come up with 13,056 AF as being "detrimental."
- We've obviously been well below the "detrimental" stage on *water* **flow** for roughly 50 years and it's time to make amends. I hope that your group will have the courage to recognize the socio-economic values of a fully restored Santa Ynez River system and enter such thinking in your final recommendations. If not, then much time, money, and human resources have been totally wasted.

Thank you for allowing me to comment. Best personal regards.

Sincerely,

Ed Henke

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Res, JSB

SAN LUCAS RANCH
P.O. Box 338, Santa Ynez, CA 93460

FAX TRANSMITTAL FORM

TO: Jean Baldridge
DATE: 12/1/98
OF:
FROM: Nancy Crawford
FAX NO. 1-925-935-5368
PAGES: 6 incl. cover
INSTRUCTIONS: As per your request —

San Lucas Ranch

P. O. Box 338
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12/1/98

Jean E. Baldridge
590 Ygnacio Valley Rd., Suite 200
Walnut Creek, CA 94596

Dear Jean:

As per your request, I am sending a letter to you regarding the concerns of San Lucas Ranch with respect to year-round water in the Santa Ynez River due to "restoration" efforts of the steelhead/rainbow trout. Let me first state that "restoration" is an inaccurate description since it implies that the situation that is being created on the Santa Ynez River actually existed in the past. Those people who have been in this Valley for a long time are aware that abundant numbers of steelhead/rainbow trout only occurred in wet years, primarily after major floods had cleared the sandbar at Surf allowing access from the ocean.

That said, I have recently written a letter to the Bureau of Reclamation regarding the Hilton Creek Permanent Watering System. I addressed most of the issues which would apply to your question. Unfortunately, the Bureau chose to not address our concerns but instead claimed that they were operating issues. I have included a copy of that letter.

In very simple terms, due to the introduction of year-round water in the Santa Ynez River, we are no longer able to use our property in the river as we used to. It has made our work situation extremely hazardous to our employees, our animals, and ourselves. Due to the listing of the trout as endangered, we are now unable to make our river crossings safe without applying for permits, which I know, will make it impossible for us to conduct business. In addition, because our river crossing is no longer safe, we are unable to effectively use our @1000 acre pasture on the other side. This is severely impacting our ability to conduct our business.

The other huge issue here is the introduction of more vegetation to the river. It may be great for the fish but it is not great for San Lucas Ranch's groundwater supplies. It may first appear that additional water to the system could be a desirable contribution to the groundwater. Looking farther down the road than most "committees" would, there will come a time when the vegetation will outstrip the supply of additional water. Of course, there is also no accounting for additional population and additional water-intensive agriculture, both of which are booming in this Valley these days. The only water supply we have is within the boundaries of the ranch and we are becoming increasingly concerned with the introduction of major plantings on the other side of the fence, such as Caltrans planting 1000 trees and bushes on two of our creeks and the river.

They may be located on Caltrans right-of-way, but they drink from the same groundwater basin-ours! They have also fertilized those trees and bushes with two different types of fertilizer, which will probably be attributed to pollution from our animals. We have an on-going conversation with them regarding these issues.

As you can see, we have a number of issues, which are critical to our continued successful operation. To date, no agency, whether public or private, has made any effort to mitigate the negative impacts to our property caused by their efforts. Unfortunately, if this attitude continues, legal steps will have to be taken. I do hope that you will find a cooperative spirit in the fish community before this occurs.

Thank you for asking the question.

Sincerely,

Nancy Crawford

Nancy Crawford
Manager

cc: Mr. Jim Hurley, Price, Postel & Parma

San Lucas Ranch

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9/24/98

Rich Raines
Bureau of Reclamation, Technical Service Center
Attn: D-8210
P. O. Box 25007, DFC
Denver, CO 80225-0007

Dear Mr. Raines:

This letter constitutes our comments on the Aug 31, 1998 Draft Environmental Assessment for the Bradbury Dam-Spillway Modification-Hilton Creek Water Supply Line Project.

We would first like to point out that the scope of the assessment chosen for this project is wholly inadequate. To say that the introduction of a permanent supply of water to Hilton Creek which flows into the Santa Ynez River which, in turn, flows into the Pacific Ocean has no impact on anything other than Bureau of Reclamation property is, simply, not accurate. Potentially, all properties downstream of Hilton Creek could be affected by this project. Since the scope of this assessment is limited to Bureau property, and doesn't even consider neighboring properties, it clearly does not meet the requirements of an environmental assessment. You should be aware that there are already negative impacts occurring downstream as a result of the introduction of water to the Santa Ynez River at times when it did not naturally or historically occur. Such impacts range in nature from introduction of previously unknown, non-native plant species, abnormal growth of vegetation which has resulted in at least one known car accident at Hwy 154 and Lower Armour Ranch Rd, to creation of an attractive public nuisance. These are serious issues, which need to be addressed.

As immediate neighbors downstream of this project, as owners of the upper reaches of Hilton Creek and as owners of Cachuma Village, who have been here since 1924, we feel rather well qualified to discuss the environmental impacts of this project, particularly from an historical perspective. We have specific concerns about contradictions in this report and also some obvious inaccuracies.

According to NMFS March 10, 1997 conference letter, the construction of this project was to occur during the dry season, yet on page 9 of the EA it states that "work would be initiated around October 15, 1998 and would continue approximately 90 days". That is certainly not the dry season and doesn't leave much time for consideration of comments to the EA. Another apparent contradiction is the different amounts of water to be put annually in the Fish Reserve Account. It has, until this EA, been stated publicly that the Fish Reserve Account would have 2000 ac-ft per year in it. On page 4, it is stated that there would be 3000 ac-ft in years when the reservoir spills. How did this occur? Water entitlements for other users of this source do not fluctuate up and down according to the amount of water available. How, then, can the Fish account receive more water entitlement than the other users of this system? This is not justifiable in the face of an ever-increasing demand for a limited resource. We don't believe that if the general public was aware of the potential effects of this program, that they would be in favor of it either.

Our comments regarding the inaccuracies in this EA have to do with the statement made regarding Visual Resources, Land Use, Air Quality, Noise Surface Water, Groundwater, Vegetation, Wildlife, and Fishery Resources. It is stated in the Comparison of Environmental Effects Associated with Implementing the Preferred Alternative that in each of these categories there will be "no change from the No Action Alternative" which says there will be "no change from existing environment". This simply is not true and does not even reflect the severe changes that have already occurred downstream of this project. Our points are as follows:

- Visual Resources- due to year-round water artificially introduced into the Santa Ynez River system for the past several years, there has be introduction of never before seen plant species that spread rapidly along the river; algae is encouraged to grow in abnormal amounts and trees have grown at abnormal rates blocking sight distances for vehicles travelling across Hwy 154 bridge at the River.
- Land Use- due to year-round water artificially introduced into the Santa Ynez River, we are having difficulty accessing our property known as the 1000 acres which is directly across the River from the main ranch- due to greatly increased amounts of algae on the rocks in the River, it has become exceedingly dangerous for cowboys, horses and cattle, including small calves to cross our river property to the pasture on the other side which we must do several times a year. Until the artificial introduction of water, this was not a problem.
- Air Quality- Cachuma Village and other residences on San Lucas Ranch have already been impacted by noise and dirt of construction activities at Bradbury Dam for the past year and a half. The Bureau of Reclamation is no longer a quiet neighbor. This project will continue to degrade our lives. Using water, a limited resource, to accomplish better air quality is foolhardy and paving will forever change the character of the area to something urban with easy access. This is unacceptable to us.
- Noise- see Air Quality.
- Surface Water-due to year-round water artificially introduced into the Santa Ynez River, and because the nature of rivers is to flow somewhere, naturally there will be an impact outside of the project area. Already my employees and I, and the Sheriff's department have spent an inordinate amount of time pursuing fishing-trespassers in the Santa Ynez River. We are grateful to California Department of Fish and Game for finally seeing reason and closing the River to fishing although they have yet to set signs stating that. However, during hot summer months, when normally there are only isolated pools of water and not a live stream, existence of surface water has and will continue to create an "attractive public nuisance"-a serious liability for this project.
- Groundwater-due to year-round water artificially introduced into the Santa Ynez River, the nature of the groundwater has naturally changed. Since there has, according to this EA, been no water quality sampling done on the reservoir, and antiquated assumptions that high TDS

levels are due to agricultural runoff as opposed to being naturally occurring, there can be no assumption that this project will have little or no negative impact on other properties. We have two large wells in the River, one residential and one for agriculture- clorination is not an option for our crops or our livestock. Sediment run-off has the potential to damage or destroy our river wells.

- Vegetation- due to year-round water artificially introduced into the Santa Ynez River, increased vegetation has already occurred with the real potential of ultimately impacting groundwater supplies for San Lucas Ranch. The 1997 planting by CALTRANS of over 1000 trees and bushes along tributaries and the River on their right-of-way will have the same effect. How will this project prevent those cumulative impacts to our groundwater supplies?
- Wildlife- due to continued construction activities at Bradbury Dam for the past year and a half, wildlife patterns, particularly for deer and wild pigs have already been changed- hopefully not permanently. Since none of the preparers of this EA live in the area, naturally they would not be aware of wildlife movement patterns as we are. To say that there are minor changes and that they can mitigate for them is ignorant and inaccurate. The only way to mitigate for them is to complete the construction as quickly as possible and to leave the area.
- Fishery Resources/Special Status Species-due to year-round water artificially introduced into the Santa Ynez River fish of all sorts, including "special status species" have been encouraged to venture up this river at times when they are then trapped with rising temperatures and decreasing oxygen due to algae growth, threatening their survival. Fish rescues then have to be performed requiring private property owners to forfeit their constitutional right to control access to their property in order to avoid being accused of an "incidental take" of an endangered species. The negative impacts in Hilton Creek, such as barriers and lack of water during certain times of the year, are naturally occurring, not man-made- something the supporters of this project neglected to mention during any part of this process.

We would like to thank you for this opportunity to respond to Hilton Creek Water Supply Line Project Draft Environmental Assessment. As you can see, we have some very strong concerns regarding this proposed project since it has already negatively impacted our lives, our operation, and the lives of those creatures we share this ground with. We are very opposed to the artificial creation of a fish situation which never existed anywhere here except in the minds of some avid fishermen who hoped to have more fish in the area that they could trespass and fish for. As taxpayers, we expect that some reasonable measure of reality backed by science will prevail in this case.

Sincerely,

Nancy Crawford
Manager, San Lucas Ranch

RECEIVED
JUN 17 1999
ENTRIX, INC.
(FRONT DESK)

To: Jean Baldrige
Re: Lower Santa Ynez River Fish Management Plan
June 15, 1999

I just wanted to offer a little regarding the Plan. I attended the public meeting in Santa Barbara in May. I think the whole effort has been very worthwhile, and I hope it can be kept up. The habitat enhancements are especially exciting, including at Hilton Creek and on private land with conservation easements, as well as the Fish Reserve Account.

My overall feeling is that we need somehow to maintain a "vision" of steelhead recovery in southern California. I have tried to follow this issue. The LA Times has covered this a lot with respect to Ventura County. I've enclosed a number of recent articles on the topic. You've probably seen most of these - you're quoted in one of them. It does seem like the Ventura River may offer the best opportunities around. It is pretty clear that the Santa Ynez is limited in what amount of steelhead recovery we can get out of it, although this may be more than we might have thought before (I'm referring to the rescue of the 800 trout last year). I think the Plan overall is a good analysis of the Santa Ynez watershed and what we can do there; I just think we have to keep the regional picture in mind, especially if steelhead are flexible enough to return to watersheds completely separate from their natal origin. That was something I didn't know before - that a fish that originated in the Ventura River watershed might actually spawn in the Santa Ynez.

Hopefully the federal listing by NMFS will serve to provide a regional vision. Also along these lines, I agree with Craig Fusaro of California Trout that reconnecting the lower and upper Santa Ynez watersheds needs to be kept on the table. I realize the problems with trap-and-truck, but with the bulk of the cool, dependable water above Cachuma, we need in the long run to try to find ways to reconnect the ocean-going fish with this habitat. Of course, the same issue arises with respect to Matilija Dam and the Malibu Creek dam. Along with trap-and-truck, I think the hatchery supplementation issue needs to be kept alive. I know this type of thing can be controversial, but some of the Indian tribes in Oregon and Washington have used this with some success.

I've also included an article by Marc Reisner in High Country News, as well as an article from the Chico newspaper from January 1999. The work on Butte Creek strikes me as a fantastic example of habitat restoration and the hope that we do have, despite all the pressures from human civilization, of actually restoring some of the damage we have done to rivers, estuaries, and oceans. I don't think the huge (relative to the last 50 years) return of Spring Run Chinook to Butte Creek in 1998 was all due to the dismantling of the dams there. High flows in 1998 and before in 1995 had a lot to do with it, of course. But it serves as a great example and encouragement for this kind of work. I'd like to think we could mimic this with the enhancements on Hilton Creek, with the Fish Reserve Account, and by removing barriers like Matilija Dam (I know - maybe we can't do it because of all the silt - but we need to be thinking with an admittedly idealistic vision where we can).

Ross A. Gerrard
150 Verona Ave.
Goleta, CA 93117

Ross A. Gerrard

Monday, November 30, 1998

Extinction of Special Fish May Hit a Snag

Nature: Once-thriving southern steelhead, declared endangered in 1997, has a powerful defense mechanism built into its genetic makeup. But will it be enough?

By STEVE HYMON, Times Staff Writer

[A]s far as fish stories go, this one has to rank right up there.

And it's a story that's been in the making for millenniums. Silver and blue weighing up to 10 pounds, the southern steelhead trout is strong and swift and, fishy standards, even smart and cunning.

For generations this beautiful fish not only has survived, but thrived, in an area infamous for its endless cycle of drought, fire and flood. To perform its signature act, migrating from ocean to upstream spawning grounds, the steelhead navigated an obstacle course through the creeks and rivers that once ran unhindered from Southern California's mountains to the sea.

Sometimes the fish would slither across the sand in a few inches of water to reach a creek's mouth. Once in the stream, it would dart under boulders and leap over small waterfalls. Anything to reach the place where it could spawn and produce the next generation of resilient steelhead.

No one knows just how many steelhead live in Southern California today. Some researchers say the fish, declared endangered last year, will soon be extinct. Others aren't so sure.

"We've done everything we possibly can to eradicate these fish," says Dennis McEwan, a fisheries biologist and steelhead expert with the California Department of Fish and Game. "But the steelhead are still there."

The wildlife and scientific communities are now debating what to do about the southern steelhead, how to protect it and how to balance its needs against those of man. But this isn't just the classic people-versus-nature story, though there's plenty of that in this tale. The story of the southern steelhead is also a tale of genetics--genetics that might explain how all species evolve.

It's Survival of the Most Adaptable

Southern steelhead are still here, most biologists say, because they evolved to beat the odds.

"These fish have had to be extremely flexible because of the [climate] in Southern California," says Sara Chubb, a fisheries biologist with the Los Padres National Forest. "They are a hearty fish that can jump far, have a lot of stamina and stream smarts because, in order to survive, they have to make it to places with marginal habitat."

That habitat once extended from the Santa Maria River near Pismo Beach down to Baja California. Today, the steelhead's range is believed to extend no farther south than Malibu Creek, where a silt-choked dam blocks steelhead from migrating upstream.

Tens of thousands of years ago--no one is exactly sure when--there was an ancestral population of Pacific salmon. As the years passed, the population was separated as glaciers overtook the land, earthquakes pushed up mountains and other forces molded the Earth.

Eventually, these separated populations developed into various subspecies of Pacific salmon, such as Chinook and coho. The steelhead, which is actually classified as a salmon, also established its own niche in nature. But evolution hardly stopped there. Different stocks of steelhead evolved, each unique to its particular habitat. And, within these stocks, another peculiar trait developed. Some steelhead are anadromous, meaning they are born in freshwater and later run to the sea. Others are non-anadromous, spending their entire lives in freshwater. These fish are known as rainbow trout.

"This is a species that has an enormous palette of life histories to choose from," says Jennifer Nielsen, a biologist and geneticist with the U.S. Forest Service.

Steelhead evolved, in other words, to play by the hard rules Mother Nature set down in Southern California.

Then, people came along and the rules began to change. Impassable barriers like dams cut off the headwaters where steelhead like to spawn. Pollution robbed the fish of clear water. Lagoons were drained or filled in, taking away the transition zone where steelhead make the chemical transformation to saltwater.

"The health of the species depends upon the health of the component parts," says Rob Jones, a spokesman with the National Marine Fisheries Service. "If we lose more and more of those parts, the ability of the fish to survive will decline until we lose everything."
Much has already been lost. Twenty-three stocks of steelhead trout have gone extinct this century, and another 43 (including the southern steelhead) face a moderate to high risk of extinction, according to the fisheries service. The reason: habitat loss and degradation.

The Santa Ynez River, near Solvang, was once considered to have the highest population of steelhead in Southern California. In fact, in 1944 the California Department of Fish and Game found approximately 1 million juvenile steelhead trapped in a drying portion of the river. Today, the number of adult steelhead in the Santa Ynez is probably less than 200.

Many biologists and ecologists express a guarded optimism that the southern steelhead will not be lost. It has survived this long, they say, and there is still good habitat left in Southern California.

The problem, however, is that the steelhead often can't get to the habitat. Solstice Creek is a small, perennial stream on National Park Service land flowing from the Santa Monica Mountains to Malibu. But a culvert under Pacific Coast Highway prevents steelhead from reaching it.

In Matilija Creek, in Santa Barbara and Ventura counties, wild rainbow trout are stuck upstream behind the silted-up Matilija Dam. What would happen if their path were again clear? After 50 years, would they show anadromy and run to the sea?

Sespe Creek, north of Fillmore in Ventura County, is the last free-flowing major stream in Southern California. Steelhead once migrated 80 miles up the Sespe and, today, most of the creek lies within protected wilderness. But fish have difficulty reaching the Sespe because it drains into the Santa Clara River, which suffers from environmental problems.

"Those fish went to places you would never believe there were fish," says Sara Chubb. "There seems to be something inherently bred in their genetics that makes them want to go further, to keep repopulating."

Southern Steelhead's Amazing Secret

Throughout most of this century, the decline in the number of steelhead in Southern California was of little concern to the populace and government alike.

After all, steelhead could always be found in the wetter climates of Northern California and the Pacific Northwest. In mighty rivers like the Klamath or the Rogue, a 30-pound steelhead could snap a man's $1,000 fly rod in two. In these places, men line up elbow to elbow at river's edge, hoping to hook a winter-run steelie and experience what one guidebook calls the "apogean angling experience." Conversely, the southern steelhead was thought to be a freakish, negligible population of strays from the north that, perhaps unfortunately, was doomed. Fishing regulations in Southern California were few and, often, not enforced. Besides, the sea and reservoirs offered more-plentiful angling opportunities.

Then, in 1994, came a remarkable--and controversial--discovery. That year, Jennifer Nielsen, the forest service geneticist, used DNA fingerprinting technology to determine that southern steelhead had more genetic diversity than any other type of steelhead. Quite suddenly, southern steelhead were no longer a trivial presence.

"When the study came out, all hell broke loose," says Nielsen. "I had calls from people asking if I was certain these were steelhead I had studied. These were fish just waiting for the door to open because genetically they had a lot to say."

Like circles inside a tree stump, genetic diversity is believed to be a sign of age--the more genetic diversity a species has, the older the species is believed to be.

Nielsen and many other biologists believe this could mean that southern steelhead are the oldest steelhead of them all. Perhaps they are even native to the area (harsh environments are thought to produce genetic diversity).

This, in turn, could mean that all steelhead stocks evolved from southern steelhead or that southern steelhead may have repopulated northern areas following the last ice age.

"To keep every cog and wheel is the first precaution of intelligent tinkering," wrote the naturalist Aldo Leopold, half a century ago. Leopold's rule has since become the guiding principle in efforts to save endangered species.

Or, to put it another way, if you really want to save a species, save all its diverse parts. Because, one of those parts--like the southern steelhead's ability to cope with warm water--just may be the key to adapting to something like global warming.

A Long-Closed Door May Someday Reopen

Many biologists believe steelhead never had a grip on Malibu Creek, so much as a loose grasp on it.

In the drought years, much of the creek probably dried up. Steelhead and rainbow trout may have survived in a few deep pools. Or, some may have sought refuge in the sea.

Other steelhead, too, likely perished. More than anything, Malibu Creek was a wild, dynamic, ever-changing place. Until people began taming the land.

About 2 1/2 miles upstream from the ocean, Malibu Creek turns abruptly to the east and then enters a steep and narrow gorge. From the point of view of an engineer, this notch in the canyon walls was the perfect place to anchor Rindge Dam.

In 1926, the year Rindge Dam was completed, the entire lower section of Malibu Creek was a part of the 17,000-acre Rindge family ranch. The family needed water for its ranch, and the concrete arch dam--reinforced with railroad ties from the dismantled Hueneme, Malibu and Port Angeles Railroad--was the perfect solution.

But the dam had a problem: sediment. Within 40 years, the small reservoir behind the dam had completely filled with the heavy silt load Malibu Creek carries. The creek no longer backed up behind the dam, but instead flowed right over the top.

There has been talk of removing the dam for 30 years, but this September the talk turned serious when the Army Corps of Engineers said it would consider a feasibility study of modifying or removing Rindge Dam.

According to the corps, it's a project that could take almost a decade to complete--if it does indeed go forward. Local sponsors will have to carry almost half the cost. And the price could be considerable: A 1994 federal study said removing the dam could cost at least $4 million, maybe even $17.5 million.

"The biggest thing we need to do is to reconnect those fish with their upstream habitats," says McEwan. "If we can just work on that one thing, and if dams like that one are made passable, then the fish can take advantage of those good, wet years where there is a lot of flow. Right now it doesn't matter, because they can't get there."

Malibu Creek has been dammed in four places, but biologists have deemed Rindge Dam as the most harmful to steelhead because it squeezes the fish into 2 1/2 miles of stream between the dam and the ocean. A 1990 study estimated that removing the dam and fixing three minor barriers would allow the steelhead to reach five more miles of upstream habitat, including two major tributaries--Cold Creek and Las Virgenes Creek.

After all these years, would steelhead swim above the dam if given the chance? If so, could the fish end up reaching suburbs like Calabasas and Agoura Hills--the last place most people would expect to see a 2-foot-long fish returning from the sea?

"I'm not aware of any data indicating steelhead were ever above Rindge Dam, but we consider the behavior of fish in other streams to form an opinion of what the fish might have done, and will do, in Malibu Creek," says Anthony Spina, a biologist with the fisheries service. "It's my opinion that any time we can open additional habitat for steelhead, we should."

Perhaps the most intriguing thing about a recovery effort in Malibu Creek is this: There are 80,000-plus people living in the Malibu Creek watershed, and biologists see the creek as an opportunity to prove that people and fish can coexist. Helping the steelhead would provide incentive to further clean up the creek's diminished water quality. There's even talk of one day building a steelhead interpretive trail along Malibu Creek.

"I used to think it was fish versus people," says McEwan. "Now, it's fish versus funding. We don't have to have wildlife in a park or zoo. We can make room for these creatures within our own environment."

Steve Casey, who used to fish for steelhead in Malibu Creek before they were declared endangered, puts it differently.

"All my life, I've heard about the way California used to be," says Casey. "Well, I'm sick of hearing it and I don't want to tell my kids the same thing about Malibu Creek and the steelhead."

If It's Not Extinct, It Should Be

"Fifty years ago every live brook,
runnel and stream that made a pretense of carrying some head of water though the summer drought had its quota of steelhead moving upstream."
--from the book "Steelhead to a Fly," written by Clark Van Fleet.

Almost a century after Van Fleet's observation about steelhead in 1901, no one knows how many southern steelhead still exist. There are few people paid to look for them, and even when they do, the fish are hard to find.

But the one thing everyone agrees on is this: There are nowhere near as many steelhead as there used to be. Jennifer Nielsen points out that under the rules of traditional conservation biology, the southern steelhead trout should be extinct. Once the population of a species drops below a certain threshold, mortality outpaces reproduction and extinction is inevitable.

Yet, the southern steelhead has stubbornly resisted that rule.

In August, Anthony Spina, a marine fisheries biologist, went snorkeling in Topanga Creek. Steelhead were often caught in the creek in the 1960s and early 1970s. But no one had seen a steelhead in the creek since 1983, and many biologists thought water pollution had done them in.

Wading from pool to pool along the creek, Spina looked down and saw a 5-inch juvenile steelhead.

Later, when the soft-spoken and cautious Spina was asked about it, his answer was: "Interesting."

Interesting, indeed, that the southern steelhead trout, at least on this one day and in this one place, was still there.

Saga of the Steelhead

Steelhead trout have a life cycle similar to
salmon. The Southern California strain of steelhead has dwindled to nearly zero from a variety of factors, including loss of habitat due to water diversions, dams, urban development and pollution.

Steelhead are anadramous, meaning they are born in fresh water, migrate to the ocean and return to fresh water to spawn. Unlike most salmon, not all steelhead return to their native streams, and a small percentage of steelhead can spawn more than once. Steelhead that live their entire lives in fresh water are called rainbow trout

Life Cycle

Steelhead are nothing if not adaptable, and this is especially true of the southern strain, which has historically dealt with extreme changes in Southern California's climate. Steelhead must wait until winter rains raise creek levels high enough to breach the sand bar that forms at the mouth of most creeks. In dry years, they may not even get the chance.

1. Female buries eggs several inches deep in nests in river gravel. Male fertilizes eggs, which hatch in 3-5 weeks and become "alevins."

2. Surviving alevin, or fry, remain in stream's deep pools to avoid predators, and feed on insects and crustaceans. 3. Fry turn into smolts--shedding scales and turning silver--and usually spend 1-3 years in river system. Smolts adapt to salt water by staying in estuary where fresh and salt water mix

4. Steelhead migrate to ocean and typically remain there for 1-3 years
5. When ready to spawn, steelhead use sense of smell to locate their birth streams. Female finds suitable spawning area and the process begins anew

Steelhead Trout Size:
In the past, full-sized adults in Malibu Creek measured to 20 inches in length. Northern strains can reach 40 pounds.
Coloring: A steel-blue color, which distinguishes them from the multi-hued rainbow trout.
Habitat and diet: Steelhead require cool, clear water. Malibu Creek is believed to be the southern strain's southernmost location. At sea, adults are typically found close to ocean's surface and prefer to eat squid, small fish and crustaceans.

Distribution of Steelhead Trout

To Find Out More
For more information on the plight of the steelhead, check the following websites: National Marine Fisheries Service: www.nwr.noaa.gov California Trout: www.caltrout.org/steelhead/steelindex.htm California Dept. of Fish & Game: www.dfg.ca.gov/ Sources: National Marine Fisheries Service; "California Coast & Ocean"; "Field Guide to the Pacific Salmon" California Trout. Researched by JULIE SHEER/Los Angeles Times

[Los Angeles Times]

Wednesday, November 4, 1998

Trickle of Support
To Some Supervisors, Removing Old Matilija Dam Is an Idea That Holds Water

By GARY POLAKOVIC, Times Staff Writer

[A] proposal to tear down a dam in the Ventura County back country sounds radical, but it is an idea that just might work.

At least the county Board of Supervisors seems to think so and is intrigued enough to encourage the idea, although it stopped short of endorsing the proposal at its meeting Tuesday.

Supervisor Susan Lacey, whose district includes much of the Ventura River, said removing Matilija Dam north of Ojai holds appeal as a way to let sand flow to fast-eroding beaches.

Supervisor John Flynn said removing the dam would help save steelhead, an ocean-going trout he used to catch from the river 40 years ago, but that is now sliding toward extinction.

And Supervisor Kathy Long, whose district includes the dam, indicated that the proposal has enough merit that she would like to find a way to get it done.

"We've got a real good chance to do something major here. There's not anything divisive here. We need to go forward," Flynn said.

For now, the dam is safe. The board took no action on the proposal, preferring instead to encourage interested parties to work together to find a way to remove the dam. The county flood control agency owns the structure.

Costs of removing the dam are every bit as imposing as the concrete monolith straddling the upper reaches of the Ventura River.

The Casitas Municipal Water District, which operates the dam, says a study by UC Santa Barbara puts the cost for removal at about $75 million. The supervisors said the county cannot afford that and would have to find money elsewhere.

Nevertheless, advocates of tearing down Matilija Dam were undaunted. They say they are not expecting much from the board at this point. Indeed, they say they are concentrating efforts on uniting various groups and agencies to tear down the dam.

"It's not that there are political obstacles; there are funding obstacles," said John Buse of the Environmental Defense Center.

Matilija Dam is under scrutiny because critics say it has outlived its purpose and does more harm than good. Built in 1948, it was designed to capture sediment to reduce flood risks downstream and to store water for growers and residents in the Ojai area.

But today, the dam holds little water and does not hold back sediment because it is full of dirt. Meanwhile, it blocks 20 miles of spawning grounds that steelhead could use, officials say.

The case for removal is being championed by Ed Henke, a former Ventura resident now living in Oregon. He laments the loss of the fish, which he used to catch in local streams when he was a boy in the 1930s. Henke, who calls the dam "a gigantic public nuisance," plans to present his case to the Beach Erosion Authority for Control Operations and Nourishment at 9 a.m. Friday at Carpinteria City Hall, 5775 Carpinteria Ave.

In an Oct. 22 letter to Henke, William T. Hogarth, regional administrator for the National Marine Fisheries Service, said removal of Matilija Dam would be "one of the most beneficial actions that could be taken to help rebuild the steelhead population on the Ventura River." The letter also says water diversions at Robles Diversion Dam downstream are also an obstacle to fish migration.

But removing dams is time-consuming and complicated. Environmental studies must be done. Flood control concerns must be addressed. Water supplies need to be protected. It takes years to answer all those questions, said Mike Gauldin, Interior Department spokesman.

Nonetheless, the idea of removing dams across the West is rapidly gaining favor among fishermen, recreational river users, environmentalists, biologists, Indian tribes and some water agencies. Plummeting salmon populations up and down the West Coast have forced a reevaluation of dams.

The fisheries service is studying whether to remove four big dams considered harmful to salmon from the lower Snake River in the Pacific Northwest. The agency will make a recommendation by the end of 1999.

Some economists argue that so-called in-stream values, resulting when rivers flow free, have more economic value than storing the water in reservoirs. Dams also provide 25% of California's electrical energy, although none of it comes from Matilija Dam.

[Los Angeles Times] [THE ENVIRONMENT]

Sunday, December 6, 1998

Demolishing Dam May Not Help Fish

Environment: Critics suggest there are cheaper, simpler ways to revive population of endangered steelhead trout in Matilija Creek.

By GARY POLAKOVIC, Times Staff Writer

[A] proposal to remove Matilija Dam near Ojai to save the endangered southern steelhead trout has gained favor with environmentalists, but a growing number of critics say it would be costly, complicated and potentially dangerous for the few remaining steelhead left in Southern California.

A variety of scientists, government officials and two recent studies contend there are cheaper and simpler ways of restoring the steelhead's habitat than spending millions of dollars to dismantle a 145-foot-tall dam.

Removing the dam is "very attractive to talk about, but it's mind-boggling to do," said Alex Sheydayi, deputy director of public works for Ventura County. "Someone needs to look at this whole picture other than tearing down the dam. It's very complicated."

The proposal to tear down the 51-year-old dam on the Ventura River is part of a national crusade that has already led to the destruction of dams in several states. The campaign against Matilija is being led by Ed Henke, who lives in Oregon and has championed recovery efforts for salmon in the Northwest. He returned to his boyhood home in Ventura in November and began rallying support against Matilija.

"That dam was a historical error that needs to be corrected," Henke said. "If we're going to have a great river and a great fishery, then we're going to have to take that dam down. There's no way around it."

Groups such as Friends of the River, the Surfrider Foundation and the Environmental Defense Center have signed on to the dam-busting proposal. Officials at the National Marine Fisheries Service also endorse the dam's removal, provided it's done properly. And Ventura County's Washington lobbyist is seeking federal aid for the project.

The reason for the concern is that Matilija Dam sits on one of the last remaining stretches of steelhead trout habitat in Southern California, 19 miles of spawning streams in Matilija Creek, enough to sustain 1,100 adult steelhead.

As recently as 60 years ago, tens of thousands of the metallic-colored, ocean-going trout migrated up the Ventura and Santa Clara rivers to the mountains, where they spawned in shallow creek beds. Prized by anglers for their cunning and power, the steelhead can leap 5-foot-high barriers and muscle through currents powerful enough to sweep a man away. But today--as a result of development, pollution and water barriers such as dams--the number has dwindled to a few hundred fish in Southern California.

The southern steelhead was declared an endangered species in August 1997.

So far, the National Marine Fisheries Service, which is charged with protecting steelhead under the Endangered Species Act, has not developed a strategy for restoring the fish. Absent such a plan, Matilija Dam has become a target for environmentalists, in part because, if the fish is to be saved, it will be saved in Ventura County, with its extensive back country and freshwater streams.

"Ventura County is ground zero with respect to recovering steelhead south of San Francisco," said Jim Edmondson, conservation director of California Trout Inc., a sportfishing organization. "If we're going to have any hope in the next 10 years of recovering the steelhead, these efforts will have to be focused on the Ventura and Santa Clara rivers."

Built at a time when the nation's dam builders were taming rivers all across the continent, Matilija Dam was designed to prevent flooding on the Ventura River and store water for farmers and Ojai Valley residents. But it has been dogged by problems for years. Made of unstable concrete, the dam's top 30 feet were removed in 1965. It filled nearly to the brim with sediment years ahead of schedule and no longer protects against floods or holds much water, according to officials.

"It was a fiasco from the start," Sheydayi said. "Its value is not very significant. If the dam all of a sudden disappeared, it would have a minuscule impact on the water supply. I don't think anyone would be hurt by [removing] it. I don't think we'd notice."

The fate that may await Matilija Dam has been carried out elsewhere. Throughout the nation, obsolete dams are coming down to help migratory fish. Interior Secretary Bruce Babbitt has taken a sledgehammer to small dams in North Carolina and Northern California. Three were removed in Wisconsin, one in Maine and another in Oregon during the past two years.

"We breached the dams and the fish came back immediately," said Babbitt spokesman Jamie Workman. "It's a whole new way of thinking. Dams are not forever."

Studies Raise Some Questions But some experts are beginning to have second thoughts about the wisdom of pulling down Matilija Dam. Two recent studies raise questions about the project. One of the studies was prepared in April as a thesis project by graduate students at the UC Santa Barbara Bren School of Environmental Science and Management. The other was prepared by Walnut Creek-based ENTRIX Inc. and Woodward-Clyde Consultants of Santa Barbara last December.

The UCSB study says it would cost $64 million to $82 million to remove the dam and the sediment that has backed up behind it. Though expensive, excavating sediment is necessary because it reduces the impact on fish and property owners downstream.

The cost could soar to $150 million if habitat above and below the dam is restored and debris from the demolished dam is hauled away, according to the ENTRIX report.

Henke said he hopes the dam could be removed for less. He also said there are benefits to removing the dam that have nothing to do with steelhead recovery. Without the dam, sand could be flushed to beaches to stem coastal erosion.

In an August 1997 letter to California Trout, California Department of Fish and Game Director Jacqueline Schafer estimates removing Matilija Dam could cost as little as $3 million or as much as $45 million, depending on how sediments are handled. However, those figures underestimate by nearly half the amount of debris in Matilija Reservoir.

Digging and disposal of the 6.1 million cubic yards of mud, boulders and trees behind Matilija Dam account for about 90% of its removal cost, according to the UCSB study.

A cheaper alternative would be to gradually lower the dam and allow the river to skim away mud over several years and wash it downstream to beaches. But that option could release enough silt to "decimate the remaining steelhead populations" in the Ventura River and increase danger of destructive floods, according to the UCSB report.

The report by ENTRIX warns "the adverse environmental impacts associated with removing Matilija Dam are greater and more complex than those impacts associated with removal of other dams that are closer to the ocean. Increased sediment loading in the highly developed Ventura River would . . . potentially increase property damage due to flooding."

The Problem With Robles Moreover, even if Matilija Dam was eliminated, steelhead might never reach that far upstream. Other impediments--such as the Robles Diversion Dam two miles below Matilija--block their passage. Critics say any recovery plan must deal with Robles dam, even before Matilija.

"Robles is the place to focus our immediate attention," Edmondson said. "It is the No. 1 problem."

Since 1960, Robles dam has diverted water from the Ventura River and Matilija Reservoir into Lake Casitas. Robles lacks a fish ladder, which would give steelhead access to several miles of quality habitat in the north fork of Matilija Creek even if Matilija Dam was left alone. Fish screens would also help, officials say.

. "Providing access to habitats upstream of Robles Diversion Dam is one of the most important actions that can be taken to improve steelhead populations in the Ventura River," states the ENTRIX study. The report says it would cost only $1 million to $2 million to install fish passage devices at Robles dam.

"You get a lot better bang for your buck getting [steelhead] up over Robles dam," said ENTRIX fisheries biologist Jean Baldrige.

Other actions that might help the steelhead include improvements to the fish ladder at the Freeman Diversion Dam in the Santa Clara River. That would enable more steelhead to reach Sespe Creek above Fillmore, opening 50 miles of habitat.

"If you get more adult steelhead to the Sespe, then you get more reproduction, and that could mean a lot more fish," Edmondson said.

The Ventura River and its tributaries could be made more fish-friendly by adding gravel, native vegetation and objects where fish could hide, such as roots and logs, the report says. Also, flows of water must be increased during dry spells to enable steelhead to navigate shallow stretches of the Ventura River. Without extra water, fish will not be able to reach Robles dam, much less habitat behind Matilija Dam upstream, according to the ENTRIX study.

Then there are the bridges, concrete aprons across streams and culverts that have turned the Ventura River into a formidable obstacle course for migrating fish. Replacing or redesigning those structures would help the fish, too, without touching Matilija Dam.

"The largest impediment to half of the historical habitat is the Matilija Dam," the UCSB study concludes. "[But] it is uncertain if dam removal alone would improve conditions enough for the fish to recover their numbers. . . . Many other plans that would be much less costly could restore steelhead numbers in the region."

[Los Angeles Times] [THE ENVIRONMENT]

Sunday, November 29, 1998

PERSPECTIVE ON THE ENVIRONMENT, 2 Views of Matilija Dam

Structure Should Come Down for Sake of Beaches, Steelhead

The effort would help reestablish the beach replenishment processes and preserve an endangered species.

By ED HENKE

[I] grew up in Ventura during the 1930s and '40s, and the life was simpler and easier. There were numerous opportunities for a young person to interact with the great outdoors, as there was an abundance of fish, wildlife and natural resources easily accessible--free natural capital for all to enjoy.

In the early days, the old Anacapa Hotel in Ventura would fill up with people from all over Southern California during the trout and steelhead seasons, a local tradition at the time.

John Lorenzana and William "Andy" Anderson lived on Ventura Avenue, and as late as 1946 would hurry down to the Ventura River at the foot of Ramona Street and each catch a limit of three large adult steelhead--and still get to the school bus in time for their first-hour class. During one lunch hour in 1944, a number of classmates drove me down to the mouth of the river, and I caught three large adult steelhead and was back in time for my fifth-hour class.

Before Thanksgiving and Christmas, there were shotgun clay target shoots for turkeys at the foot of Seaward Avenue.

This era came to an abrupt close after World War II. Great natural gifts and traditions freely available for young and old alike were rapidly disappearing.

In January 1994, following my retirement from the business world, I began a historical research project on anadromous salmonids (salmon, trout and related fish that spawn in fresh water but live in the sea) in Southern California coastal waters. When the federal government declared the southern steelhead an endangered species, I narrowed my focus to the Ventura River and advocated removal of the now worthless Matilija Dam to save these fish and to help reestablish sand for eroding Ventura County beaches.

Through previous research, I had estimated that at optimal production periods, the Ventura River system annually produced more than 66,000 pounds of salmonids and more than 16,000 adult steelhead averaging four pounds. As late as 1946, an estimated 5,000 adult steelhead were spawning in the Ventura River system. Chinook or king salmon, which elsewhere have reached record weights of 125 pounds, had been documented in the Ventura River in 1881.

In July I completed this research and presented copies to the Ventura County Board of Supervisors. On Nov. 3, I made a plea before the board, asking the supervisors for a resolution advocating complete removal of Matilija Dam.

They agreed in theory but felt further evaluation was necessary.

In 1941, Secretary of War Henry L. Stimson introduced to Congress on behalf of the Army Corps of Engineers its recommendations for the building of four dams on the Ventura River system as proposed by Ventura County officials. The corps gave thumbs down, as none of the dams would provide flood control or water storage on a cost-effective basis. Citizens had also expressed concerns about safe sites.

But the Ventura City Council championed the idea, and in 1945 a water development bond issue that had failed on two previous occasions was passed by Ventura County voters and construction began.

Almost immediately after Matilija Dam construction started in 1946, problems plagued it. Ventura County sued the construction firm over engineering problems and lost, with a $33,000 court assessment. Against the recommendations of a professional, sand and gravel from the Santa Clara River were used and mixed with alkali in the cement. This created an alkali-reactive aggregate condition, causing failing and deteriorating concrete. There was internal swelling, external cracking, disintegration of the dam's concrete wall in the upper 20 to 30 feet, which had to be removed; safety factors of concrete were well below acceptable minimal levels for such arch dams.

And there were other problems. The layer of silt and rock in the stream bed was 20 feet greater than estimated. And the abutments have continued to move during the dam's lifetime.

The problems led to the dam's footbridge being dynamited and the dam being notched twice, down from 163 feet to approximately 130 feet. The dam backs up an estimated 11 million cubic yards of silt and other material. It provides no flood control and minimal water storage.

I urge the complete removal of Matilija Dam and its mountain of silt / sediment / debris for the following reasons:

* Public safety. It's better to take the dam down in a planned and orderly manner than to risk its collapse because of floods or earthquake.

* To reestablish the beach replenishment processes. Sand trapped by the dam should be allowed to resume the natural process of nourishing beaches eroded by ocean waves.

* To help preserve the southern steelhead, an endangered species with only 20 stream miles of refugia area remaining, all of it above Matilija Dam.

* To reestablish historical in-stream values and socioeconomic benefits. Restoring the natural flow of the Ventura River would be good for people as well as fish.

Future generations would thank us for these efforts.

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Ed Henke, 71, Grew up in Ventura and Now Lives in Ashland, Ore

Sunday, November 29, 1998

PERSPECTIVE ON THE ENVIRONMENT, 2 Views of Matilija Dam

Removal Would Destroy an Asset

Taking out the dam would be costly and provide no guarantee of benefits. Instead we should explore rehabilitating it for storage, flood control.

By RONALD L. RINDGE

[P]roponents of removing the Matilija Dam cite two reasons for doing so:

* To restore full sediment flow to the beaches.
* To provide additional spawning areas for steelhead trout, which would help save them from extinction.

The sediment trapped by the dam has come about over a 50-year period. The dam does not trap all sediment, because much of it is in suspension in the water flowing over the dam during peak storm runoff and does reach the beaches. Whether the sediment-flow argument is valid depends on whether the sediment trapped by the dam each year justifies the cost of removing the dam.

The argument that removing the dam would help save the steelhead by increasing its spawning area is weak. There is no guarantee that removing the dam would bring back steelhead to this waterway.

Steelhead thrived below the dam for many years after the dam was built in 1948. Are there any steelhead now in the Ventura River? How many steelhead have returned to the Santa Clara River since the Freeman Diversion Dam and fish ladder were constructed for millions of dollars years ago? If there are no or very few steelhead, manual transport to upper spawning areas should be considered.

The decline of steelhead in Southern California has been caused by many factors, primarily the degradation of marine and stream waters resulting from the ever-increasing urbanization of coastal watersheds.

It is significant that the impetus to remove Matilija Dam is coming from special fish interests and taxpayer-funded public agencies that seem to have little concern for cost-benefit analysis. Not only would removing the dam cost as much as $75 million, according to one estimate, but doing so would destroy a multimillion-dollar asset that could be rehabilitated for critical water shortage and flood-control purposes.

Taxpayers are not clamoring to spend $75 million on a Las Vegas gamble that removal of the dam will solve Ventura County's beach erosion problems or "save the steelhead."

The option of rehabilitating the Matilija Dam to full storage capacity and flood-control capability needs to be seriously examined.

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Ronald L. Rindge of Moorpark Is the Grandson of Pioneer Mailbu Rancher May Knight Rindge, for Whom Rindge Dam on Malibu Creek Is Named. Environmentalists and Steelhead Advocates Are Also Seeking the Removal of Rindge Dam

Tuesday, January 26, 1999

Gallegly Calls for Study of Matilija Dam's Removal

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Nature: Congressman says structure may have outlived its usefulness and should come down. Environmentalists welcome support.

By GARY POLAKOVIC, Times Staff Writer

[B]ackers of a plan to remove Matilija Dam may have found an ally in a Ventura County congressman who believes removing the structure has merit because it could save fish and restore sand flows to the coast.

In an action likely to focus more attention on the controversial proposal, Rep. Elton Gallegly (R-Simi Valley) has called on federal engineers to begin an investigation on how to remove the dam. It would be a first step toward determining whether the proposal makes environmental or economic sense.

"It appears the dam may have outlived its usefulness and may be causing more problems than it is solving," Gallegly said in a news release issued Monday. "If removing it will solve our beach erosion problem and help steelhead trout to recover from its endangered species status, and if its removal is cost-effective, I could support its removal. This study will begin to answer those questions."

Gallegly said he discussed the issue during a meeting last week with Col. John P. Carroll at the Army Corps of Engineers office in Los Angeles. The two discussed removal of the dam, flood control on Santa Paula Creek and dredging at county harbors.

Matilija Dam was built in 1948 to prevent floods, and to store water for citrus growers and residents in the Ojai Valley.

Today it is nearly filled to the brim with mud and is widely viewed as obsolete. It holds little water and acts as a 145-foot-tall barrier to endangered southern steelhead trout trying to reach 20 miles of prime spawning stream in Matilija Creek.

By weighing in on the dam dispute, Gallegly adds an influential and prominent voice to a growing chorus of calls to tear down the dam.

For the most part, environmentalists have attempted to rally additional support for the proposal. Already a majority of the Ventura County Board of Supervisors and the National Marine Fisheries Service have expressed interest in the plan.

"He's on the right track there," Ron Bottorff, chairman of Friends of Santa Clara River, said of Gallegly's efforts. "You can't just go in there and take the dam down, because it's got all this sediment piled up behind it. It's a complicated problem."

Although Army Corps officials could not be reached Monday, Gallegly spokesman Tom Pfeifer said the agency has not yet decided to proceed with a dam-removal study.

He said approval must come from Washington, and it will take a few weeks before a decision is made.

While several estimates have been prepared, it would probably cost about $75 million to remove the dam and clear out the tons of sediment trapped behind it.

In other matters, Gallegly urged the corps to complete a Santa Paula Creek flood control project. About 2,000 people were evacuated from their homes during heavy storms last February.

The first phase of the project is completed and $16 million is needed to finish the work, Gallegly said.

[Los Angeles Times] [THE ENVIRONMENT]

Tuesday, May 4, 1999

Task Force on Dam Removal Is Planned

Environment: Many agree barrier on Matilija Creek in Ventura County is outdated. But the cost of tearing it down is daunting.

By CATHERINE SAILLANT, Times Staff Writer

[V]ENTURA--Saying the proposal would bring wide, sandy beaches to much of Ventura County and protect threatened fish, dozens of environmentalists, scientists and officials from federal, state and local agencies met Monday to hash out a plan to dismantle Matilija Dam.

After hearing from experts, the 60 participants agreed to name a task force to answer several critical questions. Chief among them is: Who would pay for such a massive and costly project?

While early estimates have ranged as high as $82 million, the true cost is not known and would depend on the process chosen to bring the dam down, panelists said.

What seems sure at this point, suggested Supervisor John K. Flynn and other panel members, is that the dam across the Ventura River would not be torn down unless the county is able to tap heavily into state and federal dollars.

Even if money is found, it would take 10 to 15 years to get through the studies and permits required before a single chunk of concrete is removed, panelists said.

The meeting was called to share information on the dam's history and problems associated with it. Roundtable members also identified issues that must be tackled before any work could begin, such as commissioning engineering and environmental studies.

Participants agreed that the dam should be retired because it has outlived its usefulness. It was built in 1948 to prevent floods and to store water for farmers and residents in the Ojai Valley. Today, it is nearly filled to the brim with mud and holds just 500 acre-feet of water.

"It can be stated categorically that it serves no flood-control purpose," said Art Goulet, director of the Public Works Agency. "We would like to see this [dismantling project] progress."

Environmentalists are concerned because the concrete wall acts as a 145-foot-tall barrier to endangered southern steelhead trout trying to reach 20 miles of prime upstream spawning grounds in Matilija Creek.

If the dam were dismantled, the population probably would rebound to about 2,000 adult steelhead, officials said. Removal would also allow sandy sediments to flow down the Ventura River and into the ocean, said Jerry Nowak, executive director of a beach erosion awareness group.

Beaches from Ventura to Point Mugu probably would widen by 30 feet, a process that would take several years, Nowak said. Formation of the task force demonstrates growing support for the dam's removal. A majority of the Ventura County Board of Supervisors and the National Marine Fisheries Services already have expressed interest in the plan.

Rep. Elton Gallegly (R-Simi Valley) has asked federal engineers to begin a study on how to remove the dam. Brian Miller, Gallegly's chief of staff, said the $100,000 study is awaiting funding approval by Congress.

[Los Angeles Times] [THE ENVIRONMENT]

Thursday, February 11, 1999

Project OKd to Aid Endangered Steelhead

Wildlife: Casitas water district will build a $2.3-million fish ladder at a Ventura River dam to enable the trout to reach spawning habitat.

By GARY POLAKOVIC, Times Staff Writer

[A] county water agency decided Wednesday to build a $2.3-million fish ladder at a Ventura River dam as part of an ambitious plan to keep the endangered steelhead trout from sliding to extinction.

The Casitas Municipal Water District board unanimously voted to pursue measures that would improve river conditions for the fish and enable it to reach prime spawning streams in the Topatopa Mountains above Ojai.

The action establishes the river as a focal point for steelhead recovery in Southern California, where the prized game fish once abounded before coming under pressure from dams, pollution and water diversions.

Casitas district officials acknowledged their actions are motivated by legal concerns as well as environmental worries. The district has spent the past two years discussing with federal officials measures to save steelhead, and officials acknowledge the threat of a lawsuit forces them to act sooner.

* * *

One of those threatening suit is California Trout Inc., a pro-fishing group that contends Casitas' management of the river and Robles Diversion Dam conflicts with the Endangered Species Act and is pushing steelhead to the brink.

"It's an investment we need to make to protect the fish," district General Manager John J. Johnson said. "We want to take the high road so if they do decide to take us to court, we can tell the judge we are taking every reasonable action to take care of the fish."

But it appears very unlikely the Wednesday action will go far enough to fully restore the fish in the Ventura River or assuage critics of the agency, which manages the river to control floods and provide water to growers and residents in the Ojai Valley.

Cal Trout Executive Director Jim Edmondson described the decision by the district as "very encouraging," but added he intends to file suit Feb. 19 if the agency fails to produce a comprehensive plan in writing to protect the fish. Cal Trout filed a 60-day notice of intent to sue in mid-December.

"These fish are under full protection of the Endangered Species Act and we're very concerned about [actions that result in] take of the fish," Edmondson said. "This is a trust-but-verify situation."

One practice Cal Trout seeks to end is water diversions from the river to Lake Casitas, a practice Cal Trout says kills steelhead smolts trying to return to the ocean. But the district governing board rejected a staff proposal to suspend the practice for one year while the fish ladder is built. About 60,000 gallons have been diverted so far this year.

"Who's going to get the water: the fish or the people?" Casitas board member Bill Hicks said. "Isn't there some sort of maxim that the water should be used for the highest and best use?"

And costs for steelhead recovery clearly disturb some board members, who openly questioned how to pay for the fish ladder and other measures.

* * *

The $2.3-million cost could be paid by state and federal grants or perhaps from a $100-million fund the Clinton administration designated last month for salmon recovery in the west, officials say. The district's contribution to the project, however, could come from ratepayers.

"The people who live in this district are going to have to end up spending the money," board member James W. Coultas said.

Johnson, however, said the district was going to have to build the fish ladder sooner or later. Fighting it and other steelhead recovery measures would only result in costly litigation, which in the end would incur greater expense and probably fail, he said.

The fish ladder at Robles Diversion Dam would consist of a series of underwater terraces to enable fish to climb the barrier and reach miles of high-quality spawning habitat on the north fork of Matilija Creek. Also, screens would be installed to steer smolts from the diversion intakes.

Steelhead proponents say changes at Robles Diversion Dam are a necessary precursor to the removal of the much larger Matilija Dam farther upstream.

That dam blocks about 20 miles of habitat once used by steelhead earlier this century.

The actions taken Wednesday by the Casitas district do not affect Matilija Dam.

Under the measures, the Casitas district, working with the National Marine Fisheries Service and the U.S. Bureau of Reclamation, will solicit proposals for the design and construction of the fish ladder, screens and steelhead monitoring system at Robles Diversion Dam.

Also, the board directed Johnson to work with federal officials to develop a comprehensive, long-term plan for steelhead management on the river.

At its core would be a "habitat conservation plan," which permits limited destruction of steelhead to ensure that vital operations continue on the river, as long as actions are taken to offset the losses and promote the fish throughout its range, said Jim Lecky, assistant regional administrator for the Marine Fisheries Service.

Other measures that could be taken to benefit steelhead include replacing road crossings and culverts that block fish migration, cleaning tributaries to enhance habitat and raising steelhead in hatcheries for release to streams.

"They deserve a lot of credit for stepping forward to work on this," Lecky said.

Ventura County has been at the heart of the steelhead debate since the southern population of the fish was declared endangered in August 1997.

Environmentalists last year launched a campaign to tear down Matilija Dam to benefit the fish.

Cal Trout plans to make the Ventura and Santa Clara rivers and the Santa Ynez River in Santa Barbara County ground zero in the fight to save the fish.

Last week the Marine Fisheries Service identified 140 waterways, including nine in Southern California, essential to steelhead recovery.

[Los Angeles Times] [THE ENVIRONMENT]

Monday, March 8, 1999

Freeman Dam Fish Ladder Spawns Debate Over Water Use

By GARY POLAKOVIC, Times Staff Writer

[W]ith the push of a button inside the control room at the Freeman Diversion Dam near Saticoy, thousands of gallons of Santa Clara River water gushes through the dam's fish ladder.

In the eight years since it was built at a cost of $2 million to help save the endangered southern steelhead trout, six adult fish are known to have passed through the concrete and steel contraption.

That is $333,000 per fish, not counting the value of the water that could have gone to houses and farms on the Oxnard Plain, instead of washing out to sea.

"I would like to see some results for the loss of the water," said Dana Wisehart, who works for the United Water Conservation District, which operates the dam.

"I would like to see more fish. The water we put through here could be put to other uses. We spent all this money, let's get some results, doggone it."

Fish ladders like the one at Freeman Diversion Dam--the only ladder operating in Southern California--have been considered important tools to help fish reach spawning grounds blocked by impassable dams.

Just last month, the Casitas Municipal Water District agreed to build one at a cost of $2.3 million at the Robles Diversion Dam on the Ventura River near Ojai, also to benefit the steelhead. But the high cost and marginal benefit of the Freeman ladder serve as an object lesson in how difficult it will be to bring steelhead back to Southern California streams. The problems at Freeman are stoking a debate over who should get the water, people or fish.

"We are somewhat concerned about the ladder. It's not operating as efficiently as it could be. It needs fine tuning," said Eric Shott, a biologist at the National Marine Fisheries Service. That agency is working with the U.S. Army Corps of Engineers and the United water district to find ways to get more steelhead past the 25-foot-high dam to their spawning grounds in the Upper Ojai.

As poorly as the Freeman ladder has performed, it has at least proven one thing: Steelhead still live in Southern California rivers.

Dam operators have annually counted about 400 smolt passing through a fish screen at the Freeman dam on their return trip to the ocean.

Many more juveniles are believed to wash over the top of the dam during storms.

This is good news to conservationists, because the very existence of the fish was hotly debated when the fish ladder was proposed for the dam a decade ago.

Since then, small numbers of steelhead have been seen by biologists in the Ventura River, Sespe Creek, Malibu Creek, the Santa Ynez River and Topanga Creek, Shott said.

* * *

They are all that is left of the thousands of fish that early this century migrated each winter from the ocean to spawning tributaries in local mountains.

The species was declared endangered in 1997, their numbers depleted by water diversions, dams, pollution and overfishing.

Steelhead are ocean-going rainbow trout that grow up to 2 feet in length and are prized by sports fishermen. Like salmon, they are relentless in their determination to migrate and spawn, swimming headlong into raging currents and astounding scientists with their navigation skills.

But officials are disappointed that so few fish have been seen using the Freeman dam fish ladder. Getting more steelhead past the dam is vital because the Santa Clara River is the path to tributaries such as Sespe Creek, considered the best remaining steelhead habitat in Southern California.

One possible reason more adult fish haven't been observed is that some fish may be getting through the ladder without being seen. The ladder is a terraced staircase of switchbacks made of concrete and steel.

Once inside, fish ascend the dam step by step, leaping from one level to the next.

But water coursing through the fish ladder is so turbulent it could easily conceal a big fish.

"We may have a few more fish using the ladder than have been observed," Shott said.

But not necessarily. Since each adult female lays hundreds of eggs, even a few fish could account for the hundreds that come back down the river to the sea.

Another possible reason few fish show up in the ladder is because it is only operating a few months in the year, during the wet season.

It runs in March, believed to be the peak of the steelhead migration, and it runs for up to 48 hours after storms.

Any more use than that releases too much water, Wisehart explained.

About 5,000 acre-feet of water was released to enable the six steelhead known to have traversed the ladder to get over the dam. That is enough water to supply a city of 20,000 people for a year.

"It's going to be interesting if we begin using [more] water for steelhead," Wisehart said. "The people need to decide if we want an improved environment or to sustain what we have."

One reason fish may not be using the ladder is that they are having trouble finding it, said Jim Edmondson, conservation director for California Trout Inc.

The portal is a 4-foot square hole in a concrete wall on the extreme south end of the dam. Steelhead, following the currents, may reach the pool at the base of the dam and get confused, he said.

Edmondson proposed using divers to see if steelhead get stuck in the pool at the base of the dam during storms.

Beyond these theories, searching for fish is a tenuous proposition under the best of circumstances, as any fisherman knows.

* * *

Finding an endangered fish in a big waterway is like looking for a needle in a haystack.

For those reasons, Shott, at the Marine Fisheries Service, says his agency is committed not only to the Freeman fish ladder but also to the new one at Robles dam. But the design may be different.

"We're going to take a very close look at the design and construction of the ladder at Robles dam," Shott said. He said the Ventura River flows in a narrower channel, which should make it easier to funnel steelhead into a fish ladder.

Environmentalists say it's too early to lose faith in restoration efforts such as the Freeman fish ladder. It will take time for the steelhead to rebuild their numbers. High expectations at the beginning of the recovery process are unrealistic, said Mark Capelli, executive director of Friends of the Ventura River.

"It's taken 50 to 60 years to put steelhead into the condition they are in, and it's going to take a little while to restore them," Capelli said.

Thursday, March 25, 1999

Discovery of Dead Trout Renews Debate on Dam

[V]ENTURA--The discovery last week of a dead steelhead trout at the Freeman Diversion Dam has renewed debate over how the dam's fish ladder is operated.

The 22-inch steelhead was found March 16 by biologists working for the United Water Conservation District.

The carcass was taken to Long Beach for analysis by federal wildlife biologists, who found that it contained thousands of eggs.

Officials are not sure how the fish died, but they say it was found in an area that adult steelhead do not frequent.

"The mystery is why it swam the way it did, because it came upstream and then went back downstream into an area it could have easily gotten out of," said Jim Kentosh, the district's manager of operations. "We don't know why it stayed there."

According to Kentosh and other officials, the fish negotiated the dam's fish ladder Feb. 13 but instead of swimming up the Santa Clara River, it turned right and went downstream, where it got caught in the district's fish screen bay. Feb. 13 was the last time the ladder was in operation.

The bay is where young smolt are trapped and steered toward the river and away from the diversion canal.

The fish apparently lived in the bay at least three weeks before it died.

Environmentalists who have been lobbying to protect the endangered steelhead hope the death will force water officials to reexamine their conservation efforts.

District workers said they are operating the dam and ladder according to federal wildlife protection standards and that their conservation efforts have been successful.

[Los Angeles Times] [THE ENVIRONMENT]
Tuesday, March 23, 1999

Conejo Creek Dam Project Spawns Ire

Environment: Opponents say the stream is prime habitat for the endangered steelhead trout, but water officials have found no scientific evidence.

By COLL METCALFE, Times Staff Writer

[P]lans to build a diversion dam on Conejo Creek near Camarillo have raised the ire of conservationists who contend that the small stream is critical to the survival of southern steelhead trout.

Environmentalists hope to convince federal wildlife officials to designate the waterway as a prime habitat for the endangered fish.

"I think it's pretty clear that the creek is important for the species," said Ed Henke, an Oregon-based environmentalist who has championed initiatives to restore populations of the once-plentiful steelhead. "That, I think, is what the evidence is telling us here."

Yet proponents of the project say there is no evidence that indicates Conejo Creek is or ever was an important spawning habitat for the ocean-going fish.

They say the $9-million dam is needed to satisfy the area's increased water demands and relieve pressure on an already overused system of underground aquifers.

"This is an issue that only recently came to our attention, because there's been nothing that would have indicated that this is steelhead habitat," said Donald Kendall, executive director of the Calleguas Municipal Water District, which is helping design the dam. "And quite frankly, I don't think there's ever been anything that's shown this is a sustainable habitat."

Like a slender thread weaving through the hills of east Ventura County, Conejo Creek begins in the Thousand Oaks area north of Hill Canyon and meanders south toward Camarillo before emptying into Calleguas Creek and the Pacific Ocean.

Last month, the National Marine Fisheries Service listed Calleguas Creek--along with the Ventura and Santa Clara rivers--among 140 western waterways absolutely necessary for the preservation of southern steelhead trout.

A final decision on whether to keep Calleguas Creek among those waterways deemed critical habitat for the rare fish is pending while the service hears arguments from both opponents and supporters.

Federal officials will meet today with conservationists and water district representatives to collect data needed to make their final decision.

If endorsed by the service, those waterways would be subject to strict controls that would limit development, road construction, diversion dams and sewage treatment.

Critics such as Henke said that because Conejo Creek empties into Calleguas Creek it, too, should be subject to the same restrictions.

"I think it's safe to say that if a steelhead swims up the Calleguas Creek it could also swim up the Conejo Creek," Henke said. "And I believe there's enough evidence to support that."

However, project supporters say the evidence is specious because it relies on neither empirical nor scientific analysis and that past studies conducted by state and federal agencies have not found conclusive evidence to suggest either Conejo Creek or Calleguas Creek are critical habitats for the fish.

They point out that most of the water that flows down Conejo Creek is treated discharge from the Hill Canyon Wastewater Treatment Plant in Thousand Oaks.

Ventura County has been at the center of the steelhead debate since it was added to the endangered species list in August 1997. No one knows exactly how many steelhead trout live in Southern California.

Last year, environmentalists launched a campaign to raze Matilija Dam so the fish could swim to their natural spawning grounds far upriver.

In another instance, pressure from environmentalists prompted the Casitas Municipal Water District last month to approve a $2.3-million fish ladder at a Ventura River dam as part of a plan to aid steelhead migration.

Conservationists have also called for more stringent guidelines for water use in the western United States to protect the species, whose decreased numbers are blamed on pollution and closed spawning grounds.

Plans for the Conejo Creek diversion dam are already underway.

Engineers are finishing preliminary blueprints for the 3-foot earthen berm that would be located just south of where the creek crosses under the Ventura Freeway at the western edge of the Conejo Grade.

The dam project will be spearheaded by the Camrosa Water District and would be used primarily to supply irrigation to farmers in Camarillo and the Santa Rosa Valley.

If plans for the dam are scuttled, water district officials said, it will be a tremendous loss, particularly when newer and more novel concepts of water usage need to be found and exploited.

"The dam is important because we're reclaiming water that we would have had to import from the north," said Henry Graumlich, resource manager for the Camrosa Water District.

"[The dam] would cut at least some of our need for imported water, which is something we need to do."

Feature Article

High Country News -- October 27, 1997 (Vol. 29, No. 20)

photo courtesy Lundberg Family Farms
FAMILY FARMERS: Organic rice farmers Harlan, Homer, Eldon and Wendell Lundberg

Deconstructing the age of dams

by Marc Reisner

In the early fall of 1991, I got a call from a cheery young man named Bob Herkert, who introduced himself as the field manager for the California Rice Industry Association. He wanted to invite me on a "good will" tour of the Sacramento Valley rice-growing region, where he said I would see two salmon-blocking dams that one of Northern California's largest irrigation districts planned to blow up.

The irony of a water district eager (so he said) to demolish its own dams threatened to fell me.

Since the publication of my book, Cadillac Desert, in 1986, I had been anointed a Public Enemy by many Westerners, especially California irrigation farmers, and I figured that no farmer liked me less than one whose crop is rice. Californians tend to be blasé about the profoundly unnatural acts they have performed with water (the creation of Los Angeles, for example), but you can still slacken some natives' jaws when you inform them that their state raises half a million acres of rice. In fact, in the years following publication of my book, I was being paid decent money to exploit this fact on the lecture circuit, lampooning a monsoon crop grown in a desert state.

But if the rice farmers were as incensed with me as I suspected, why were they inviting me on a good-will tour? And if rice doesn't just like to soak up water but likes to stand knee-deep in water, how could a district full of rice farmers even think about destroying its water-diversion dams? It smelled like a setup, but I'd already agreed to go.

A setup it was. My welcoming committee was not the half dozen "friendly-as-hell-despite-everything-you've-said-about-them" farmers promised by Herkert, an innocent-looking country boy from Colusa, Calif., with killer political instincts; it was 19 tight-lipped farmers and industry leaders waiting with claws bared. After a debating session that, over lunch, came fairly close to a food fight, everyone settled down, we conceded each other some points, and a temporary truce was declared. Then my adversaries, whom I was secretly beginning to like, led me through the history that was about to culminate - perhaps for the first time in the American West - in an environmentally inspired deconstruction of dams. How could we have reached this point?

Gary Brown
SAFE PASSAGE: Western Canal Dam diverts water from Butte Creek into Western Canal

Three strikes against rice

Although rice has been grown in California since 1912, it wasn't until the last couple of decades that it began to acquire a sorry public image. One obvious argument against rice - especially in an overpopulated, semi-arid state - is its water demand.

Actually, rice raised on the most efficient California farms uses less water than an irrigated pasture of alfalfa, whose evapotranspiration demand is at least 4 feet per acre per year; rice grown on hardpan soils can survive on three and a half feet.

Yet the state's 400,000-500,000 acres of California rice guzzle roughly as much water as 6 million people in the Bay Area, and the gross crop value is only $500 million or so. The Bay Area economy, which is largely dependent on imported water, is worth nearly $200 billion, so one could argue that the rice region's water would be better used there. Earlier in the century, the same line of reasoning resulted in Los Angeles.

Meanwhile, the rice-growing district with by far the greatest thirst, the Glenn-Colusa Irrigation District, spent the 1970s and 1980s stonewalling fish and game agencies which asked for effective fish screens across the district's huge intake pipes at the Sacramento River.

California Rice Industry Association
BED-AND-BREAKFAST: Snow geese flock to a California rice field

Publicity about the obstructionist tactics of its law firm (Minasian, Minasian, Minasian, Spruance, Beber, Meith, and Soares - the name alone a dilatory strategy) was so damaging to the rice industry that the California Rice Industry Association helped overthrow the district's board of directors. Today, with a new board, law firm and general manager, the district has become one of California's most progressive.

Yet another public-relations meltdown came from rice farmers' use of pesticides. Concentrated in return flows from the heart of the Sacramento Valley, the chemicals entered the Sacramento River just upstream from the city of Sacramento, which draws some of its drinking water from the river. (If you are going to taint some city's water supply, it shouldn't be the state capital's.)

The residue was enough to affect the water's flavor, if not its potability, and even though the Sacramento Valley grows a hundred-odd crops - most of which are chemically sprayed - suspicion fell mainly on rice.

California Rice Industry Association
Bob Herkert with son, Hans, is field manager for the California Rice Industry Association

Still, nothing was blackening the industry's reputation more than its habit of blackening the air. Rice stalks, or straw, are inordinately high in silica; it is tough stuff, and won't decompose as readily as most plant detritus. Harvesters leave the straw behind, and rice farmers have to get rid of it before they can plant next year's crop.

In Asian countries, most rice and wheat straw is converted to newsprint, or compressed into bricks for home construction - you can do all sorts of things with its durable cellulose.

In the United States, still content to gnaw its forests away, the market for agricultural straw is miniscule; it is most commonly used to control erosion in wildfire zones. Lacking an economic alternative, California's 2,000 rice growers simply burned it.

While the state Air Resources Board regulated the practice by issuing burning permits based on daily weather forecasts, interior California winds are notoriously shifty. During one famous smokeout, a thunderhead-size plume from the rice region blew into Sacramento and set off smoke alarms in tony shops on Capitol Mall. With a dispatch some found startling, the state Legislature, in 1991, drafted a bill phasing out rice-straw burning over the next 10 years.

After some howling, the rice industry association decided to give in. Despite bitter objections from many of the farmers it represents, who sensed that any alternative to burning would cost more than matches and kerosene, the association endorsed the burning phaseout after inserting a contingency clause in the bill for hardship cases.

Meanwhile, to avert even more regulation, its members launched a pesticide-reduction program, switching to compounds that biodegrade more quickly and storing return flows in ponds to give the chemicals more time to break down.

The pesticide-reduction program was already a demonstrable success by the time the growers asked me to meet with them. Between 1983 and 1992, estimated rice pesticides entering the river declined from 40,000 to 218 pounds, an achievement that won a rare commendation from the California Environmental Protection Agency.

Burning was tougher. The only alternative straw-removal technique that seemed efficient and affordable - if you had a relatively cheap and ample water supply - was flooding fields after harvesting the rice. A number of farmers had already tried it, generally with success. Soils in the central Sacramento Valley tend to be fine, river-borne silts compressed over eons into something like pottery clay; its dogged impermeability is the main reason rice thrives where most other crops fail.

If you flood a field 6 inches deep in early October, you're still likely to have standing water in mid-November, when California's rainy season generally begins. By flooding the fields in the fall, when temperatures are still warm, the decomposition of the rice stalks is accelerated. Rain during winter and spring finishes the job.

And there was an unexpected boon: Growers who had experimented with fall flooding told of waking up on winter mornings, when the Pacific Flyway's waterfowl migration season was in full swing, and seeing ducks, geese and shorebirds mobbing their fields.

Waterfowl like water, of course, and many also like rice: harvesting typically leaves behind 200-300 pounds of grain to the acre. But the birds' interest in flooded rice fields was so striking that waterfowl biologists came in to see what was going on. They discovered a whole new water-based food chain that had evolved in a few weeks - midges, annelid worms, copepods, crayfish. It was a vast, diffuse, high-protein larder for the famished birds, whose migratory ordeal can claim at least a third of their body weight.

Sensing a spectacular opportunity, the rice industry association was poised to sell fall and winter flooding to environmentalists and a perhaps dubious public (What? They want even more water?) as the perfect synthesis of farming and habitat.

In 1992, The Nature Conservancy, keen on creating new habitat on private lands, hired me as a consultant to help it and the rice association deal with the vexing issue of finding more water. The amount necessary - probably hundreds of thousands of acre-feet with the burn phaseout in full force - assured that this would be no cakewalk.

To make the task more difficult, between 1987 and 1992, California experienced its severest drought since the Dust Bowl of the 1930s. Water rationing was so universal and in some places so harsh that memories of it would persist for a good while.

Yet the state's rice association began promoting winter-flooding just as the drought ended, while some elementary math - several inches of water applied to several hundred thousand acres - suggested that the program might require more water than that used by the cities of San Diego and San Francisco combined.

Even worse, growers would be drawing water from rivers in the fall, when flows are lowest and salmon migrations are under way. To maintain flows for salmon and steelhead and other users downstream, dams would have to release more water, and reservoir levels would drop; and when the next drought came, rationing would be even more severe.

In so many words, the rice growers, in complying with one environmental law - the Rice Straw Burning Reduction Act of 1991 - might violate half a dozen other laws or rules, including the Endangered Species Act. But they might also be creating new or better habitat for species - Aleutian Canada geese, Ross' geese, sandhill cranes, giant garter snakes - protected by the same act.

However ironic and bureaucratic the situation, the water-use conflicts were real, and biologists with California's Department of Fish and Game were the first to recognize them. While the state's waterfowl division waxed enthusiastic about flooding rice fields, its fisheries section was loudly skeptical.

In the environmental community, similar schisms showed up: A waterfowl-group biologist complained about environmentalists' "obsession with fish, fish and only fish," while fish-rights activists skewered birders who portray waterfowl hunting "as a blood sport while murdering salmon is fine and dandy."

Another environmentalist - a real one, she called herself, not "a biologist on the payroll of some hunters' group" - groused about a program whose hidden purpose was "to breed more ducks for rich hunters to kill."

John Roberts, the state rice association's unlikely executive director - a vegetarian Republican who was the original drummer with the rock group Kansas - was flummoxed by the environmentalists' skepticism, and called a couple of times a week to tell me so. Meanwhile, Herkert, the association's field manager, was running around looking for "fish-friendly" water, which seems to exist only in certain months of wetter years.

One strategem would have been to slow the burning phaseout, which had been put together on the assumption that markets for straw would materialize. Environmentalists and the administration of Republican Gov. Pete Wilson agreed on almost nothing except rice straw's potential as a substitute for lumber and pulp. However, finding a market would take time, and when the association's board flirted with a two- or three-year burn-phaseout delay, early reaction from the clean-air lobby caused them to drop the idea like a lump of plutonium.

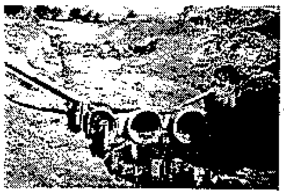


Photo courtesy Western Canal Water District
FREE PASSAGE: Fish in the creek will pass freely through pipes, where the old Western Canal Dam once blocked many of them. (See correction in HCH, 11/10/97.)

One group gets radical

The Western Canal Water District, where I had begun my good-will tour, was the one entity in the rice region that had managed to pick a clean route through this obstacle course.

The district had a couple of million dollars in the bank and it offered to invest it in the demolition of its two diversion dams and some relatively inexpensive piping. Whatever it took, the district said, in addition to helping migratory birds, it was going to do salmon more good than harm.

I had taken a liking to this district, in whose offices I had been roasted in 1991. Western Canal's most prominent board member, Homer Lundberg, was the angriest of my 19 adversaries, but ultimately I understood why: The Lundberg family runs the largest organic rice-growing operation in the United States and maintains a winter bed-and-breakfast for huge flocks of waterfowl - their droppings are the farm's principal fertilizer - by permitting no hunting on any of its land. ("It hurts," Homer told me later, "when we run what amounts to a pesticide-free wildlife refuge and people still don't think of us as environmentalists.")

Photo courtesy Western Canal Water District
Gary Brown, general manager of the Western Canal Water District, stands in one of the pipes

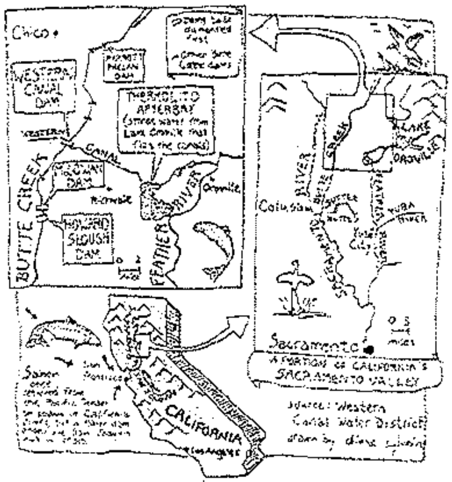
Gary Brown, the district's general manager, whose physique is extra-large and who looks faintly undressed without a holster and gun, is one of the most tireless conservationists I have ever met. Brown is also a rice-region rarity: a male in a hunting culture who doesn't hunt.

"I couldn't shoot at a duck," he once told me. "I'd feel too sorry if I actually hit one."

Western Canal's water supply flows by aqueduct from Oroville Dam, a gigantic state-financed structure on the Feather River, the Sacramento's biggest tributary. But as the canal meanders west and north, it irrigates only about half its district before running into Butte Creek, which drains another watershed. To get water to the district's 30,000 acres on the other side of the creek, two small retention dams block the creek. The dams keep Oroville water from going downriver and allow big pumps on the other side of the creek to suck it right back out.

These dams are semi-removable concrete-and-flashboard structures, connected to a river island; when their six-foot wooden flashboarding is taken out at the end of the irrigation season, an athletic salmon can jump upstream. The dams also have primitive fish ladders around the sides. Even so, a slow-learner salmon or steelhead can spend many hours trying to surmount them, and once it does, the unscreened pumps are powerful enough to suck up adult fish, not to mention inch-long juveniles.

"We're the second biggest rice district in the valley," mused Gary Brown. "Our water is cheap and we've got lots ... In a drought, we might be delivering through the winter, and then you can't drop the dams at all.



Diane Sylvain

"So we got to thinking, good God, we've got wild fall-run chinook in the river; that's the gene pool for the hatchery fish that keep the whole salmon industry from going down the tubes. We've got the spring-run chinook in here and they could go on the endangered species list. If that happens, commercial fishermen can't fish because the spring-run feeds off the coast with the fall-run, and you can't tell them apart. Meanwhile, everyone who diverts Sacramento River water from here to L.A. is gonna take a hit. We're on a spring-run tributary, so we get blamed. We've got steelhead in the creek, too.

"I have to be careful sometimes not to get too far ahead of my board, but this was a no-brainer. They all said: 'We're gonna take those dams out. And then we've got to go to work on the rest of the watershed.' "

A 'lost cause' that wasn't

The district wasn't going to give up any water. It was simply going to run its water in pipes under Butte Creek instead of damming the creek to pump water across. But it was certainly going to spend some money.

Before dams, the spring-run was California's most abundant salmon race, the stock that sustained a now-extinct inland fishery.

Spring-run spend months hunkered in cold river pools before they run up Sierra rivers in the fall, crashing through Class V rapids and leaping low waterfalls. They do not go ripe (inedible) until the final spawning surge, so they were fished inland, where it was easier than catching them at sea.

Some 700,000 salmon used to stream through the Golden Gate and spawn in 40-odd Sierra streams; 21 turn-of-the-century canneries processed their flesh.

When the Age of Dams flowered after World War I, the species began to disappear in river after river. Shasta Dam and some hydro projects upriver knocked out the upper Sacramento run, the greatest of all. The San Joaquin run, another 150,000 spawners, went to oblivion in 1950, when Friant Dam went up across the lower mainstem. Runs of 20,000, 30,000, 50,000 fish went extinct on other rivers as more giant dams were built in the '50s, '60s and '70s. The new structures were so high that their reservoirs sometimes buried middle-size dams upstream.

By the late 1980s, pure spring-run stock spawned in only three or four small Sacramento River tributaries, one of which was Butte Creek. But neighboring watersheds to the north, Mill Creek and Deer Creek, were obstructed by fewer dams, and until the 1990s, efforts to rebuild the vanishing stocks focused mainly on them.

"Butte Creek," says Paul Ward, a Department of Fish and Game biologist assigned to spring-run habitat, "was widely perceived as a lost cause."

Along its valley reach, eight irrigation diversion dams had been built; upstream of those diversions, in a gorgeous, deeply incised volcanic canyon, are two small hydropower dams owned by Pacific Gas and Electric and a private hydro project spurred by subsidies from Congress during the 1970s oil scares.

The fish are delayed, at least, by the rice growers' diversion dams, and, if they make it into the canyon they come to the first hydro dam, a two-story structure that some salmon can jump when flows are high and the dam becomes a waterfall.

Spawner counts fluctuated greatly from year to year, but the unmaking of California's natural hydrologic regime pointed to an inexorable decline. Finally, during the 1987-92 drought, the total state population was estimated at fewer than 500 fish.

Then in 1993, the drought was chased off by a banner year, which rushed the juveniles to sea before too many were devoured by predators or captured by the huge pumps in the delta, which ship water to Central and Southern California. Two years later, in 1995, when spring-run from the Class of 1993 returned to spawn, there was great early runoff for a clean upriver migration.

In the fall of that year, so many fall-run spawners were coming back to Butte Creek that farmers got off their harvesters and drove over to take a look.

At the 10-foot Parrott-Phelan dam, just outside the city limits of Chico, Gary Brown watched six big spawners trying to leap the sloping downstream face - at once. During 1979, only 10 fish had made it as far as Parrott-Phelan Dam.

By early winter of 1993, the end of the run, California state biologists had counted at least 7,500 fish - the most since World War II, and more than twice the number in all other streams combined.

Butte Creek earns respect

A couple of years earlier, if you mentioned Butte Creek, no one seemed to know where it was. Now everyone did.

The assistant general manager of Southern California's Metropolitan Water District came up for a look, along with several members of his staff. Since half of Southern California's supply comes from Northern California, and since a spring-run listing might shut down the delta pumps for long periods (listing the winter-run chinook had already produced that result), the Met had a vital stake in salmon recovery.

Representatives of San Joaquin Valley agriculture were in the same boat. They showed up on the heels of their sparring partners, lawyers with the Natural Resources Defense Council and the Environmental Defense Fund. Herkert and I, who were busy running this tour service, wondered whether we should lease a Gray Line bus.

Fish and Game biologists, meanwhile, had sensed a larger opportunity in Western Canal's decision to take down its two dams. The original plan involved an under-the-river siphon to get water to the other side of the district, and little else. Now the state wanted to expand its scope.

If some lateral canals were joined to the district's northside canal, and some water exchanges were worked out, then smaller districts up- and downriver could demolish their own Butte Creek dams; fuller flows would remain in the creek.

The Bureau of Reclamation, which dreaded a spring-run listing as much as anyone, agreed to fund a $130,000 feasibility study, even though none of the districts were in its immediate service area. The study concluded that Fish and Game's scheme made plenty of sense. However, the expanded project - which would take out two more dams (including the tallest), relocate a troublesome diversion on nearby Big Chico Creek, and add several miles of canals - would nearly triple the original $3 million cost.

The two downriver districts that agreed to take out their dams were unwilling to contribute, even though they lease land to duck clubs where memberships can cost more than a Lamborghini car.

In the end, financial rescue came mainly from two sources, each improbable until you fathomed what was at stake: the Metropolitan Water District and farmers from San Joaquin Valley.

The money was already there, waiting to be spent. The Central Valley Project Improvement Act, enacted in 1992, created a Restoration Fund, financed mainly by surcharges on San Joaquin water deliveries, that had been looking for projects exactly like this. A couple of years later, several of the state's urban water districts, principally the Metropolitan Water District, embraced enlightened self-interest and created a similar fund, which is known as Category Three, with nearly identical goals.

A week after the disbursing committees for both funds agreed to a three-way split with the Western Canal Water District, I called Gary Brown to offer congratulations. The shock of partnering with the most hated urban water district in the West still had him in the recovery room.

"A few years ago," he mused, "I might have bet 500 bucks that no one from the Metropolitan Water District would voluntarily set foot in our district. The only thing less imaginable than that was hearing my board thank God that they did."

Dams will fall ... like dominos?

This August, the three siphons, each one 10 feet in diameter, were being laid into place under Butte Creek, replacing the district's diversion dams.

Constructing the lateral canals comes next; the dams will come down in midsummer of next year.

The old salmon-trapping diversion on Big Chico Creek, which hosts fall-run fish and occasionally some spring-run, has already been relocated and fitted with a state-of-the-art fish screen. During critical migration periods, 40 cubic feet per second of extra flow is now reserved for the stream.

Meanwhile, in Washington state, on the Elwha River, the two structures that top most people's list of dams that ought to be destroyed first are still in place, thwarting the restoration of salmon runs that once numbered in the thousands. Their removal has been planned, discussed and negotiated for a number of years; the betting odds are that it will be years before they come down.

With the possible exception of a dam in eastern Oregon, it is the Western Canal, McGowan and Howard Slough dams on Butte Creek that are going to be the first Western dams dismantled solely for the sake of fish. In California, they probably won't be the last. (See correction in HCN, 11/10/97.)

With some funds from the National Fish and Wildlife Foundation and the Hewlett Foundation, William M. Eier Associates, a fisheries consulting firm, and I are assessing the possibility of removing, or at least modifying, the two Pacific Gas and Electric dams that block salmon access to the pristine upper canyon reach of the Butte Creek.

If the quality of the habitat seems to argue for removal or modification, PG and E has promised to be "open-minded."

A similar assessment may soon be under way on Battle Creek, a more developed small-hydro stream that could, according to some biologists, host even more salmon than Butte Creek.

Meanwhile, watershed associations joining landowners and conservationists have been formed to restore Mill and Deer creeks. Last January, when runoff reached record levels during a 40-inch storm series, nature enlisted in its own cause, blowing out a Deer Creek dam.

Can other Western states find inspiration in this? That is the tantalizing question, especially if one subscribes to the notion that California is such a peculiar state that some things that happen here can occur nowhere else. Pet cemeteries, three-hour commutes (one way), and billion-dollar wildfires may be unique to California; what about consensus on removing dams?

For Butte Creek's dams to come down, a remarkable set of circumstances had to come together. The rice-straw burning phaseout forced farmers to look to flooding as an alternative. The potential impact of fall water diversions forced them to explore dramatic mitigation measures - among them the removal of dams.

Meanwhile, the drought, which hastened the stupefying decline of the spring-run and other fisheries, forced everyone to get serious about saving fish. The spectacular rebound of Butte Creek's salmon with the dams still in place let people imagine how things might be if we made life easier for the fish.

At the same time, a Bay/Delta Accord, negotiated in 1994 as a kind of Bosnian truce on water wars, gave urban water managers, farm-industry leaders and environmentalists an opportunity to know each other - which is to say, to stop demonizing each other. Erstwhile antagonists have become, if not exactly friends, then at least friendly. More important, they discovered that they have the same goals.

In its scarcity, a vanishing species attains peculiar majesty: A spring-run endangered listing might mean that fishermen can't fish, farmers can't farm and environmentalists lose the Endangered Species Act in the political whirlwind that follows. That has driven environmental restoration in California, the nation's wealthiest state, and now it has become a growth industry.

The Central Valley Project Improvement Act Restoration Fund is amassing $40 million to $50 million a year; contributions are piling up faster than they are being spent. Category Three funders have pledged $180 million over three years. Last year, California voters, who have finally lost patience with the initiative process (most measures on the ballot lost), still showed their environmental colors by approving Proposition 204, a water-and-restoration package contributing about half a billion dollars more. A matching federal contribution could double the amount.

Suddenly, there is all kinds of money around that can be spent - that has to be spent - on restoration. California's environmentalists have been on the losing side of many, if not most battles, but now, at least, they are rich.

Ty Barbour photo
Marc Reisner writes from the Bay Area of San Francisco

It cost a great deal of money to build thousands of dams throughout the American West. It will cost a lot of money to take some of them down.

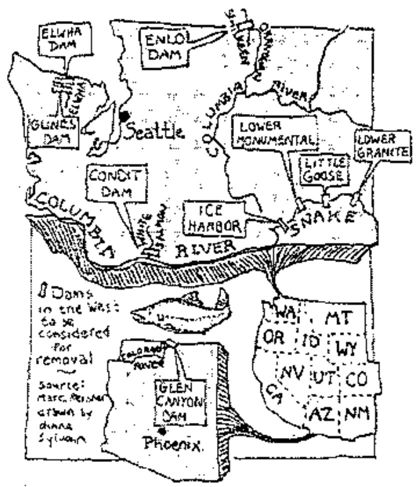
You need money for replacement power, for new water-delivery infrastructure, for buyouts of affected parties, for indemnification. You need money to get rid of accumulated silt and debris behind dams, if you can figure out what to do with it. Thanks to money - and to an odd, serendipitous consensus - dam deconstruction has acquired serious momentum in California. It has even captured the imagination of people more used to lobbying for new dams.

If history tells us anything, what happens in California is going to happen elsewhere. That is not always a curse.

See table of contents for related stories in this issue.

Feature Article

High Country News -- October 27, 1997 (Vol. 29, No. 20)



Diane Sylvain

Dam deconstruction - what's next?

by Marc Reisner

Here are some of the other dams under attack throughout the West:

Elwha River dams, Olympic Peninsula, Washington

Built decades ago, these two dams have nearly destroyed what was once, given the host river's size, a salmon fishery nonpareil. Estimates of the Elwha ancestral runs go higher than 350,000 fish; among them were some of the largest salmon ever seen, weighing over a hundred pounds. Technical experts believe that the dams can be removed for less than $25 million, but watershed restoration could add substantially to the cost. Now and then, the Clinton administration displays toughness and persistence, and it has here. The idea is strongly supported by Washington's major newspapers and, according to poll samplings, by most residents of the state. The one serious opponent is Republican Sen. Slade Gorton, who takes a position that may be unprecedented in U.S. Senate history: Spending federal money to remove the dams, he says, would be unfair to taxpayers in other states. (Presumably, Gorton has no problem with U.S. taxpayers subsidizing Columbia River dams and his constituents' bargain-basement hydroelectric rates, which are among the cheapest in the world.) Gorton's opposition may appear hypocritical, to put it gently, and seems inspired by an eagerness to oppose almost anything Clinton supports. But the senator, a former prosecutor, is a tenacious adversary.

Condit Dam, White Salmon River, Washington

Built three miles up this lower tributary of the Columbia River, in 1913, Condit Dam eliminated a productive salmon fishery, though not an extraordinary one like the Elwha's. Its power production averages only 8-10 megawatts, but the dam is 125 feet high; cost-of-removal estimates range from $10 million to $24 million. American Rivers and numerous other organizations have lobbied strenuously for dam removal. There appears to be no opposition, even from the corporate owner, which faces a tough relicensing fight. Odds that the dam will be taken down look good.

Enlo Dam, Similkeen River, Washington/Canada

Although it has been decommissioned for years, Enlo Dam, built early in the century on this Okanogan River tributary, still sits there, blocking salmon passage for 320 miles. There are no fish ladders. Only 35 feet high, the dam could be removed at relatively low cost. However, the Okanogan Public Utility District has proposed to re-operate it, and, according to John Volkman of the Northwest Power Planning Council, "Canada isn't sure it wants salmon with U.S. diseases moving back upriver." Spawners that make it as far as Enlo Dam have already trespassed beyond eight big dams on the Columbia reach. According to Volkman, "They deserve a break."

Lower Snake River Dams, Washington

These four federally built structures - Ice Harbor, Lower Monumental, Little Goose and Lower Granite - have catastrophically disrupted one of the most far-ranging inland salmon migrations in the world. Some determined salmon still reach Idaho's Stanley Basin via the Columbia, Snake and Salmon rivers, having swum more than 800 miles and surmounted eight large dams, but at Redfish Lake - named after the spawning coloration of many thousands of sockeye salmon - there are only ghosts. A decade ago, the idea of removing the four lower Snake dams would have seemed far-fetched, to say the least, but $3 billion has gone for salmon restoration in the Columbia Basin, and overall the fishery is still in decline. Last winter, the Corps of Engineers, which built the dams, released a consultant's study that calls removal the most effective and cost-efficient restoration strategy. Recently, the Idaho Statesman, the state's most influential newspaper, endorsed the idea (the dams aren't in Idaho). Trade-offs are daunting: Each dam produces 300-400 megawatts of power, and they raise river levels for barge traffic, which is an important facet of the regional economy. But then, so were salmon.

Glen Canyon Dam, Arizona

In an interview for a television documentary based on Cadillac Desert, which aired recently on PBS, former Arizona Sen. (and reincarnated American hero) Barry Goldwater averred that, if Glen Canyon Dam were before the Senate today, "I'd vote against it ...Water is important, but it isn't that important."

Goldwater's remark may have galvanized a nascent campaign to drain Lake Powell, if not get rid of the dam. David Wegner, formerly the Bureau of Reclamation's environmental expert in the region, and the Sierra Club and David Brower, among others, have endorsed the idea. But some environmentalists believe this is a truly quixotic campaign, and the dam's constituency - which includes Southern California - seems unopposable for now.

See table of contents for related stories in this issue.

Chico Enterprise-Record January 7, 1999.

Spring salmon becoming abundant in Butte Creek

By Michael Gardner - E-R Sacramento Bureau

Spring run salmon, being considered as an endangered species, returned to Butte Creek last year in record numbers.

Counters recorded 20,200 spring run adults in 1998, according to the State Department of Fish and Game.

"That's an astronomical record. That's the highest we have ever seen," said fisheries biologist Paul Ward.

The previous high was 8,700 recorded in 1960; the worst was 1979 with just 10 returning adults, Ward said.

Fish run numbers were also up elsewhere: Big Chico, Mill and Deer Creeks, according to Ward.

On Big Chico Creek, the returns numbered 369 in 1998 compared to a sighting of just two adults in each of the previous two years.

It was such a good year that a few "strays" were also spotted in Little Chico Creek in 1998, said Ward.

The spring run migration to and from spawning grounds in north state creeks was aided by high flows in 1995 and again when they returned as adults in the El Ni=Flo year of 1998, he said.

And, the wet year meant the state could slow operations at the giant pumps diverting water southward through the Delta. The force of the diversion sucks many salmon off-track into the Delta maze where they get lost and often killed by the pumps.

The federal Fish and Wildlife Service is expected to rule in March on whether the spring run should be listed as "endangered." It is already listed as "threatened" by the state Department of Fish and Game.

Despite the recent trend upward in spawning adults, it's unlikely fisheries officials would consider delisting the spring run until there is a 5-to-10-year stretch of steady improvement, Ward said.

Noting salmon populations have been up and down in the past years, Ward said "It's classic in a species in decline: boom or bust."

Farmer Les Heringer, who has been active in efforts to preserve salmon runs, is obviously pleased at the numbers counted on Butte Creek.

"We're out here working everyday with the environment. These fish are part of the environment. It makes us feel good when we see a lot of fish in the creek. It means we're doing our job right too," he said.

"Farmers along Butte Creek have done a lot to expedite the movement of the fish," continued Heringer, manager of the M&T Ranch.

Heringer was instrumental in the compromise deal that relocated M&T's diversion pumping facility off of Big Chico Creek where it posed risks to migrating salmon. The diversion is now on the Sacramento River.

"I think we all like to see the creeks full of fish," he stressed.

While accepting some credit, Heringer said better rainfall over the past few years is what's really boosted salmon, which rely on flows to get from the creeks to the ocean.

"The most important thing we've seen is a return from drought years to above normal rainfall. Mother Nature has the control over that," he said.

Salmon juveniles migrate to the Pacific Ocean where they spend up to three years before returning to spawn and die. That's why a good year like 1995 led to a high return rate in 1998.

The spring run count over the last four years in area creeks:

	1998	1997	1996	1995
Butte Creek	20,200	635	1,413	7,000
Big Chico Creek	369	2	2	200
Deer Creek	1,879	466	614	1,295
Mill Creek	424	200	252	320

SYR Fish Management Plan
May Public Meeting Comments
Questions & Answers

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General Comments on the Fish Management Plan:

The Plan doesn't state a measurable objective. How are we going to (quantifiably) measure the success of the program? How are we going to measure habitat recovery? What is the timeline?

The Plan recommends a series of projects, each with specific goals and measurable objectives. Overall, we will measure the success of the Plan through improved habitat quality. The measures of habitat quality include spawning habitat (e.g. appropriate spawning gravels, access to spawning areas, appropriate flows), rearing habitat (e.g. adequate pools/refugia, water temperature, flow, access to rearing habitat), quantity and quality of riparian habitat, and increases in year-round flows. We will then see how fish populations respond to any habitat improvements (e.g. Are spawning habitats being utilized? Are various age classes of fish inhabiting improved pool habitats?). Each project will have a specific timeline for success. We are not counting fish because it is not appropriate for this system.

Comment: Opinion that the term "typical" used in the Plan is not appropriate. "Episodic" is more descriptive.

There is a map in the Plan that characterizes current habitat as poor, fair, and good. If we implement the Plan, what do we expect to occur to the habitat rating categories? Would these ratings move up a step, for example "poor" habitat to become "fair?"

This depends on each action that is implemented. The goals of each project will be laid out as each project in defined. But, yes, the ratings should go up in some areas.

Did we look above Bradbury Dam to evaluate impacts? Do we get credit for protecting the fishery above the dam?

The primary focus of the Plan coincides with the ESU boundary which is on the Lower Santa Ynez River below Bradbury Dam. So we do not really get "credit" for any habitat enhancements above the dam.

Comment: We really need better management of the watershed above the dam so that greater runoff could occur. Controlled burns should be continued.

There is a debate within the Forest Service as to how much to burn at a time. Both the City and County of Santa Barbara are in favor of the controlled burn program.

What portion of Hilton Creek is the Plan talking about restoring? The quarry contributes lots of sediment to the creek. Is this a problem?

Implementation actions have been recommended for the portion of Hilton Creek that lies on Bureau of Reclamation (Reclamation) property. The quarry is following a sediment control plan approved by the Regional Water Quality Control Board to contain sediments produced by quarry operations in mitigation ponds. The SYRTAC Project Biologist has only observed excessive sediment input into Hilton Creek once in five years during the first storm of the 1997-98 storm season. Even during this event, the resulting turbidity cleared quickly and caused no negative impact to the fish in the stream. Before and since then, sediment has not been a problem.

What happens down the road? Where is the mandate for implementation?

Reclamation has an obligation through the Biological Opinion and Water Rights permits to implement the recommendations in this Plan.

Comment: Water agencies are contributing funds to this process and discuss funding at public meetings. The water agencies have an interest in keeping this plan going for the foreseeable future.

Is there a reason steelhead aren't specifically listed as the "only" objective? It seems they are the only species considered in the Plan, yet that's not clearly stated. Are all fish equally important? Will the Plan protect all species (e.g. bass, catfish)? Or are steelhead considered the best/only barometer of river health?

All aquatic species are considered in the Plan. Steelhead are the most sensitive and have the most stringent life-history requirements. The other aquatic species should benefit from actions that benefit steelhead.

Where are we monitoring habitat? Are we ignoring everything downstream of Buellton? Why does the Plan's emphasis [seem to be] upstream of Buellton?

The SYRTAC studies focus on year-round habitat, much of which is above Buellton. All of the south-side tributaries below Bradbury Dam have been studied as part of this plan. These tributaries include: Hilton, Quiota, Alisal, Nojoqui, Salsipuedes, El Jaro and San Miguelito Creeks. Each of these is described in detail in the technical appendix. We are also monitoring the lagoon. Along some creeks access for surveys has been limited due to private property. A portion of Hilton Creek lies on Bureau of Reclamation Property. As such, access for surveys has been available, and opportunities for restoration actions are greater and easier. We intend to pursue activities on all tributaries where restoration potential and (lack of) passage barriers deem it prudent, pending landowner cooperation.

Are we giving up on Salsipuedes/El Jaro (and other tributaries below Buellton)? What are the issues in this system? What are we planning to do in the tributaries?

We are definitely not "giving up" on the Salsipuedes/El Jaro watershed. We are currently pursuing conservation easements with interested landowners on this watershed. The technical appendix outlines potential actions for each of the tributaries, including those below Buellton.

Is it true that if there were no steelhead in the river, or if they hadn't been listed as endangered, then we wouldn't need this Plan?

No. As part of the water rights permits to operate Bradbury Dam, Reclamation and the Cachuma Project member districts have an obligation to protect public trust resources below the dam. Steelhead is only one of these resources. The SYRTAC began its studies and work on this Plan in 1993 before steelhead were listed in 1997. Because of the listing, emphasis has been placed on steelhead and steelhead habitat, but all aquatic resources are considered in the Plan. The State Water Board wants to know the impact of the Project on all public trust resources, so we would have to develop a Plan even without the endangered species listing.

Does Department of Fish and Game (DFG) have a separate steelhead plan?

In 1996 DFG published the *Steelhead Restoration and Management Plan*. This manual identified the restoration and enhancement of spawning and rearing habitats in tributaries below Bradbury Dam as one of its primary recommendations for restoration along the Santa Ynez River. SYRTAC's *Fish Management Plan* starts with the recommendations of DFG's plan, further describes the habitat and makes specific implementation recommendations.

Are we water rich or habitat poor? Do we have more water or more habitat?

These are not unrelated. Putting more water into the Santa Ynez River does not necessarily help because beyond a certain point in the year, water temperatures become too warm regardless of the amount of water in the system. Putting cool water into the tributaries would help, but we can't get it there from the reservoir. This translates into relatively poor summer habitat.

Do the willows near Lompoc create barriers for steelhead migration? How does the Plan address this?

In general, willows do not necessarily create a passage barrier for steelhead but may be an impediment if flow in the river is affected or if their is no passage corridor through the willows. Any willow clearing activities implemented for flood control would serve to benefit steelhead passage.

Increased flows will lead to flood control and riparian habitat issues. Who will pay for the consequences of increased flows? (referring to Lompoc flood control issues).

Flood control issues in the Santa Ynez River have been of concern for a very long time. The County Flood Control District has had ongoing permitting difficulties with the Army Corps of Engineers and other involved agencies. The impact (environmental and economic) of increased flows in the river as a result of additional water being released to sustain fish habitat will be evaluated through in the Environmental Impact Report being prepared for the State Water Board water rights hearings in 2000. However, increased flow for the fishery does not mean there will be water flowing all the way to Lompoc; the extent of the flow is dependent on the rain year. Even with a 5-10 cfs release, water will probably not flow past Buellton. Modification of the "willow dams" is not within the scope of the Plan.

Is flood control one of the public trust issues?

Not in the sense of fish, vegetation, and water quality.

What caused us to find that Hilton Creek has the best "good" spawning habitat?

Spawning habitat is based on a number of factors including quantity and quality of spawning gravels, water temperature and flow. SYRTAC surveys also note the presence of redds and spawning activity. Compared to the mainstem and many of the tributaries, Hilton Creek has the flow, gravel and temperature required for steelhead spawning, as well as the presence of redds and spawning individuals. What Hilton Creek lacks is natural perennial flow to support the offspring that are produced. The Hilton Creek Water Supply System was developed to address this issue and will provide the perennial flow to allow the offspring to grow until they migrate to the ocean. Voluntary property owner participation is needed to work anywhere else in the system.

Comment: You are trying to fix the steelhead "problem" with the poorest habitat we have. This is a weakness in the Plan. The best habitat is above Bradbury Dam, yet the management actions are focused in the poor habitat below the dam. The upper basin has the best habitat, now and historically.

Yes, the best steelhead habitat historically was in the upper basin. Bradbury Dam prevents upstream migration and passage around Bradbury Dam is infeasible, so we are looking for opportunities in the lower basin to provide steelhead habitat.

Comment: Most management actions contemplated are below the dam. Everyone knows the best habitat is above the dam. Cal Trout believes that one of the things that should remain on the table is to find a way to reconnect the habitat upstream. A fish ladder is not feasible, but trap and truck operations are. Jennifer Nielson (genetics expert) has said that it is good to have anadromous and resident fish interbred even though it is hard on the fish to move them. Santa Barbara Sea also supports the trap and truck option and would like to see this option higher on the management list of priorities to maintain the genetic mixing of resident and anadromous forms.

At this time, NMFS restricts the handling of steelhead to only rescue efforts. NMFS and DFG have required that trap and truck be de-emphasized, however, we have not removed it from the list of options. The Plan is a living document and we will take another look at trap and truck if there is an opportunity to do so at a later time.

Comment: California Parks and Recreation Department and users of the Lake Cachuma fishery have not really been involved in this issue.

We have invited them and welcome their input and contributions. The County Fish and Game commission has been involved for the recreational fisheries in Lake Cachuma.

Comment: We need watershed management, especially with reference to wet El Nino years and planning.

Yes, we agree. This is very important.

Comment: The Plan is thorough and well written.

Property/Water Rights Comments:

Comment: Clarify in the Plan that only the lower basin habitat is privately owned. Much of the upper basin is National Forest.

Do we have cooperation of landowners? What percentage?

We have held workshops with several landowners and a number of them along Salsipuedes/El Jaro Creeks have expressed interest in pursuing conservation easements and conservation management practices. We intend to continue our outreach efforts to encourage other landowners to voluntarily participate in the process. We will also help match interested owners with funding sources to carry out habitat enhancements.

Are we forecasting condemnation of private property?

Absolutely not. Participation is voluntary. We are recommending voluntary actions which landowners can implement on their own properties, and pursuing conservation easements if the landowner expresses an interest in this option.

There is concern that a change in Cachuma Project yield with respect to fish releases may lead to increased pumping. Many owners currently do not pump to their allowed allocations. How does the Plan address pumping rights and impacts to fisheries? Concern that pumping may be considered a fish "take" by NMFS.

Currently, water allocated for fish releases (2,000 acre feet per year) comes out of Cachuma Project yield. This amount may increase depending on what is eventually required by NMFS through the Biological Opinion and/or the State Water Board at the water rights hearings. The Plan does not address prescriptive water rights relative to the impact on fisheries. NMFS generally is of the opinion that if anyone removes or alters a component of the habitat needed by a threatened or endangered species, it can be considered a "take". If NMFS thinks that increased pumping is having an impact to surface water flow and, therefore, to steelhead/rainbow trout habitat, they will likely want to evaluate individual pumpers.

Comment: Need to balance water rights (i.e. pumping) and fisheries issues. As agricultural lands are converted from rangeland to irrigated crops (especially vineyards), pumping may increase. Suggested that adjudication is needed to give the assurance that property rights will not be penalized.

It has been our experience that adjudication doesn't work in these situations. We are pursuing a cooperative approach.

Comment: It is necessary to balance protection of public trust with prescriptive water rights. There may be an opportunity with this Plan to give incentives to owners for participation in fish preservation measures if their water rights could be protected. For instance, owners could trade "riparian rights" through conservation easement programs for guaranteed pumping rights by the State Water Board.

Questions about the State Water Board/NMFS Process:

When do we expect the State Water Board hearings?

The scheduled date is December, 2000.

When do we expect the CEQA review?

The CEQA process has already started and an Environmental Impact Report will be prepared by the State Water Board. More information will be available in the near future.

Will the State Water Board give credit for the existing enhanced fisheries upstream of (and resulting from) Bradbury Dam?

The Board will look at beneficial uses of the reservoir and the river.

Comment: Cachuma is only one water project. Ultimately the State Water Board will look at all water projects.

What happens if the National Marine Fisheries Service (NFMS) & State Water Board don't accept the Plan? Do they have the power to step in and do something more "heavy-handed"?

We are required to have a Plan in place; NMFS will not write a separate one. NFMS and the State Water Board staff are actively involved in SYRTAC process. The Endangered Species Act does give NMFS the power to make changes or additions to it and it is very possible for them to put more emphasis on some of the measures being suggested. However, they are contributing input at every stage. It is our intention to continue this close relationship so that when the Plan is presented, they will understand it and accept it.

What are some examples of fish preservation measures that NMFS may want to see considered in the Biological Opinion that aren't in the Plan?

The Management Alternatives report outlined over 45 alternatives. Each were evaluated and discussed in depth. For this reason and because NMFS is working closely with us on the Plan and the Biological Assessment, we do not anticipate that there will be any new measures we have not already considered. NMFS may have a different emphasis or priority for some of the measures, such as a different mix of tributary actions versus the main stem or the amount of stream flow may need to be increased over what is being recommended. But we do not anticipate that any new measures will come to light.

Does the Plan overlap with the Biological Opinion for Section 7 consultation? What is the effect on the Cachuma Project?

Yes, there will be considerable overlap, but the Biological Opinion will only address those options directly under the jurisdiction of Reclamation. Baseline will be existing operating conditions with the dam in place.

When do we expect the Biological Opinion from NMFS?

August, 1999.

Is "safe harbor" an option for conservation actions?

It may be. Typically NFMS has not used safe harbor for aquatic ecosystems, but we are investigating this as an option.

Will this Plan lead to a permit for [continued] Cachuma Project operations?

Yes, this Plan is an integral part of the required documentation for the State Water Board hearings in 2000.

What role dos NMFS's critical habitat listing play in this Plan? Will NMFS wait to see how this Plan works out?

A Critical habitat listing has been proposed and any effect the Plan may have on critical habitat will be discussed with NMFS.

Steelhead/Fish Biology Questions:

What are the effects of state water on steelhead imprinting?

The release of state water is not expected to impact steelhead imprinting. The volume of state water is small compare to the amount of project water. In addition, state water would not be released to the river during the period when smolt may be migrating, except at the very tail of the migration period during about fifteen percent of the years. Therefore, during the vast majority of years there would be no impacts on steelhead imprinting at all. During the fifteen percent of years when releases might occur, these releases would begin during the latter part of the migration season and so would affect only a small proportion of the smolt in that year. In addition, smolt tend to immigrate earlier in dry years (when such releases would occur), which would further reduce the potential impact of state water releases. Finally, state water releases would be mixed with Cachuma Project water, which would likely eliminate any remaining effect. CCWA is currently consulting with NMFS about these releases and will develop measures to avoid or mitigate any potential impacts that may occur.

Can Southern Steelhead manage warmer temperatures [than cited in the literature]?

Steelhead may survive at temperatures slightly higher than 25 degrees Celsius. This criterion was selected as a conservative estimate of their temperature tolerance. Literature evidence on other forms of rainbow trout from warm climates indicates a thermal maximum temperature of 26.2 degrees C. However, there is little evidence that steelhead can withstand temperatures of greater than 25 degrees C for a period of more than a few hours. Steelhead have been observed in warmer temperatures, but observational evidence indicates that these fish are extremely fragile and can be killed even by relative mild stresses.

What is the temperature criteria for Southern Steelhead? Is it higher here than north of us?

This has not yet been determined. It is possible that Southern Steelhead may have a greater temperature threshold than northern species, but not enough data has been collected to date.

What does "rainbow/steelhead trout" mean? How can you tell them apart?

Rainbow trout and steelhead are the same species. Steelhead are the anadromous form of the species which at a critical stage in their life history, smolt and migrate to the ocean, then return to their home streams to spawn. Unlike salmon, steelhead do not die after spawning, but can return to the ocean and return again to the streams to spawn multiple times. The Rainbow form do not smolt and remain in streams their entire life and may reproduce without entering the ocean. The progeny of steelhead may exhibit a resident rainbow trout life history and the progeny of rainbow trout may exhibit an anadromous life history.

Are rainbow trout listed?

Landlocked rainbow trout and steelhead above Bradbury Dam are not listed. The anadromous form with access to the ocean is listed. NMFS considers all trout downstream of dams as potential steelhead, hence there is no fishing of any kind allowed downstream of Bradbury Dam.

Are hatchery fish downstream of the dam steelhead?

Hatchery fish are not protected under the Endangered Species Act.

When was the last time a steelhead migrated up from the ocean?

Every year of the study steelhead (both smolts and adults) have been sighted. Smaller fish captured this year may be steelhead, but until we get results from the DNA analysis it remains unclear about the genetic origin of these fish. A 26 inch migrant was caught in the trap last week.

What causes smolting? Does exposure to brackish water cause a fish to smolt, or does a physiological change drive a fish to saline water?

Smoltification is a suite of physiological, morphological, biochemical, and behavioral changes including development of the silvery color of adults and a tolerance to seawater that takes place in salmonid parr as they migrate downstream and enter the sea. Smoltification occurs when fish reach a particular size and condition and may also be influenced by the length of daylight, water temperature and water chemistry. Smoltification is not related to exposure to saltwater. Juveniles begin the smoltification process prior to reaching the ocean. Smoltification likely does cue the juvenile fish to begin moving downstream, although other factors may affect the migrational tendencies of juvenile steelhead as well.

Can a resident fish become a smolt even if its been resident for generations?

It is unlikely that a residualized fish will smolt if given access to the ocean. It is likely that its progeny could smolt and migrate.

If young rainbow/steelhead trout are "indistinguishable", then are they a different species?

Rainbow trout and steelhead are the same species.

If there were no dam, would fish above the dams migrate to the ocean?

Historically they did, so we assume that, yes, they would.

Have we seen any fish with anadromous behavior?

Yes. We have captured ocean-going fish in our migrant traps each year of the studies.

How many fish in the system are anadromous?

The number of anadromous fish within the system depends on the rain year. Any number would be speculation, but is probably less than 100.

What data do we have on inter-species competition, especially natives and exotics?

We have not studied inter- and intraspecies competition specifically. Clearly there are predation issues with exotics (e.g. bass) preying on young steelhead.

Comment: from a genetic perspective there is evidence that we don't want artificial movement of fish, they need to move (migrate) on their own. But interbreeding between resident (i.e. above Bradbury Dam) and anadromous forms increases genetic diversity. Therefore Cal Trout promotes mixing of these forms to maintain genetic diversity.

Comment: Because of concerns of mixing the genetic populations] can Parks and Recreation look at the issue of stocking fish from other regions?

We would welcome their input and cooperation.

Comment: There are new (cutting edge) methods for determining a fish's river of origin and if they are anadromous.

General Questions/Comments:

What are the effects of grazing on the river system?

Cattle in the streams can contribute fine sediments and fecal material, contribute to streambank erosion and remove riparian vegetation. Lack of vegetation increases the water temperature and eliminates important refuge areas. Increased sedimentation reduces spawning habitat and decreases the survival of eggs and young fry.

What other reports have the SYRTAC produced? Are copies available?

The Management Alternatives Report, the Synthesis Report, and Annual Data Compilation reports are available (we took the gentleman's name and address and sent him copies).

Comment: It seems that the Cachuma Project would have enhanced the flows for fish on the river. Water is now released during the summer (WR 89-18 releases) where the river was previously dry.

The Plan focuses on what we have today and how we can maximize the additional water now allocated for the fishery.

Do Cachuma summer releases enhance seasonal flows?

Yes.

Are beaver dams helpful (e.g. create pools) to steelhead, or not helpful?

Whether or not beaver dams are helpful is subject to speculation and is dependent on the rain year. Beavers provide good habitat when flows are high enough for fish to navigate through dams and pools. In low flow years they are possible passage impediments. Some years flow is sufficient to remove beaver dams. In other years (such as this year), flow was not sufficient to remove beaver dams directly downstream of Bradbury Dam, so that any migrating steelhead could not negotiate this particular dam.

Does water temperature drop when you reach the ocean/lagoon?

Yes, but in the summer they are still very high.

Is habitat between Buellton and Bradbury Dam different from pre-1950 or pre-1969? Do we have any records of what this reach looked like in 1952-69? After 1969, pools and vegetation that were in this reach are now gone. As a result, where will the fish now live?

The upper watershed was cut off by construction of Bradbury Dam in the 1950s, but the river always dried up in the summer. However, pools remained upstream of Buellton. The floods associated with the record storms of 1969 had a profound effect on the Santa Ynez River. Vegetation and pools were completely scoured particularly those areas close to the dam.

Where in southern California do we have the best potential to save steelhead? It certainly is not the Santa Ynez River.

The Ventura and Santa Clara Rivers have the best potential to re-establish significant runs of steelhead because they have little perturbances within their upper drainages (unlike the Santa Ynez River which has three dams). But there is probably not one or two streams that will pull the Southern California ESU off the Endangered Species List. It will take a collective effort within the entire ESU.

Putting fish that are smolting into the estuary would provide good rearing habitat. Has this been considered.

DFG and NMFS are not ready to do this yet until benefits can be identified. There is a challenge on determining the effects of cooler salt water mixing with warmer fresh water lenses when the composition changes depending on the flow regime and time of year. Also the tide water goby, another endangered species, needs to be considered.

What is the steelhead restoration potential in Sisquoc Creek?

Restoration opportunities on Sisquoc Creek are very difficult. This particular stream is very flashy and any migration is subject to only periodic opportunities during the winter. There is good, wild habitat upstream but infrequent connectivity to the ocean. Also flows often decrease and go underground within a short time after storms. There are long wide, sandy bottom reaches of the stream which are not conducive to spawning of rearing. The lower section through Santa Maria is a migration corridor only and offers no spawning or rearing habitat.

Are passage barriers in the Salsipuedes/El Jaro drainage a problem?

At road crossings passage barriers are a problem and there are also some erosional problems. But in general, this is a very good system.

Comment: One way to open up areas for the fish is for Caltrans to look at removing passage barriers such as culverts and bridge modifications.

What percentage of the river will come under "control" of the SYRTAC now?

A very small amount. Lower Hilton Creek, Reclamation property below the dam, and in the Salsipuedes/El Jaro drainage through conservation easements.

Is it true that the Santa Ynez River was dry in the summer before Bradbury Dam?

Yes, unless it was a very wet year such as the 1998 El Nino year when the river maintained flow throughout the summer. It could also remain dry for almost the entire year in times of drought. The Santa Ynez River is within a Mediterranean climate zone and therefore exhibits flow characteristics typical of all rivers in southern California. It is an ephemeral rather than perennial stream which means that it generally flows during the winter and dries up in the summer. While there was no continuous flow throughout the entire basin before Bradbury Dam was constructed, there were several areas where large deep pools persisted throughout the summer. The majority of the river did dry, however, these refuge pools provided habitat during the summer months.

Where are the migrant traps located?

Hilton, Nojoqui, Salsipuedes, and San Miguelito Creeks.

CALIFORNIA TROUT

KEEPER OF THE STREAMS

August 8, 2000

Ms. Kindra Loomis, Staff Scientist
Entrix, Inc.
590 Ygnacio Valley Rd., Suite 200
Walnut Creek, CA 94596

RE: PRELIMINARY COMMENTS ON LOWER SANTA YNEZ RIVER FISH MANAGEMENT PLAN

Dear Kindra:

Thank you for providing a brief window of time for comments on the Final Lower Santa Ynez River Fish Management Plan (Plan). Since only eight business days have elapsed between receipt of the Plan and the August 9 deadline you set for comments to be incorporated in the Plan that is forwarded to the State Water Resources Control Board (SWB), and because there have been numerous substantive changes, deletions and additions to the Plan since the last draft was distributed, our comments below represent only a preliminary response to your call for comments. We expect to provide a more detailed analysis and commentary on the Plan to you and the SWB prior to commencement of the Santa Ynez River SWB Hearing process.

GENERAL COMMENTS

First and foremost, the title of this Plan clearly illustrates a now-institutionalized failure of the Santa Ynez River "Consensus Committee" and the supporting Technical Advisory Committee (SYRTAC) to fully recognize that the Santa Ynez River has been artificially segmented into a "Lower" and, by default, "Upper" river. California Trout has repeatedly brought this to the attention of the "Consensus Committee" and the SYRTAC, both verbally and in written comments. Serially dismissing all facets of this issue, as the Plan does in Sections 3.3.4 and 3.3.5, is conspicuously inappropriate, and inconsistent with biological reality in the Santa Ynez River. Removal of these actions from further consideration until the lower river action items fail is inappropriate. Further, since (as noted below) there are no measurable standards for success or failure prescribed by the Plan, these issues will have no incentives to be revisited.

Every document that discusses the status of Southern Steelhead, or steelhead in California more generally, from Rob Titus' work to the California Steelhead Recovery and Management Plan to the National Marine Fisheries Stock Assessment supplement dealing with the reasons for decline of west coast steelhead, refers to the fact that the central reason steelhead are in jeopardy of extinction is lack of access to historic spawning and rearing habitat above impassable manmade barriers such as Bradbury Dam.

California Trout is unaware of any ecosystem or fisheries biologists who support the concept that the lower reaches of a river are functionally interchangeable with the upper reaches, either hydrodynamically or biologically; it is a concept that is generally not seen in the peer-reviewed, published literature on riverine ecosystems. Thus to develop a management plan that seeks to use the best available science and current ecological principles together with an adaptive management strategy, that purports to address the recovery of an umbrella species such as the Southern Steelhead (*Oncorhyncus mykiss iridius*) using only the lower portion of its waterway (encompassing perhaps only ten to twenty percent of the historic, quality spawning and rearing habitat once available to it) contradicts the fundamental tenets of both good limnological science and good stewardship.

To omit the central issue that Bradbury Dam blocks steelhead passage to the vast majority of good spawning and rearing habitat in the Santa Ynez River is akin to prescribing an aspirin for a femoral artery cut. The patient is bleeding to death and we're prescribing headache remedy. This misdirected prioritization takes the easy path through the regulatory arena, rather than "cutting to the chase."
It is entirely understandable, given the written positions of both the State and Federal agencies having the public trust responsibility to restore this run of fish, that the SYR Committees would take this path of least resistance. But it is not a path supportable by CalTrout. Thus we have not achieved the desired "consensus" referred to in the title of the policy committee.

Both the California Department of Fish and Game (DFG) and the National Marine Fisheries Service (NMFS) have, by taking expedient positions inconsistent with the biological facts of the matter, simply made it more difficult for all of us trying to "do the right thing" on the Santa Ynez River and, in fact, throughout ESU #11. In fact, the State of California does so in direct contradiction to its own Steelhead Restoration and Management Plan, which clearly states (page 198) that the feasibility of providing fish passage across Bradbury Dam should be investigated and implemented accordingly. Likewise, this Plan ignores the State's directive in this important matter. It remains to be seen, since we have been repeatedly notified of delay after delay in the ESA Biological Opinion, how NMFS will finally view this matter. Regardless of NMFS' Opinion, California Trout considers this conspicuous omission a fatal flaw in the legitimacy of the Plan as written. This should come as no surprise to either the "Consensus Committee" or the SYRTAC, who have been repeatedly advised by CalTrout that this issue cannot be swept under the rug of expediency. It is disconcerting to be so blatantly ignored in a so-called "consensus" process.

Aside from this central fatal flaw in the Plan, the measures described in Plan Implementation Sections 5.2-5.4 (Actions...) are generally appropriate and suitable measures to attempt to create or restore some semblance of functionality to a reach of the Santa Ynez River mainstem that was historically principally a migratory corridor for steelhead to get to the spawning and rearing habitats of Cachuma Creek, Santa Cruz Creek, Indian Creek and Mono Creek, among many others, that were the mainstay of production for the many thousands of fish known to have run in the Santa Ynez. In the attempt to "make a silk purse out of a sow's ear," as our forefathers would have phrased it, these measures seem to be a reasonable effort.

In general, however, it is the opinion of CalTrout that it is highly unlikely that the steelhead run in the Santa Ynez River will be restored to sustainability by Hilton and Quiota Creeks, and that Salsipuedes Creek is so degraded from adjacent land-use sedimentation that it would take herculean measures to bring this tributary into meaninful productivity for steelhead in the coming decades. The fact remains that the high-quality spawning and rearing habitat that could restore steelhead in the Santa Ynez River remains above Bradbury Dam.

A second overarching problem with the Plan is that, contrary to both traditional management as well as the more recent "adaptive management" paradigm referred to in the Plan, nowhere in the Plan are there measurable performance outcomes described, against which we can measure the success or failure of action items described in the Plan. One of the basic tenets of management reads "if it can't be measured, it can't be managed." Going back to the original issue for which this Plan was crafted, Fish and Game Code Section 5937 speaks to dam owners/operators about allowing flows below the dams to keep fish in "good condition."

California Trout has both the privilege and the obligation to ask the question: "How do we know when we've done that?" The Plan sets forth no standards of achievement, no measurable goals and objectives against which yardstick we can measure the success or failure of any individual action or the collected action items comprising the Plan. Thus the Plan, as written, has no way to judge progress, no way to assess the utility of the outcomes of the action items. The SWB is obligated to decide, absent any such measurable performance standards, exactly what "good condition" is. They have asked for these studies on the Santa Ynez River, and this Plan, to provide guidance or at least information to answer that question. California Trout believes that the Plan as written does not do that for the SWB. This constitutes a second fatal flaw in the Plan as currently envisioned.

EXECUTIVE SUMMARY

The opening paragraph of this summary lists the beneficial uses of water in the lower Santa Ynez River, but fails to mention that an accepted, approved beneficial use is for fish and wildlife.

<u>"Steelhead and their habitat"</u>

1st paragraph:
"Recent surveys suggest that small numbers of steelhead can enter the Santa Ynez River to spawn, usually in the lower tributaries (Salsipuedes and El Jaro Creeks)..."

This is a good example of selective use of data to draw a conclusion unwarranted from the bulk of evidence available. Since the SYRTAC spent over $180,000 per year since 1993 to gather data on where the steelhead go to spawn, it would be useful to use all of the data, not just "recent studies." And in many of the years, it is the tributary immediately below Bradbury Dam, i.e., Hilton Creek, that has had the largest number of spawners trapped in the data collection program. Hence the statement above discolors the true picture by attempting to suggest that spawning is principally, or at least "usually" relegated to the "lower tributaries." This is simply not reflected by the entirety of the data available.

2nd paragraph:
"Even before construction of dams in the basin, portions of the mainstem below the dam typically dried during the summer."

CalTrout has been monitoring the SYRTAC studies since before they began in earnest, and at no time during the course of the studies or reports on information gathered to support the hydrology of the Santa Ynez River, was any data whatsoever presented regarding flows in the mainstem prior to the construction of "the dams," since Gibralter Dam was constructed in 1920 or so and flow records do not go that far back. Even the rainfall records that might be used to correlate to flow by back-calculation only go back to 1906 or so, and a 14 year dataset (1906 to 1920) is grossly inadequate to characterize "typical" flows in the Santa Ynez River "before construction of dams in the basin." This statement is an opinion unsupported by any factual basis so far presented to or by the SYRTAC, and should be stricken from the Executive Summary or clearly identified as "in the opinion of the Plan authors." It is ***not*** fact.

This last paragraph of this section ends on page EX-3 discusses the issue of temperature tolerances ("thermal criteria") for steelhead. It initially says that thermal criteria for northern steelhead are regularly exceeded. It then says that despite this, steelhead have survived under these conditions. The logical syllogism remains uncompleted, however. The conclusion to be drawn from these two statements, and one that should be made explicit to the reader of this Executive Summary, is that since these Southern Steelhead survive exceedance of thermal criteria for their northern counterparts, thermal criteria for the north are inappropriate for use in the south. But the Plan does not clearly state this, and should.

"The Plan"

Paragraph 1 tells the reader that this Plan is "consensus-based." We hope that by reading this far in these preliminary comments, that you are aware that this is also not a factual statement. If the authors meant to state that "excluding CalTrout and a few other conservation groups, this plan is consensus-based," then they should so state. But it would be misleading to readers of the Plan to make the statement as it is written. And the reason that this is not consensus-based is not hidden from view, nor is it new. As noted above, our interest (and the directive of the California Steelhead Restoration and Management Plan) in addressing the fish passage barrier represented by Bradbury Dam has been consistently ignored by the SYRTAC and is likewise ignored by the current Plan. We have professional experience on our Board of Governors with the consensus-building process, and what is represented by the Plan draft as written is completely inconsistent with the term. This mischaracterization should be stricken from the Executive Summary.

The third paragraph again illustrates the institutional blinders worn by the SYRTAC and Consensus Committee, because the language exhibits an ingrained lack of recognition that there is any river or suitable steelhead habitat above Bradbury Dam. To illustrate: "The majority of rainbow trout/steelhead habitat in the Santa Ynez River basin is located on private property." This statement is completely wrong, and would not have been made had the blinders prevented the authors from looking above the Dam. The ***vast majority*** of suitable, high-quality spawning and rearing habitat is located ***above*** Bradbury Dam and contained nearly wholly in the ***Los Padres National Forest***, which, the last time we checked, was ***public*** property. This sentence is retained in this draft of the Plan despite our repeated notations to SYRTAC that it is erroneous, further illustrating the level to which CalTrout's comments have been systematically ignored in this consensus-based process. We will be pleased to provide the prior comment letters making this point, if CalTrout's letters have somehow been lost in the files or otherwise ignored.

Page EX-4, first "bullet"

Should read "…within the LOWER mainstem…"

Last paragraph of "The Plan"

"Reaches of the LOWER mainstem and tributaries BELOW BRADBURY DAM…"
(same issue/comment)

"Reaches…selected as having priority…were identified based upon…(2) water temperature…"
This identification and prioritization was made, interestingly, in the acknowledged (see "Steelhead and their habitat") absence of information on the temperature tolerances of Southern Steelhead.

Section 3.3.5 Downstream passage…

"Above the dams, steelhead became landlocked and now carry out a resident lifestyle with no juvenile migration to the ocean."

There is absolutely no evidence to either support or refute this statement-made-as-fact. Since no mainstem downmigrant trapping has been done in years when the dams spill to catch fish that weren't marked in the reservoirs, there is no way that a biologist can credibly assert that landlocked steelhead trapped upstream by these dams don't ever wash over the dams and begin a migration to the ocean.

RECOMMENDED ACTIONS

Action item (3) is characterized as "improving access to important spawning and rearing habitat in the mainstem and tributaries…"

Same issue/comment: LOWER mainstem and tribs. Once again, the institutional blinders have created a draft Plan that indicates that the "important" spawning rearing habitat is below Bradbury Dam, when, in fact, the important spawning and rearing habitat for steelhead historically in the Santa Ynez River is above Bradbury Dam.

Overall, the Recommended Actions, while somewhat useful in trying to manufacture the upper river out of the lower river (when, in fact, they are non-interchangeable) clearly illustrates the Machiavellian measures necessary to assist the recovery of steelhead in the vacuum created by failure to address the real, core issue of fish passage.

The above comments are to be taken as preliminary and interim, until adequate time has been given to California Trout to review further details of the Plan. We reserve the right, as noted above, to elaborate on these comments, add additional points of concern, or ask for further clarification of action items or background materials presented in this Plan, prior to the SWB hearings on the Santa Ynez River. Given the degree to which our previous comments have gone unread or unheard, however, we are extremely discouraged about the prospect of reaching consensus on this Plan, and disappointed about the outcome of our previous efforts to communicate our concerns to the SYRTAC in such a way that they are incorporated into the process.

Please feel free to contact us about any of these preliminary/interim comments, about how the draft Plan may be revised to incorporate California Trout's historic and ongoing concerns about fish passage across Bradbury Dam, and/or about the measurability of outcomes of action items proposed. Thank you, once again, for the opportunity to provide comments on this draft Plan prior to its submission to the SWB.

Sincerely,

Craig Fusaro

CRAIG FUSARO, PhD
Board of Governors, Central Coast Region

c: Mr. Jim McNamara, U.S. Bureau of Reclamation
Mr. Jim Canaday, State Water Resources Control Board
Mr. Charles Raysbrook, Department of Fish and Game
Mr. Eric Shott, National Marine Fisheries Service
Other interested parties

Date sent: **Wed, 09 Aug 2000 14:14:25 -0700**
From: **"TOM FAYRAM" <TFAYRAM@co.santa-barbara.ca.us>**
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Subject: **Final Fish Management Plan, Santa Ynez River**

We received notice of the tight comment period this week. To meet your deadline, please accept this email as our comments

Dear Ms. Baldrige:

The Santa Barbara County Flood Control District has received the Final Fish Management Plan. While we appreciate the need to expedite the plan for the State Water Resources Control Board Hearings, there is not ample plan to fully review and provide comprehensive comments.

Through the Fish TAC process, the Flood Control District has consistently brought forward the issue of flooding impacts as a result of additional vegetation in the Santa Ynez River associated with fish releases. To date, the issue has not been adequately addressed.

In the Appendix of the Fish Management Plan, the potential increased vegetation issue is acknowledged, however, there is no resolution included. The plan attempts to dismiss the issue by acknowledging that the Flood Control District will suffer increased costs as a result. Plan fails to resolve the enormous burden of permitting any future work with the presence, or possible presents of Steelhead, Willow Flycatchers, and possibly other endangered species. Finally, there is no identification of mitigation principles for any future work.

In the absence of a complete analysis of the problem, and solutions to the problems, the Plan should be revised to delete reference to future actions of the Flood Control District on this portion of the river. While the acknowledgment of the increased vegetation should remain, any impact of this result would fall back on the private property owners that own the particular reach of the river. The Flood Control District has not historically maintained the River outside of the Lompoc Area. Additional work in other areas is not feasible due limited resources in staffing, revenue constraints and lack of easements / property rights.

These comments should in no way be misconstrued as a lack of support for working towards the recovery of Steelhead in the Santa Ynez River. We recognize the importance of this goal and have gone to great lengths in other projects so as to not impact Steelhead. However, each action can trigger other issues. The District must go on record stating that no additional maintenance responsibilities will be accepted as a part of this action.

We request you simply delete reference to any obligations that are suggested to be assumed to be transferred to the District.

Thank you for the opportunity to comment of the Plan.

Tom Fayram
Deputy Public Works Director
Santa Barbara County Flood Control District

STATE OF CALIFORNIA-THE RESOURCES AGENCY GRAY DAVIS, *Governor*

DEPARTMENT OF FISH AND GAME
South Coast Region
4949 Viewridge Avenue
San Diego, California 92123
(858) 467-4201
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August 28, 2000

Ms. Jean Baldrige
Santa Ynez River Technical Advisory Committee
590 Ygniacio Valley Road, Suite 200
Walnut Creek, California 94596

Dear Ms. Baldrige:

Lower Santa Ynez River Fish Management Plan (TAC Draft)

The Department of Fish and Game has reviewed the Lower Santa Ynez River Fish Management Plan dated July 25, 2000 and provides the following comments:

#1. Page EX-2: Under the section "Steelhead and Their Habitat" it states that "Recent surveys suggest that a small number of steelhead can enter the Santa Ynez River to spawn, usually in the lower tributaries (Salsipuedes and El Jaro creeks)."

> Comments: This statement is not clear. Does it suggest that Salsipuedes and El Jaro creeks are the preferred steelhead stream(s)? Table 2-3 suggest that from 1995 through 1999 adult steelhead were identified in Salsipuedes and El Jaro creeks four of the five years, in Hilton Creek adult steelhead were identified in three of the five years. This summer two large (>20 inches) were seen exhibiting spawning behavior in Alisal Creek (DFG Warden). **Adult steelhead have also been documented in Quiota Creek (DFG** Warden and Mr. Craig Fussaro, Cal Trout). Based on preliminary information, it would not be surprising to find that Quiota Creek supports the largest run of steelhead within the lower basin. Meaningful comparisons cannot be made until adequate studies have been conducted on the Quiota Creek trout population.

#2. Page EX6: In section II, the first bullet describes enhancement of steelhead rearing and spawning habitat through the establishment of conservation easements.

> Comments: The El Jaro drainage which includes Salsipuedes Creek is unique compared to other principal steelhead streams within the lower Santa Ynez River. The channel is rather deeply incised for most of its reach with stream banks consisting primarily of erodible marine deposits which include diatomite. The Department agrees with the comment on page 2-44, "Spawning habitat in Salsipuedes and El Jaro creeks is moderate, due to the

presence of fine sediments and sand in the stream, with some areas of good habitat." With the exception of a small reach (upper Salsipuedes Creek), the drainage maintains a low gradient. Studies on trout populations within the upper Santa Ynez River show a strong correlation between low stream gradient and low trout density. This relationship is supported by field observations, almost without exception, in all the trout streams and rivers surveyed by Department of Fish and Game biologists in southern California. Also, the literature suggests that the presence of exotic warm water piscivorous fish species is an indication that trout stream habitat is fundamentally poor (centrachids are found in the El Jaro/Salsipuedes drainage).

As limited as trout habitat conditions are, the El Jaro/Salsipuedes drainage is extremely important in that genetic introgression appears less than that found from the headwaters at Alder Creek downstream (Fish Management Plan, Appendicies, Molecular Genetic Population Structure in Steelhead / Rainbow Trout (*Onchorhynchus mykiss)* from the Santa Ynez River). Hilton Creek by comparison has very good trout habitat but genetic analysis suggests that hatchery trout predominate. The effects of this high proportion of hatchery trout in Hilton will need to be addressed with regard to artificial flows into Hilton during the period where steelhead migration has not recently occurred. The concern is that "pumping" water into Hilton will occur when the lake levels are below the point that the siphon is not operational. This suggests that there have been several years of low rainfall so that potential for steelhead migration into Hilton Creek is extremely low. The stilling basin supports a trout population. Based on the genetic analysis of Hilton trout it can be assumed that the ratio of trout haplotypes in Hilton Creek to some extent represents the ratio of haplotypes in the stilling basin. Under the conditions that trigger the use of the pump system, river conditions will be such that stilling basin trout will dominate spawning activity in Hilton Creek. Pumped water will provide summer rearing habitat for the spawn, and thousands of hatchery trout haplotypes will be released into the Santa Ynez River. Hatchery trout most likely spawned in Hilton Creek in the past under the conditions described above; however, the period of natural surface stream flow would have been short so that the success of the spawn would have been minimal. It is a real possibility that by sheer numbers hatchery trout could displace to some extent the native wildtype.

#3. Page 2-26: Under the "Water Temperature Tolerances" heading it states that "Rainbow trout/ steelhead in the Santa Ynez River may have higher tolerances, and therefore daily average temperatures of 20°C (68 °F) and 22°C (71.6°F) were used to examine relative habitat suitability."

<u>Comments:</u> Are these higher summer water temperature tolerances being reached or exceeded in the mainstem, in the critical tributaries? If so, are elevated water temperatures a limiting factor where they occur? The water temperature data is not included in this document. Is the summer water temperature data available for various reaches of the lower Santa Ynez River, Hilton Creek, Quiota Creek, and the El Jaro/ Salsipuedes drainage? Further, it would also be useful to include the water temperature

data during the WR 89-18 releases to better understand and to anticipate how these summer water temperatures will affect trout in the mainstem.

#4. Page 2-27.Table 2-3: "Relative Abundance of Rainbow Trout in the Lower Santa Ynez River Basin"

Comments: The relative abundance data included in this table yields good information if the assumption is made that the methods, time frames, and other data gathering methods have been standardized. A few examples of things that should have been standardized are: the seasons during the survey period, sampling methods utilized, sampling period(s), stream lengths surveyed (or corrected for). The principal concern is that there is a bias indicating a false relative high abundance or other false relationships if standardizing the data is not performed. The Relative Abundance Table does not indicate if these data were standardized.

#5. Page 3-8, Table 3-2:

Comments: Are there estimates as to the amount of stream flow needed to achieve Target Flows at the Target Sites? It appears that these Target Flows are part of the Adaptive Management Account, and illustrate the importance of this Account toward maximizing biological needs with minimal waste of water.

#6. Page3-15: The first paragraph states that the supplemental watering system "will operate both gravity feed (system in place) and a pumping system (in place in 2002)."

Comments: See comments to #2.

#7. Page 3-20: The "Relocation Sites Removal of Predatory Fish" section describes the potential to relocate small trout into sections of stream that are occupied by warmwater predatory fish with the option to remove predatory species.

Comments: The success of this option is questionable: 1) not all predatory fish will be removed and the remnant population will thrive due to lessened intraspecific competition; 2) the stilling basin as well as other reaches of the stream will continue to supply predatory fish. An option not discussed which may have merit is to create exclosure sites and relocate trout into these sites. That measure can be as basic as installing netting within a selected reach of stream followed by removal of undesirable species within the exclosure. This concept is utilized in the form of pen culture for white sea bass and chinook salmon in Santa Barbara and San Luis Obispo counties and elsewhere.

Other Comments: **MITIGATION IN KIND, OFF SITE.** The Department has been evaluating benefits to steelhead trout populations as a result of relative low flow releases on streams of the coastal slope of Santa Ynez Mountains. Specifically, the Department is assessing benefits to the trout fishery in Mission Creek within the City of Santa Barbara as a result of 20+ gpm summer/fall releases from the city's valve works site located within the upper reach of Mission Creek. The first releases were made in the summer of 1999 and lasted through the fall. Releases into Mission Creek were again initiated in July of this year.

The releases created summer steelhead habitat for a reach of approximately three river miles. These three miles of stream go dry in late summer under what are now natural conditions. Last year's results were extremely promising in that most pool and riffle habitat within the three-mile reach of stream maintained trout into the winter. Several pools have maintained several age class of trout to include young of the year up to 16+ inch adults. Releases into Mission Creek also maintained surface flow in Rattlesnake Creek in proximity to the confluence of Mission Creek where a sizeable trout population survived as a result of the releases.

The amount of flow required to maintain the trout fishery in Mission Creek as well as possible future diversions into Sycamore Creek is about 39-acre feet per season (5 month period). Under the conditions described in the Interim Fish Passage Account the 39-acre feet requested for In Kind/Off-Site Mitigation amounts to 1.5 % of the 2500-acre feet at the 0.75' surcharge. With the flashboards (3' surcharge) in place this amount drops to less than 0.5 %. In terms of steelhead restoration the cost-to-benefit ratio for this proposal is as high or higher than most of the projects underway or proposed for the Lower Santa Ynez River.

Finally, it is likely that the residents of the City of Santa Barbara will strongly endorse this project as indicated by the amount of support shown recently.

Thank you for a chance to comment on a document that clearly has so much time and effort invested. Should you have any questions please contact Mr. Mauricio Cardenas at (805) 640-1852.

Sincerely,

C. F. Raysbrook
Regional Manager

MC:mc/sl

File:Chron
file: final syr manage plan

LONG-TERM MONITORING IN THE LOWER SANTA YNEZ RIVER

Appendix I

Prepared for:

SANTA YNEZ RIVER CONSENSUS COMMITTEE

Prepared by:

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE

October 2, 2000

Page

1.0 Introduction I-1-1
1.1 Long-Term Monitoring Program Goal I-1-2
1.2 Organization of this Appendix I-1-2
2.0 Long-Term Monitoring Program I-2-1
2.1 Water Quality Monitoring I-2-2
2.1.1 Mainstem and Tributary Thermograph Network I-2-2
2.1.2 Diurnal Water Quality Monitoring in the Mainstem I-2-2
2.1.3 Lake Cachuma Temperature and Dissolved Oxygen Profiles I-2-3
2.1.4 Santa Ynez Lagoon Water Quality Profiles I-2-3
2.2 Santa Ynez River Sandbar Status I-2-4
2.3 Fishery Surveys I-2-4
2.3.1 Tributaries Migrant Trapping I-2-4
2.3.2 Mainstem Migrant Trapping I-2-5
2.3.3 Redd Surveys I-2-5
2.3.4 Snorkel Surveys I-2-6
2.4 Habitat Monitoring I-2-7
2.4.1 Proper Functioning Condition (PFC) I-2-7
2.4.2 Habitat Inventory I-2-8
2.4.3 Hilton Creek Habitat Monitoring I-2-9
2.5 Water Rights Releases (WR 89-18) Monitoring I-2-9
2.5.1 Steelhead Movement during WR 89-18 Releases I-2-9
2.5.2 WR 89-18 Ramping Rate I-2-10

2.6 Tributary Enhancement Project Specific Monitoring I-2-10

2.7 Target Flow Compliance Monitoring... I-2-11

3.0 Minimization and Avoidance Measures.. I-3-1

4.0 Reporting Requirements I-4-1

5.0 References.. I-5-1

1.0
INTRODUCTION

Since its inception in 1993, the Santa Ynez River Technical Advisory Committee (SYRTAC) has directed a series of monitoring efforts in Lake Cachuma, the lagoon, and the lower Santa Ynez River and associated tributaries. The purpose of these monitoring efforts has been to (1) develop an understanding of the rainbow trout/steelhead habitat utilization in the lower Santa Ynez River; (2) develop flow recommendations for maintenance of public trust resources in the lower river; and (3) develop a background from which to recommend a broad scope of management actions to protect public trust resources in the lower river. These studies have included: (1) water temperature and dissolved oxygen (DO) monitoring in Lake Cachuma and in the lower river from the Stilling Basin to the lagoon; (2) habitat quality evaluations in both the lower river and its tributaries; (3) flow requirements for fish passage in the lower river; and (4) fish surveys in both the lower river and its tributaries (SYRTAC 1994, 1996, 1997b, 1998, 2000).

Over time, the Consensus Committee and State Water Resources Control Board recognized a need for a longer-term study plan to provide additional technical information to policy makers. The purpose of the long-term study plan was to provide information to (1) determine potential management alternatives, and (2) make recommendations about which actions should be implemented. The Consensus Committee approved a long-term study plan developed by the SYRTAC Biology Subcommittee (SYRTAC 1997a). The plan provides the overall framework for the SYRTAC studies, which are devoted to acquiring technical information regarding:

- the diversity, abundance, and condition of existing public trust fishery resources within the lower river;
- conditions which may limit the diversity, abundance, or condition of public trust fishery resources within the lower river;
- non-flow measures which could be expected to improve the conditions that currently act to limit the diversity, abundance, or condition of public trust fishery resources within the lower river; and
- alternatives to the existing operational regime of the Cachuma Project which could be expected to improve the conditions that currently act to limit the diversity, abundance, or condition of public trust fishery resources within the lower river.

Results of the monitoring program have been published in a series of data compilation reports (SYRTAC 1994, 1996, 1997b, 1998, 2000).

1.1 LONG-TERM MONITORING PROGRAM GOAL

The proposed long-term monitoring program will complement the management actions outlined in the *Lower Santa Ynez River Fish Management Plan* (Plan). Results of the proposed monitoring program will be used to:

- adaptively manage the actions recommended in the Plan (*e.g.*, flow-related releases),
- evaluate benefits and impacts of the Plan's actions on downstream aquatic resources, and
- provide information for the long-term management of the southern ESU of steelhead.

Details of the monitoring program sampling protocols are provided in the long-term study plan (SYRTAC 1997a) and the data compilation reports (SYRTAC 1996, 1997b, 1998, 2000).

1.2 ORGANIZATION OF THIS APPENDIX

The next section describes the actions that will be undertaken as part of the long-term monitoring program. In addition to these actions, the monitoring described in the 1997 SYRTAC study plan (attached to this appendix) will also be continued as part of the long-term monitoring program.

Section 3 presents the minimization and avoidance measures provided by the National Marine Fisheries Service (NMFS) for implementation of the monitoring program. These practices have been taken from the Biological Opinion that covers all the actions proposed in the Fish Management Plan, including the monitoring program (NMFS 2000). Finally, Section 4 summarizes the reporting requirements included in the Biological Opinion as they pertain to the monitoring program.

The objectives of the long-term monitoring program are to further develop technical information concerning:

- the long-term patterns of diversity, abundance, and condition of existing public trust fishery resources of the lower Santa Ynez River (with an emphasis on endangered southern steelhead); and
- habitat quantity and quality (including water quantity and quality) which may limit the diversity, abundance, or condition of public trust fishery resources of the lower river.

In addition, a number of tributary enhancement measures are discussed in the Plan, and more projects may be added as opportunities become available. Project-specific monitoring plans will be implemented along with these projects to evaluate each enhancement measure and provide information for future enhancement work.

A brief description of key actions or actions that have been revised from the 1997 study plan are outlined below. Also, the long-term study plan is attached and provides additional information on monitoring that has already been occurring in the watershed. Each action is organized to provide the objective of each action and then a brief description of the procedures that will be employed in the monitoring.

The SYRTAC Project Biologist, with the assistance of the Adaptive Management Committee, will be responsible for implementation of the monitoring program. The Cachuma Project Biological Opinion (NMFS 2000) requires the project biologist to notify NMFS of any plans for changing monitoring locations or methods and obtain approval for these changes. The resumes of the project biologist and those implementing the monitoring program will be provided annually to NMFS.

Implementation of particular actions have additional project-specific monitoring requirements. Most of these requirements are included in the description below. Minimization and avoidance measures for construction of the tributary enhancement measures are discussed in Appendix C (Section 4, Implementation). Construction-related monitoring is included in that discussion as well and is not repeated below. A similar discussion of required monitoring for the fish rescue activities is included in Appendix D (Section 3.5, Fish Rescue Plan). The Biological Opinion also includes specific reporting requirements based on the monitoring program. These reporting requirements are described in Section 4 of this document.

2.1 WATER QUALITY MONITORING

2.1.1 MAINSTEM AND TRIBUTARY THERMOGRAPH NETWORK

Objective: To determine:

- seasonal patterns of water temperature, in both the mainstem and tributaries downstream of Bradbury Dam;
- diel variations in water temperature;
- longitudinal gradient in water temperatures downstream of Bradbury Dam; and
- vertical stratification and evidence of cool water upwelling in selected refuge pools.

Purpose: To determine if and where water quality is suitable for various fish species including steelhead trout.

Method: There are approximately 14 mainstem thermographs deployed at various locations throughout the mainstem Santa Ynez River, extending from Bradbury Dam down to the lagoon. The thermograph network will continue at its present level of effort with the core mainstem thermographs located at: Spill Basin (1), Long Pool (2), pool at mile 3.4 (2), pool at mile 6.0 (2), pool at mile 7.8 (2), pool at mile 10.5 (1), run at mile 13.9 (1), run at mile 24 (1), lagoon (2). An additional pool habitat will be picked for a vertical array thermograph monitoring location to increase the level of monitoring in the Alisal Reach. The additional monitoring site will be located at approximately mile 8 downstream from Bradbury Dam. Tributary locations include Hilton Creek (2-3), Nojoqui Creek (1), Quiota Creek (1), Salsipuedes Creek (2), El Jaro Creek (1), and San Miguelito Creek (1). Deployment locations are in both run and pool habitats. Run habitats have the thermograph laying on the bottom of the habitat while pool locations generally have a vertical array with the surface connected to a float suspended 1 foot below the surface and the bottom thermograph laying on the bottom of the habitat.

The following data will be collected at each monitoring site: time of measurements, depth of measurements, and temperature (C).

2.1.2 DIURNAL WATER QUALITY MONITORING IN THE MAINSTEM

Objective: To identify diel fluctuations in DO.

Purpose: To assess the extent to which DO concentrations may be limiting refuge habitat.

Method: Diurnal water quality surveys will be conducted a minimum of twice per month beginning in May and continuing through September. Measurements will be made in consecutive run, riffle, and pool habitats at 1-foot intervals throughout the water column. Measurements will be conducted in the core locations that have been monitored since 1997. All mainstem monitoring locations correspond to sites where thermographs are deployed.

Additional sites will be chosen in the Alisal Reach for more detailed monitoring. Mainstem monitoring sites are located at: mile 3.4, mile 6.0, mile 7.8, mile 8, mile 10.5, and mile 13.9.

The following data will be collected at each monitoring site: time of measurements, depth of measurements, temperature (C), and DO (mg/L).

2.1.3 Lake Cachuma Temperature and Dissolved Oxygen Profiles

Objective: To determine at what depth in Lake Cachuma that water quality is suitable for release through the Hilton Creek supplemental watering system (primarily temperature and DO).

Purpose: To provide the Adaptive Management Committee with the information needed to determine the depth of the intake structure for the Hilton Creek supplementation water facility. This action will create a historical record that documents the timing of stratification and turnover within the lake that will be useful in future management of the system.

Method: U.S. Bureau of Reclamation (Reclamation) personnel in an aeration study conducted between 1980 to 1984 measured temperature and DO profiles at three locations within Lake Cachuma. Reclamation originally chose the study sites to document oxygen depletion at the upper, middle, and lower portions of the reservoir. SYRTAC monitoring locations duplicate those of Reclamation to the closest extent possible. All measurements will be taken quarterly throughout the year by boat (with the boat anchored) at 1-meter intervals from the surface to the bottom of the lake. Station #1 is located directly upstream of Bradbury Dam at the deepest portion of the lake (lower lake); Station #2 is located within the deep river channel of Tequepis Point (middle lake); and Station #3 is located within the deep river channel directly opposite of the Tecolote Tunnel (upper lake).

Water quality parameters to be measured include temperate and DO.

2.1.4 Santa Ynez Lagoon Water Quality Profiles

Objective: To track the water quality in the lagoon by monitoring seasonal, vertical, and longitudinal patterns.

Purpose: To provide information to assess the habitat suitability for various age classes of steelhead to rear and/or over-summer in the lagoon.

Method: Sample locations will correspond to sites used in the past Santa Ynez River studies: lower lagoon at Ocean Park, middle lagoon at 35th Street Bridge, upper lagoon at Santa Ynez River inflow. Water quality profiles will be measured in May, August, November, and February. Measurements will be conducted in the above locations at 1-foot intervals from the surface to the bottom.

Parameters to be measured include: temperature, DO, salinity, and conductivity.

2.2 SANTA YNEZ RIVER SANDBAR STATUS

Objective: To determine the status (open or closed) of the sandbar at the mouth of the river and how this relates to the water surface elevation in the lagoon.

Purpose: To provide the Adaptive Management Committee with information on the status of the sandbar at the mouth of the river so that decisions can be made regarding passage flow supplementation.

Method: A stage recorder will be installed directly upstream of the lagoon/ocean interface and will remotely monitor the water surface elevation of the lagoon. Data will be collected remotely within the equipment and downloaded manually once per week to couple the equipment readings with regular visual observations.

Parameters to be measured include: lagoon water level and status of the sandbar at the mouth of the lagoon (open/closed).

2.3 FISHERY SURVEYS

2.3.1 TRIBUTARIES MIGRANT TRAPPING

Objective: To determine the use of the tributaries by both adult (upmigrant) and smolt (downmigrant) rainbow trout/steelhead. Timing and abundance will be determined in the tributaries of Salsipuedes, Hilton, and Nojoqui creeks, along with any additional tributaries where access may be granted in the future.

Purpose: To determine fish use of the tributaries and track changes in the abundance, timing, and distribution of the migrating fish. In addition, this monitoring, in conjunction with the mainstem trapping, will be used to evaluate the movement of steelhead as it relates to storm events.

Methods: Both upstream and downstream traps will be deployed in January so that the start of both adult immigration and juvenile emigration will be bracketed. Due to the extreme flashy nature of the watershed, both migrant traps will be removed prior to storm events to prevent trap loss during high flows. Traps will be re-deployed once flows recede to the point where effective trapping can be conducted. Traps will be cleaned of debris and checked daily for migrating fish in the morning. Traps will be checked every 4 to 6 hours. After traps are checked for fish, field personnel will inspect the traps and panels for scour points or holes, which will be repaired or plugged.

The following data will be collected daily: trap name, time, date, temperature, DO, and staff gage elevation. If any migrating steelhead are captured, the following data will be collected: length (mm), scale sample, tissue sample, brief description of migrant, photograph and measured flow. As part of the handling protocol required by NMFS' federal collection permit, water temperatures will be measured prior to handling captured steelhead. If water temperatures are greater than 20ºC (68ºF), captured migrants will be enumerated and immediately released without data being collected (size estimated).

In areas where specific construction projects address passage barrier fixes, monitoring will be conducted to evaluate the success of each project. In areas where property access is available, migrant traps will be deployed upstream of passage fixes to determine if upstream migrating adults are able to negotiate through the project sites. If migrant trapping is not possible, success will be determined using bank observations (spawning surveys) or snorkel surveys to verify presence of various age classes of steelhead.

2.3.2 Mainstem Migrant Trapping

Objective: To determine the timing and abundance of fish migrating in the mainstem upstream of the Alisal Reach.

Purpose: The information will be used to refine fish passage supplementation releases (*i.e*., fish travel time, the relationship of migration to storm hydrographs, flow levels required for passage).

Method: The protocol described under "Tributary Migrant Trapping" will be used for mainstem trapping. Deployment of the mainstem trap will coincide with the lagoon opening to accurately assess the time it takes for migrating steelhead to traverse the mainstem river.

2.3.3 Redd Surveys

Objective: To determine the timing, numbers, geographic distribution, and preferred flow conditions of spawning adults in the mainstem and tributaries of the Santa Ynez River (where access is granted).

Purpose: Redd surveys are used to provide information about the habitat preference and use within the Santa Ynez River and also to provide information on the status of rainbow trout/steelhead. In addition, once specific passage enhancement projects have been completed, spawning surveys will be conducted upstream of the projects to evaluate if adult steelhead are able to negotiate past the instream fixes.

Methods: Redd surveys (spawning surveys) will continue at their present level of effort to determine timing, numbers, geographic distribution, and preferred flow conditions of spawning adults in the mainstem and tributaries of the Santa Ynez River. Spawning surveys will be conducted bi-monthly beginning in January and continuing through May in each of the mainstem reaches: Highway 154, Refugio, Alisal, and Avenue of the Flags, and in the tributaries of Hilton, Salsipuedes, El Jaro, Nojoqui, and San Miguelito creeks. Spawning surveys in the mainstem will account for nearly 10-river miles downstream of Bradbury Dam where mainstem spawning conditions can be evaluated.

In order to accurately describe spawning conditions in the mainstem, an inventory of the known spawning locations will be conducted. Transects will be established across known mainstem spawning areas (as observed during 1999 to 2000) to determine wetted width and redd location in relation to flow conditions during the spawning season of 2001 and beyond. Redd locations will be monitored throughout the spawning season during various flow regimes to evaluate if flow conditions are affecting the spawning availability (*i.e.*, are known spawning locations above the water line at certain flows). Transects will be broken into quarters and pebble counts (n=50/quarter) will be conducted within each quarter to accurately describe available spawning material at different flows. Spawning gravel embeddedness will also be evaluated. This information coupled with water inflow data into Lake Cachuma and reservoir outflow (decay rates) will be used to determine if water releases, including those proposed to provide for upstream migration, is affecting spawning availability. Since additional water flowing into the river during the spawning season will positively affect steelhead, negative affects will be determined if flow regimes are creating conditions where suitable spawning locations are above the water line.

When conducting redd surveys, surveyors will proceed in an upstream direction. Once redd excavations or spawning activity is identified, flagging with the date and redd number will be attached to vegetation adjacent to the site. Length and width of the excavation will be measured to the nearest foot. Four depth and velocity measurements will be made at the excavation: one at the head of the excavation, and three across the egg deposition area. Additionally, surveyors will measure the distance to the nearest instream cover likely used by the spawning steelhead including 15- to 30-random depth and velocity measurements between the excavation site and cover to determine if spawning steelhead are keying into certain instream cover components and/or instream velocity preferences.

2.3.4 SNORKEL SURVEYS

Objective: To track the number of steelhead (adult, juvenile, and young-of-the-year) and other fish in select habitat units.

Purpose: Snorkel surveys are conducted to provide information on the status of the downstream fishery. More specifically, snorkel surveys are done to:

- determine if successful spawning occurred by observing young-of-the-year;
- determine presence or absence of juvenile and/or adult steelhead rearing over the summer in the mainstem and/or tributaries of the Santa Ynez River;
- determine geographic distribution of steelhead inhabiting the lower Santa Ynez River downstream of Bradbury Dam;
- document fish species composition and relative abundance in each location; and
- document the success or failure of enhancement and restoration projects by evaluating steelhead use of project areas over time.

Methods: Snorkel surveys will be conducted three times per year (June, August, and October) in both the mainstem and tributaries. The June survey will take into account baseline conditions (initial fish numbers) prior to the critical summer period by documenting numbers and locations of over-summering rainbow trout/steelhead. The August survey will evaluate instream conditions during the critical time of the year for over-summering rainbow trout/steelhead. The October survey will evaluate the ability of rainbow trout/steelhead to successfully over-summer in both the mainstem and tributaries of the Santa Ynez River. Cover utilization and upwelling evidence will be recorded for all habitats where steelhead are observed. If upwelling zones are observed, a thermograph array will be deployed in the habitat to monitor water temperature conditions during the critical summer period.

Abundance estimates will be conducted using direct observation techniques. Depending on the size and water clarity of the habitats to be snorkeled, one or two observers will traverse the habitat a minimum of two times with a short 30-minute interval between each pass. The following data will be collected: date, time, habitat number and type, number of each species by size class (3-inch size categories) and pass, length of habitat snorkeled, average width of habitat snorkeled, and duration of each pass.

Mainstem sample locations will include all core locations that have been sampled historically. There are usually between four to ten pool habitats per reach, whereas under the new monitoring plan, all pools will be sampled. In addition to the pool habitats sampled, adjacent run and riffle habitats to the pool habitat will also be sampled. If conditions are too shallow to allow for snorkeling, bank observations will be conducted instead of direct observations.

Tributary sample locations will include all core locations that have been sampled historically. Any tributaries that are re-habitat typed will include the core snorkel sites in order to provide a historic perspective with respect to steelhead usage. New tributaries or areas where access may be granted will be habitat typed, and a table of random numbers will be used to select pools, riffles, and runs to be sampled.

2.4 HABITAT MONITORING

2.4.1 PROPER FUNCTIONING CONDITION (PFC)

Objective: To determine the proper functioning condition of the mainstem and tributaries downstream of Bradbury Dam where enhancement actions may take place.

Purpose: To determine location enhancement measures likely to succeed (*i.e.,* be durable). When streams are functioning properly, they can withstand 25- to 35-year floods and recover from them quickly. Enhancement measures constructed in reaches that are not properly functioning are more likely to be damaged or washed-out in storms. A PFC analysis will help the Adaptive Management Committee determine the benefit of enhancement measures in a particular reach of stream (*i.e.,* purchase conservation easements, identify locations where riparian planting might be useful).

Method: The PFC methodology is an interdisciplinary approach whose team members include watershed specialists, geomorphologists, biologists, hydrologists, riparian ecologists, and soil scientists. A SYRTAC team has been trained in the use of PFC. The PFC inventory may be conducted in the lower Santa Ynez River and its tributaries where access is granted. Where access is unavailable, attempts would be made to conduct the PFC analysis from aerial photographs. A PFC analysis will be conducted in new reaches where tributary enhancements are proposed as future opportunities become available.

2.4.2 HABITAT INVENTORY

Objective: To determine the distribution, abundance, and quality of mesohabitats (*i.e.*, pool, riffle, and run), and how the various age classes of rainbow trout/steelhead utilize them.

Purpose: The purpose of the habitat typing will be to:

- track changes in overall habitat distribution in various reaches of the Santa Ynez River and tributaries, and
- identify snorkel survey locations to monitor distribution, abundance, and survival of over-summering rainbow trout/steelhead.

Method: Mainstem and tributary habitats will be inventoried every two to three years to monitor changes in overall mesohabitat distribution (*i.e*., the number of pools, riffles and runs). If significant storm events occur that alter the habitat composition along specific study reaches, then the habitats will be inventoried again that year. Habitat typing will use a Level III classification as described in the California Department of Fish and Game (CDFG) *Salmonid Stream Habitat Restoration Manual* (Flosi *et al.*, 1998). Habitat types will be identified by riffle, run, and pool (scour and dammed), and glide.

- Riffles are characterized by turbulent flow with a typical coarser substrate than units directly upstream or downstream. Substrate is usually cobble dominated, some of which may be partially exposed.
- Runs are fast water areas with shallow gradient, typically with a substrate ranging in size from gravel to cobble with no major flow obstructions. Runs are usually deeper than riffles and appear to have little or no turbulent flow.
- Scour pools are characterized by areas of sediment removal, slow water velocities, and a highly variable substrate with the greatest depth typically at the head or middle of the pool. Dammed pools are characterized by the material causing the impoundment. These pools are typically deepest at the tail of the pool, have more fines than scour pools, and fill with sediment at a more rapid rate.
- Glides are characterized by a uniform channel bottom, low to moderate flow velocities, and little or no turbulent flow. Substrates are usually cobble, gravel, and sand.

Additional information that will be collected includes: habitat unit length, width, depth, maximum depth, residual pool depth, percent instream shelter, percent total canopy, right and left bank dominate vegetation types, and any relevant comments with respect to landmarks, landslides, barriers, or changes in channel substrate.

2.4.3 HILTON CREEK HABITAT MONITORING

Objective: To determine the quantity of available habitat for rainbow trout/steelhead in Hilton Creek as it relates to flow.

Purpose: The Hilton Creek watering system provides the capability to manage the flows in this creek. Determining the relationship between flow level and habitat will provide the Adaptive Management Committee with information necessary to properly manage these releases.

Method: In order to accurately characterize the available habitat, transects will be installed every 100 feet through the lower 1,300 feet of Hilton Creek (downstream of the cascade/chute passage impediment). A minimum of five to ten depth and velocity measurements will be taken across the transect to establish a profile of the wetted channel. Transect measurements will be taken at approximately 1 cubic-feet-per-second (cfs) flow intervals from 1 cfs to 10 cfs to provide the data necessary to evaluate the habitat availability. This study will take advantage of natural and supplemented changes in flow rate to determine the flow versus habitat relationships. Flow from the Hilton Creek watering system will not be specifically modulated for this study.

The following data will be collected: flow, habitat type, wetted width, and a minimum of five depth and velocity measurements across each transect.

2.5 WATER RIGHTS RELEASES (WR 89-18) MONITORING

2.5.1 STEELHEAD MOVEMENT DURING WR 89-18 RELEASES

Objective: To determine if rainbow trout/steelhead are moving downstream in response to water rights releases.

Purpose: To determine if further measures need to be taken to protect steelhead during these releases.

Method: Snorkel surveys will be conducted to determine numbers and species composition at sites known to contain rainbow trout/steelhead both upstream and downstream of the Alisal Reach. A study plan will be created and provided to NMFS for review and approval. After NMFS has approved the study plan, it will be implemented for the subsequent 3 years of water rights releases. The result of implementation will be reported each year to NMFS.

Surveys will occur before and after the peak release levels for WR 89-18 releases. Surveys will also occur in the same locations after the releases have ended. Such surveys will be conducted during all water rights releases events in the first three years after the Plan is adopted.

Abundance estimates will be conducted using direct observation techniques. Depending on the size and water clarity of the habitats to be snorkeled, one or two observers will traverse the habitat a minimum of two times with a short 30-minute interval between each pass.

The following data will be collected: date, time, habitat number and type, number of each species by size class (3-inch size categories) and pass, length of habitat snorkeled, average width of habitat snorkeled, and duration of each pass.

2.5.2 WR 89-18 Ramping Rate

Objective: To determine if the ramping rate for water rights releases meets the "less than 1-inch change in stage per hour" criteria generally accepted for steelhead.

Purpose: To determine if the ramping rate needs to be revised to meet the generally accepted standard for protecting steelhead.

Method: The relationship between flow, stage, and wetted width during ramping events, and the next WR 89-18 release will be studied. A single transect and staff gages will be established at two locations within the mainstem. The locations are as follows:

- directly downstream of the Stilling Basin, and
- approximately 3.5 miles downstream of Bradbury (Refugio Reach).

Transects will be established in run habitats. Once flow decreases are initiated, field personnel will man each transect location, recording measurements every 15 minutes to establish the change in wetted width and depth over time.

The following data will be collected: time, wetted width, and staff gage depth.

2.6 Tributary Enhancement Project Specific Monitoring

Objective: To determine:

- the ability of fish to migrate through fish passage modifications;
- fish use of the habitat upstream and downstream of fish passage structures; and
- fish use of habitats created, protected, or enhanced.

Purpose: To determine that fish passage structures are functioning according to design (*i.e.,* hydrological monitoring) and provide information on any maintenance requirements. The results of this monitoring may also be used in refining the design of future enhancement actions.

Method: As each enhancement project is implemented, a project-specific monitoring plan will be developed.

2.7 TARGET FLOW COMPLIANCE MONITORING

Objective: To monitor the flow levels in the Santa Ynez River at the Highway 154 and Alisal Road bridges.

Purpose: To determine to what degree the target flows are being maintained at the Highway 154 and Alisal Road bridges, and to be used in the passage flow supplementation releases.

Method: Flows in the Alisal Reach will likely be monitored by the U.S. Geological Survey (USGS) Solvang gage. Modifications to this gage will be necessary to improve its ability to monitor low flows. This gage will also be used for the passage flow supplementation monitoring. Habitat maintenance flow targets have been established at the Highway 154 Bridge, where there was formerly a USGS gaging station. A number of options for monitoring the Highway 154 target flow compliance are being explored. The Member Units are in discussion with CalTrans, which has an easement at the Highway 154 Bridge, to allow access for gage installation and monitoring. In the interim, monitoring of the flow level at this site will occur weekly when flows have receded to the target flow levels. Flow will be monitoring using a standard protocol. A staff gage can be used to monitor flow once the water surface elevation to flow relationship has been developed and verified for at least one rearing season. Monitoring of the residual pool depth in the Refugio and Alisal reaches will occur if conditions warrant implementation of this action. Monitoring will occur weekly by reading the water surface elevation off a staff gage installed in representative pool habitats.

Some of the actions in the monitoring program, such as migrant trapping, snorkel, and bank observations, involve take of endangered steelhead. These actions will be conducted such that impacts to rainbow trout/steelhead are minimized. Such minimization measures are outlined in the current sampling permit held by the SYRTAC Project Biologist and the Cachuma Project Biological Opinion (NMFS 2000). Those from the Biological Opinion have been reproduced below verbatim (from Term and Condition #11):

- All ESA-listed fish handled out-of-water for the purpose of recording biological information must be anesthetized. Anesthetized fish must be allowed to recover (e.g. in a recovery bucket) before being released. Fish that are simply counted must remain in water but do not need to be anesthetized.

- ESA-listed fish must be handled with extreme care and kept in water to the maximum extent possible during sampling and processing procedures. Adequate circulation and replenishment of water in holding units is required. The transfer of ESA-listed fish must be conducted using a sanctuary net that holds water during transfer to prevent the added stress of an out-of-water transfer.

- ESA-listed juvenile fish must not be handled if the water temperature exceeds 21 degrees Celsius (70 degrees Fahrenheit) at the capture site. Under these conditions, ESA-listed fish may only be identified and counted. If any adult ESA-listed fish are captured incidental to sampling for juveniles, they must be released without further handling, and such take must be reported.

- Visual observation protocols (such as snorkeling and stream side surveys) must be used instead of intrusive sampling methods whenever possible. This is especially appropriate to ascertain whether steelhead are merely present.

- If there is any indication that the survival of ESA-listed fish will be affected by increasing water flows or other conditions, the traps must be removed from use until hazardous conditions have elapsed.

- Due caution must be exercised during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA listed adult steelhead when they are spawning. Whenever possible, walking in the stream must be avoided, especially in areas where steelhead are likely to spawn.

- Tissues of ESA listed steelhead are the responsibility of Reclamation and remain so as long as they are useful for monitoring the effects of the Cachuma Project. The transfer of tissues from Reclamation on other entities requires written approval from NMFS.

- Traps and live boxes must examined every 4-6 hours, at minimum to minimize delay and harm to steelhead. Reclamation shall redesign the migrant traps to provide additional habitat space for adult steelhead waiting to be released, prevent access by predators and prevent tampering by non-authorized persons. Trap design and staffing procedures are subject to NMFS approval.

The purpose of the monitoring program is (1) to provide data to the Adaptive Management Committee for implementation and evaluation of the actions proposed in the Plan and (2) to provide information for the long-term evaluation of the program. Formal reporting requirements have not yet been developed for these purposes. However, in addition to those needed for internal implementation and evaluation of the Plan, there are a number of reporting requirements included in the Cachuma Project Biological Opinion (NMFS 2000). The Project Biologist and the Adaptive Management Committee will be responsible for providing the required information to NMFS. A list of the required reports is found below.

Where quotations exist, the text was taken directly from the Cachuma Project Biological Opinion (NMFS 2000) unless otherwise noted.

- The result of the study to determine the habitat versus flow relationships in Hilton Creek (see Section 2.4.3 above) will be reported to NMFS in each year the study is conducted. *Term and Condition #2 (item 2)*

- The result of the monitoring of the downstream water rights releases (see Section 2.5 above) will be reported to NMFS in each year monitoring occurs. *Term and Condition #6 (item B) and #7 (item 2)*

- "yearly reports (unless otherwise noted) that include the data taken each year and preliminary data analysis. Especially important for monitoring the effects of the Cachuma Project will be monitoring of: steelhead movement during migration supplementation, successful access, spawning, and rearing of steelhead in previously inaccessible and/or access restricted tributary habitat, and mainstem flow targets and the condition of steelhead in the mainstem." *Term and Condition #11 (item 1)*

- "NMFS shall receive quarterly reports detailing water releases for fish and the achievement of flow targets (and pool surface areas) during the interim period (until the 3.0 surcharge is achieved) and for the first three years of long term operations. In later years, these reports may occur on a yearly basis." *Term and Condition #11 (item 6)*

- "plans for changes in monitoring locations and methodologies and obtain approval from NMFS prior to implementation." *Term and Condition #11 (item 7)*

- "identify to NMFS the personnel designated to conduct the monitoring activities described in this opinion prior to each monitoring season and confirm their experience through resumes or other evidence of their accomplishments." *Term and Condition #11 (item 8)*

- “If water releases to the mainstem and/or Hilton Creek fail, NMFS will be contacted immediately and Reclamation shall relocate any steelhead that may become stranded to appropriate habitats.” *Term and Condition #12 (item 1)*

During the construction phase of implementing the enhancement projects, specific monitoring is to be conducted by the Project Biologist. A description of the best management practices for these construction projects is included in Appendix C. Below are the construction-related reporting requirements *(Term and Condition #8, items 13, 17, 18, and 19*) as quoted from the Biological Opinion (NMFS 2000):

- “Reclamation’s fisheries biologist shall contact NMFS fisheries biologist Darren Brumback (562-980-4026) immediately if one or more steelhead are found dead or injured. If Darren Brumback is unavailable Reclamation shall immediately contact NMFS Protected Resources Division at 562-980-4020. If no one at Protected Resources is available, Reclamation shall immediately contact NMFS’s Office of Law Enforcement at 562-980-4050. The purpose of the contact shall be to review the activities resulting in take and to determine if additional protective measures are required. Reclamation will need to supply the following information initially: The location of the carcass or injured specimen, and apparent or known cause of injury or death, and any information available regarding when the injury or death likely occurred.”

- “provide a written monitoring report to NMFS within 30 working days following completion of any work activity. The report shall include the number of steelhead killed or injured during the work activity and biological monitoring; the number and size of steelhead removed; and photographs taken before, during, and after work activity.”

- “provide a written report to NMFS describing the results of the revegetation task within 30 working days following completion of revegetation. The report shall include a description of the locations planted or seeded, the area (m^2) revegetated, a plant palette, planting or seeding methods, proposed methods to monitor and maintain the revegetated area, performance or success criteria, and pre- and post-planting color photographs of the revegetated area.”

- “provide a written report to NMFS describing the results of the vegetation monitoring within 30 working days following completion of each fall inspection. The report shall include the color photographs taken of the work area during each inspection and before and after implementation of the work activities, and estimated percent of exposed soil remaining within each area affected by the work.”

During predator removal projects associated with fish rescue activities, specific monitoring (see Appendix D, Fish Rescue Section) and reporting requirements (below) have been included by NMFS (*Term and Condition #9, items 1, 3D & 3F*) :

- From the letter cited in the Biological Opinion - NMFS 1998: "The report shall contain descriptions of the following:
    - Specific description of the removal/relocation activities performed.
    - Number of steelhead removed from the project area and the number transferred to each relocation site.
    - Number of steelhead killed or injured during the removal/relocation.
    - Description of any problems encountered during the project or when implementing special conditions.
    - Any effect of the project on steelhead that was not previously considered."
- "Reclamation's fisheries biologist shall contact NMFS fisheries biologist Darren Brumback (562-980-4026) immediately if one or more steelhead are found dead or injured." If Mr. Brumback is unavailable, then follow the same protocol identified under the first bullet under construction.
- "provide a written report to the NMFS within 4 weeks following completion of the proposed action. One report shall be submitted to the NMFS for each year that the project action is implemented. The report shall include the number of steelhead observed, handled (captured, collected, trapped), killed and injured during the proposed action; the estimated size of individual steelhead observed, handled, injured, or killed; a map delineating the location(s) where steelhead were observed or handled; a description of any problem encountered during the project or when implementing terms and conditions; and, any effect of the proposed action on steelhead that was not previously considered."

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. *California Salmonid Stream Habitat Restoration Manual*. Third Edition. State of California, Resources Agency, Department of Fish and Game.

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SYRTAC. 1998. Data Compilation Report for 1996-1997. Prepared for the Santa Ynez River Consensus Committee, Santa Barbara, CA. Draft report.

SYRTAC. 2000. Data Compilation Report for 1998-1999. Prepared for the Santa Ynez River Consensus Committee, Santa Barbara, CA. Draft report.

APPENDIX I

ATTACHMENT 1

PROPOSED INVESTIGATIONS TO DETERMINE FISH–HABITAT MANAGEMENT ALTERNATIVES for the LOWER SANTA YNEZ RIVER, SANTA BARBARA COUNTY

1997 UPDATE

Prepared by

SANTA YNEZ RIVER TECHNICAL ADVISORY COMMITTEE
BIOLOGY SUBCOMMITTEE

JUNE 1997

PREFACE

The waters of the Santa Ynez River are put to a variety of uses, including the maintenance of public trust resources both within Lake Cachuma and downstream of Bradbury Dam, as well as consumptive urban and agricultural uses within the Santa Ynez Valley and along the coastal plain encompassing the City of Santa Barbara and its urban environs. Since 1993, the U.S. Bureau of Reclamation, California Department of Fish and Game (DFG), U.S. Fish and Wildlife Service (FWS), and various water project operators have been party to a "Memorandum of Understanding (MOU) for Cooperation in Research and Fish Maintenance" on the Santa Ynez River, downstream of Bradbury Dam ("lower river"). Parties to the MOU maintain a Technical Advisory Committee (TAC) whose ultimate goal is to "develop recommendations for long term fishery management, projects and operations" in the lower river.

The TAC was established in response to State Water Resources Control Board (SWRCB) actions dealing with Bradbury Dam and the lower Santa Ynez River that culminated in the SWRCB requesting flow recommendations for maintenance of public trust resources in the lower river. It was also established to broaden the scope of management options potentially available to protect public trust resources within the lower river, to attempt to accommodate the needs of all interested parties, and ultimately develop mutually acceptable management actions. Since 1993, the TAC has worked from year to year to undertake a variety of studies of the lower river. These studies have included: (i) water temperature and dissolved oxygen (DO) monitoring in Lake Cachuma and in the lower river from the stilling basin below Bradbury Dam to the lagoon; (ii) habitat quality evaluations in both the lower river and its tributaries; (iii) flow requirements for fish passage in the lower river; and (iv) fish population surveys in both the lower river and its tributaries (SYRTAC 1994, 1995).

Over time the parties and the SWRCB recognized a need for a longer-term study plan to provide additional technical information to policy makers. In March 1996 the Consensus Committee approved a long-term study plan developed by the TAC Biology Subcommittee (SYRTAC 1996). The plan provides the overall framework for the TAC studies, which are devoted to acquiring technical information regarding:

1. The diversity, abundance, and condition of existing public trust fishery resources within the lower river;

2. Conditions which may limit the diversity, abundance, or condition of public trust fishery resources within the lower river;

3. Non-flow measures which could be expected to improve the conditions that currently act to limit the diversity, abundance, or condition of public trust fishery resources within the lower river; and

4. Alternatives to the existing operational regime of the Cachuma Project which could be expected to improve the conditions that currently act to limit the diversity, abundance, or condition of public trust fishery resources within the lower river.

The studies described herein are designed to develop the information necessary for the TAC to recommend measures that will be considered and evaluated by the Consensus Committee. The Consensus Committee will then recommend specific management measures to the SWRCB for the purpose of achieving a reasonable allocation of Santa Ynez River water between public trust resources and competing consumptive uses consistent with the goals and objectives outlined below.

The 1996 study plan promoted the continuation of some ongoing investigations, cessation of studies that have already provided sufficient information within the context of this plan, addition of investigations required to augment existing information, and implementation of investigations necessary to support the analytical component of this plan's objectives. To assist in the overall planning process and management of the study program, the 1996 MOU required the compilation, synthesis, and analysis of information collected on the fisheries resources and habitat conditions during the 1993-1996 study period, which was presented in the Synthesis Report (SYRTAC 1997).

In light of the Synthesis Report's findings, the Biology Subcommittee organized several technical meetings in early 1997 to further develop and make fine-grained course corrections to the TAC studies. The meetings addressed technical issues of the TAC studies, such as the impact of lack of access to certain areas, development of habitat-flow relationships, protocols for field studies, and identification of potential management actions. This 1997 update of the long-term study plan incorporates the recommendations from these meetings.

As stated above, the ultimate goal of the cooperative effort is to develop management recommendations in preparation for the SWRCB hearing in the year 2000. It is therefore necessary to focus the studies on collecting data that will address environmental issues and aid development and evaluation of alternative management actions. Identification and preliminary assessment of potential management actions is underway in the Management Alternatives Report. This will highlight areas where data are sufficient and other areas where data are inadequate to evaluate the potential biological benefits associated with the management actions. The iterative process of refining and updating the long-term study plan will allow development of specific studies and opportunistic experiments to address these gaps.

GOALS AND OBJECTIVES

STUDY GOAL

The goal of this study is to identify reasonable flow and non-flow measures that will improve habitat conditions for fish populations in the lower Santa Ynez River within the context of overall management objectives and competing demands on the Santa Ynez River.

STUDY OBJECTIVES

The study objectives are to develop technical information concerning:

1. The diversity, abundance, and condition of existing public trust fishery resources of the lower Santa Ynez River;

2. Conditions – habitat quantity and quality, including water quantity and quality – which may limit the diversity, abundance, or condition of public trust fishery resources of the lower river;

3. Non-flow measures which could be undertaken to change existing conditions that act to limit the diversity, abundance, or condition of public trust fishery resources within the lower river; and

4. Alternative flow regimes for the Cachuma Project which could be expected to change the conditions that currently act to limit the diversity, abundance, or condition of public trust fishery resources within the lower river.

MANAGEMENT OBJECTIVES

Identification and evaluation of potential alternative management actions will be based, in part, on the following objectives:

1. Improve habitat conditions to maintain fish populations in good condition;

2. In particular, protect, maintain, and improve habitat conditions for species listed under the State and Federal endangered species acts or identified as California Species of Special Concern;

3. Improve the availability and suitability of stream corridor and channel habitat for a diversity of species of fish and wildlife.

Alternative management recommendations will be developed and evaluated in context with other management objectives for the river. The comparative feasibility of various alternative management actions in achieving these management objectives will be evaluated with respect to the following criteria:

- The proposed management action has a high probability of achieving the desired benefit;

- The management action can be reasonably implemented considering the constraints imposed by natural hydrologic conditions.

GENERAL APPROACH

Several study elements are proposed to obtain data on habitat conditions and fisheries resources in the lower Santa Ynez River. These include describing and monitoring physical habitat and monitoring water quality (temperature and dissolved oxygen) under varying flow conditions; modeling habitat-flow relationships and water temperature; surveying habitat use by fish; and determining population stock structure of rainbow trout/steelhead.

Habitat and fish use information will be developed using a stratified sampling approach. Strata will be based upon large-scale features, such as gradient, substrate and accretion (reaches), and small-scale geomorphological features (habitat types). The studies of stream habitat fall into three approaches (typing, characterization, and modeling) and two types of data (monitoring and experimental/opportunistic), as depicted in the table below. Habitat typing is important for determining the analytical structure of the TAC studies. Characterization of conditions, both currently existing and under experimental variations, will provide empirical habitat information, which will also be used to supplement modeling efforts.

	Type and objectives of habitat data	
Approach	Describing current conditions	Experimental conditions
Typing	Determine habitat units to provide context for habitat sampling units (Job 1)	
Characterization	Monthly habitat monitoring (e.g. depth, width) (Job 3) Temperature monitoring (Job 4)	Field studies of habitat-flow relationships How do conditions change with flow? (opportunistic site-specific observations at different flow conditions) (Jobs 3, 4, 5 and 6)
Modeling		Modeling habitat-flow relationships How do habitats respond to changes in flow? (Job 3)

Habitat conditions and fish use will be monitored in various channel conditions, or habitat types, in each reach under different flow regimes. Different flow regimes could result from natural variation in hydrology, WR 89-18 releases, Fish Reserve Account releases, and potential modifications in routine operations at Bradbury Dam. Flow-habitat modeling sites will be selected from habitat types based upon function. Surveys of habitat availability and fish use (e.g., species composition, diversity, abundance, condition, and reproductive success) will include both the lower Santa Ynez River main stem and major tributaries. Genetic analysis of steelhead/rainbow trout will help determine stock origins of fish from different regions of the lower river basin.

The relationship between habitat quality and quantity and instream flow will be determined by integrating channel conditions and fish use information within the framework provided by a flow-habitat model. The Physical Habitat Simulation model (PHABSIM), developed by the FWS (Bovee 1982), will be used to relate fish use and habitat quantity and quality to flow. The study plan will also monitor and model stream temperature, in addition to monitoring other water quality parameters such as dissolved oxygen that affect habitat quality.

Based upon results of the proposed fisheries and water quality studies , various alternative management strategies can be developed and the associated biological benefits, operational feasibility and constraints, and potential adverse impacts to public trust resources and water supplies of the Santa Ynez River system can be evaluated. Results of these technical studies will provide the necessary foundation for developing a reasonable and balanced management program for the Santa Ynez River.

STUDY PLAN

JOB 1. Stream reach and habitat inventory

OBJECTIVE: To identify major stream reaches and determine distribution, abundance and quality of mesohabitats (e.g., riffles, pools, etc.) throughout the lower Santa Ynez River and selected tributaries.

PURPOSE: This information will be used to systematically subsample habitats within stream reaches for detailed investigation of fish-habitat relationships and to identify habitat quality with the potential for habitat restoration.

PROCEDURES: Two levels of stratification will be used to inventory available habitat throughout the lower main stem and tributaries. The first level consists of determining the major reaches of the main stem with regard to channel morphology. The TAC has already broken down the main stem into three major reaches for the fish passage study conducted in May 1995. These reaches correspond approximately to those described by Shapovalov (1946) with regard to substrate quality and steelhead/trout spawning: mouth to Salsipuedes Creek, Salsipuedes Creek to Solvang, Solvang to Bradbury Dam, with substrate quality increasing from downstream to upstream. Aerial photos will be reviewed, especially for regions where ground access is not available, as in the Highway 154 reach. Each tributary[1] will also be divided into major reaches, e.g. a high-gradient, boulder-controlled upper section vs. a low-gradient, alluvial lower section.

The second level of stratification consists of geomorphic habitat typing. Habitat types will be determined in each reach of the mainstem and selected tributaries. A modified DFG habitat survey methodology (Flosi and Reynolds 1991) will be used where the principal habitat component is mesohabitat, i.e., pool, riffle, run, etc. Habitat typing of the main stem and large tributaries such as Salsipuedes will be done by DFG staff using the aerial photographs taken in April 1995 and November 1996 as well as photos from T.R. Payne's 1992 survey.. Individual habitat units will be numbered from downstream to upstream. DFG staff will ground truth the mainstem during WR 89-18 releases and will train the TAC project biologist in habitat typing methods. The TAC biologist will habitat type the tributaries. While ground truthing selected units, data on habitat attributes will be

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[1] Tributaries included for consideration based upon preliminary survey results dealing with flow and other habitat attributes are Alisal, Hilton, Nojoqui, Quiota, Salsipuedes-El Jaro, and San Miguelito creeks.

collected following the instructions in Appendix 1. Potential passage barriers will be identified during the field surveys.

Data from these surveys will be compared with past surveys done by Tom Payne and for the EIR/EIS.

SCHEDULE: Habitat typing of the main stem from photographs, and ground truthing of selected units in the mainstem and selected tributaries, will be done during June-July 1997.

JOB 2. Habitat function as reflected by fish use

OBJECTIVE: Identify species abundance, diversity and spatial and temporal distribution, and the potential function of available habitats within the mainstem Santa Ynez River and its tributaries with regard to spawning, rearing, and migration.

PURPOSE: This information will be used to evaluate the habitat representation of the transects for modeling flow-habitat relationships (PHABSIM) and determine habitat condition including potential for restoration. The migration component will also determine influences of flow and habitat condition on fish movement. Results of these surveys will also provide data on the species composition, abundance reproductive success and condition of the fish populations inhabiting the Santa Ynez River downstream of Bradbury Dam.

PROCEDURES AND SCHEDULES: A table of random numbers will be used to select four pools, and a minimum of three riffles and three runs, from each reach. These units will be sampled systematically to assess their function as spawning and rearing habitat.

Spawning

Selected habitat units in the mainstem and selected reaches in the tributaries will be monitored once every two weeks from December through May, when flow conditions provide for migration and spawning. Key tributaries for sampling include Salsipuedes, El Jaro, San Miguelito, and Hilton Creeks, and possibly Alisal and Quiota Creeks if access is granted. During wet years when the extent of potential spawning habitat is greater, it may be necessary to subsample in the tributaries. Units will be checked for spawner use/non-use by looking for spawning activity or recently constructed redds. The location of redds will be marked with rebar and flagging. Water depth and average column velocity will be measured at three locations over undisturbed gravel adjacent to the redd**.**

Rearing

Monthly snorkel surveys to assess distribution and abundance of fish were conducted in the mainstem from August 1995 to September 1996. The Biology Subcommittee recommended continuing the surveys, but at a lower level of effort.Abundance estimates will be made for each fish species in each unit twice a year: once in June when young-of-the year fish are available and once in October after the period of low summer flows, high temperatures and potentially low DO. This will be done each year to census relative abundance of fish in the system.

Abundance estimates in pools and runs will be made by direct observation (Helfman 1983), when appropriate. Each unit will be traversed by snorkeling at least twice with a minimum of two observers. Each observer will be assigned a “sample lane,” the width of which is dependent on water clarity. Lane width will be determined using the “fish-on-a-stick” method. A 10 cm long facsimile of a fish will be attached to the end of a stick and gradually moved away from the underwater observer until the fish disappears. The distance from the observer to the point where the fish reappears is the maximum lane width. Lane width can be narrower than the maximum if the total habitat unit width is less than the sum of the designated lanes; i.e. (no. observers ∗ maximum lane width) < (total habitat unit width). Observers maintain proper lane width and traverse the habitat, from downstream to upstream, counting fish by species and estimating actual size, within their respective lanes. At least two passes will be made with a short (30 minute) interval between passes.

The following data will be collected: date; time; reach; habitat number and type; specific location; no. of each species by size class, by pass, and by lane; length of habitat sampled; lane width, maximum lane width (fish-on-a-stick distance), and number of lanes; and duration of each pass.

Lagoon Trapping

The lagoon may provide rearing and refuge habitat for steelhead. Passive traps (e.g. hoop nets) will be deployed in three different seasons to sample for steelhead. Six traps will be deployed throughout the lagoon to assess the presence of juvenile and adult rainbow trout/steelhead. The general principle is that fish swimming in the lagoon will encounter vertical panels (lead net or wing nets) that will cause the fish to turn and swim along the net. The fish will be directed to the mouth of the trap and funneled through a small opening into the hoop net section of the trap. The hoop net section has a series of small openings that allow the fish to enter but make it difficult for the fish to find their way back out. Once past the small openings in the hoop nets, the captured fish swim freely within the back holding area of the hoop net portion of the trap until they are removed.

The three traps will be deployed three times during the year for one-week periods. Trapping will occur during the following seasons:

1. Winter shortly after the lagoon mouth is breached (December or January)

2. Spring when juveniles migrate downstream (April-May)

3. Fall after the summer rearing period (September-October)

The traps will be distributed throughout the lagoon. Trap placement may be adjusted in seasons when directional movement by steelhead could be expected. For example, two traps may be placed side by side in the upper end of the lagoon, approximately 0.5 miles upstream of the 35th Street bridge. At this location, one trap would face upstream and the other trap would face downstream. The side panels would form a barrier across a majority of the width of the lagoon to ensure capture of fish moving upstream and downstream.

The traps will be checked on a daily basis during each of the trapping periods. Checking of the traps will involve lifting up and opening the end portion of the hoop net. After removal of the captured fish, the end portion of the trap will be lowered back into the lagoon. All fish captured will be identified. The fish will be held in buckets of water filled from the lagoon awaiting data collection. Data collected for rainbow trout/steelhead will include fork length (mm), weight, description of appearance, scale and tissue samples. All fish will be released back into the lagoon. Life stage will be classified using the following criteria. *Fry* are newly-emerged fish, typically with at least a vestige of their yolk sac ("unzipped" or not "buttoned up"). *Parr* are darkly pigmented fish with characteristic oval- to round-shaped parr marks on their sides. *Silvery parr* have faded parr marks and a sufficient accumulation of purines in the scales to produce a silvery, but not fully smolted, appearance. *Smolts* have highly faded parr marks, or lack them altogether, a bright silver or nearly white color, and deciduous scales. During November–June, trout will be checked for ripe gonads by applying pressure to the abdomen. If milt or ova are extruded, the corresponding sex of the fish will be recorded. Scales will be collected from all adult trout and processed by TAC biological subcommittee representatives to evaluate life-history traits (e.g., growth, migratory history, etc.). A tissue sample (an approximately 1 cm piece) will be collected from the right pectoral fin, half for genetic analysis and half for the DFG regional biologist to archive.

<u>Migration</u>

Adult and juvenile steelhead/trout movements in relation to flow conditions will be monitored at key locations throughout the lower river system. Two-way trapping will be conducted on the main stem at a suitable location between the lagoon and Solvang (Alisal Reach); that is, downstream from the predicted primary spawning area. Additional opportunities for deploying another mainstem trap will be investigated. Two-way trapping will also be conducted in Hilton, Salsipuedes, El Jaro, Alisal, Nojoqui, Quiota, San Miguelito, and Alamo Pintado creeks, depending on stream flows and access to property.

Trap deployment in the mainstem and tributaries begins with the onset of the winter storm season. The first few storms typically do not create much runoff, but simply "charge up" the water shed. Once the watershed is charged, runoff from storms can be very flashy (i.e. high flows but short duration). Due to these flashy flows, both upstream and downstream migrant traps will be removed from the stream prior to or during the onset of rain to prevent loss of traps in high flows. Traps will be redeployed immediately following peak flow events. Traps will be installed before 1 January so that the start of both adult immigration and juvenile emigration will be bracketed. Tributaries will continue to be trapped into summer until trout movements cease. A staff gage will be installed near each tributary trap, and discharge will be measured at various flow levels to develop a standard curve. The mainstem trap will be maintained for as long as flow is continuous to monitor trout movement during the rainy season, and WR 89-18 and experimental Fish Account releases.

The mainstem and tributary traps will be checked once or twice daily, depending on debris load and weather conditions. Field personnel first check the contents of the trap for any fish. If no migrants are captured, personnel will remove debris from the trap and panels to prevent accumulation of debris. Traps will be inspected for scour points and "holes," which will be repaired or plugged.

The following data will be collected each time a trap is checked: trap name or number; starting and ending date and time of trapping; staff gage elevation; and estimated proportion of flow fished by the trap. Each rainbow trout/steelhead captured will be PIT tagged (tagging protocol is under review). PIT tagging will facilitate study of fish movements throughout the lower basin. Personnel will record the fork length, weight, appearance, and sex. Each trout will be classified by life stage, using the following criteria. *Fry* are newly-emerged fish, typically with at least a vestige of their yolk sac ("unzipped" or not "buttoned up"). *Parr* are darkly pigmented fish with characteristic oval- to round-shaped parr marks on their sides. *Silvery parr* have faded parr marks and a sufficient accumulation of purines in the scales to produce a silvery, but not fully smolted, appearance. *Smolts* have highly faded parr marks, or lack them altogether, a bright silver or nearly white color, and deciduous scales. During November–June, trout will be checked for ripe gonads by applying pressure to the abdomen. If milt or ova are extruded, the corresponding sex of the fish will be recorded. . Scales will be collected from all adult trout and processed by TAC biological subcommittee representatives to evaluate life-history traits (e.g., growth, migratory history, etc.). A tissue sample (an approximately 1 cm piece) will be collected from the right pectoral fin, half for genetic analysis and half for the DFG regional biologist to archive. For any other captured fish species (e.g. largemouth bass, sculpin, etc.), fork length and weight will be recorded.

JOB 3. Habitat-flow relationships for spawning, rearing, and migration

OBJECTIVE: Determine the relationship between stream flow and habitat quality and quantity for each fish species life-stage function, using modeling and empirical data.

PURPOSE: Results of this model will be combined with empirical information on habitat use to develop stream-flow versus habitat availability relationships. These relationships will provide the basis for determining flow requirements for various species-life stages and eventually an important analytical tool for evaluating various management actions, including associated flow regimes and habitat restoration.

PROCEDURES: Survey transects will be established in each habitat unit for modeling flow-habitat relationships using PHABSIM (Bovee 1982). Data will be collected for model building at representative spawning and rearing habitat units under low, moderate, and high flow conditions. Data regarding fish passage were collected at two flow levels during May and June 1995. The same protocol for data collection used at the passage study sites will be used at the spawning and rearing units.

Fish Passage

Modeling and field observations will be used to determine the location of critical passage reaches and to evaluate passage conditions as a function of flow in the mainstem. Transect selection and stage and velocity versus discharge data collection to evaluate fish passage conditions were begun in May 1995 at several sites in the main stem where barriers to fish passage likely develop under low-flow conditions. Sites were selected from the aerial photographs taken in April 1995. DFG models will be used for passage analysis in the mainstem, incorporating reach-specific flow data and existing barrier survey data. The data decks will be run and stage-discharge relationships will be verified. Thompson criteria will be applied to the models. Sensitivity of passage to depth criteria will be analyzed for 0.4, 0.5 and 0.6 feet. For the tributaries, habitat surveys will be used to identify potential barriers (Job 1).

PHABSIM

Existing PHABSIM analysis (199 DWR) will be redone using re-evaluation of habitat mapping data, reach-specific hydrology, and Southern California Steelhead Habitat Suitability Criteria. Available hydraulic conditions will be simulated as a function of flow using existing hydraulic models. Hydrology data will be used to identify reach-specific flows, given a specific release at the dam, on a monthly time step.

Development of suitability criteria for southern steelhead will be included within the framework of examining habitat-flow relationships. Suitability criteria may be developed by reviewing published criteria for other streams, requesting input from qualified personnel, conducting a workshop with steelhead experts, and by reaching consensus within the TAC. The workshop participants will review existing steelhead suitability criteria (suitability curves on velocity, depth and substrate for each lifestage), make suggestions to modify the curves based on professional judgment, and agree on final suitability index curves for use in the Santa Ynez River.

SCHEDULE: These data collections will occur opportunistically during the ensuing study period as flow conditions allow. The southern steelhead habitat-suitability workshop will be scheduled in fall 1997. The PHABSIM model will be rerun in winter 1997-1998.

JOB 4. Temperature modeling and dissolved oxygen (DO) monitoring

OBJECTIVE: Model the relationship between temperature and stream flow, channel conditions, and other manageable influences on water temperature. Determine the seasonal and geographical distribution of water temperature and DO for various fish species life stages. Identify portions of the Santa Ynez River that would have suitable water temperatures for steelhead/rainbow trout under alternative flow management options.

DO monitoring will address three specific problem areas: seasonal DO depressions that may affect the quality of fish habitat in the main stem of the lower river; the extent of diel DO depressions in refuge pool habitat; and DO profiles in Cachuma Reservoir that may affect downstream resources through flow releases.

PURPOSE: This information will be used to evaluate various management actions on the temperature and DO conditions within the lower river. Influences of flow regime and habitat/channel restoration will be evaluated relative to achieving water temperature and DO criteria.

PROCEDURES: Studies of water temperature and DO will include monitoring of current conditions, experimental or opportunistic observations of water quality at different times or flows, and modeling of stream temperature.

Temperature and DO Monitoring

Continuous temperature monitoring (Optic Stowaway temperature monitoring units) will be continued at a core group of monitoring locations in the mainstem (7 stations), lagoon (2), Hilton Creek (1), Salsipuedes Creek (2), El Jaro Creek (1), Nojoqui Creek (1), and San Miguelito Creek (1). The thermograph units will be serviced and data downloaded on a monthly basis to avoid data loss from mechanical malfunctions and vandalism. Other monitoring sites may be added as necessary.

Seasonal vertical profiles will be conducted in Lake Cachuma (temperature and DO) and the lagoon (temperature, DO, and salinity). Measurements will be taken at one-foot intervals. Air temperature will be monitored at several locations for use with the temperature model (locations to be determined).

Diel fluctuations in DO

Surveys will be conducted to identify diel fluctuations in DO and to assess the extent to which DO concentrations may be limiting refuge habitat. The abundant algae in the Santa Ynez River can contribute to substantial diel variation in DO concentrations. During the day algal photosynthesis can saturate the water with DO, while during the night algal metabolism and animal respiration can deplete DO. Surveys will occur monthly during the late spring through early fall, when algal growth is high. The vertical profile of DO and temperature will be measured using one-foot depth intervals in the pools during the pre-dawn period and in the late afternoon. Measurements will be made from at least six sites (e.g. Long Pool, Refugio X at mile 3.4, Alisal 7.9, Alisal 9.5, Buellton 13.9) between Bradbury Dam and Buellton, in three habitat units (one each pool, run, riffle) per site (except the Long Pool), including habitat units with and without cool water upwelling.

Temperature Modeling

The SSTEMP model developed for the EIR/EIS will be used to integrate flow, channel geometry, and various other, manageable influences on temperature with meteorological conditions in order to identify portions of the Santa Ynez River that would have suitable temperatures for and evaluate potential temperature management actions. The model will be updated with new data (hydrology, climate, stream temperature) when they become available. Additional data for use in the model will be obtained from aerial photos taken at various flows (top width), and the 1996 riparian study (shading). The model will be verified with new stream temperature monitoring data.

SCHEDULE: Water temperature monitoring will be maintained in the main stem and tributaries on a continuous basis, with monthly visits to the stations to download data. Vertical profiles of Lake Cachuma and the lagoon will be measured approximately quarterly. Surveys of diel fluctuations in DO will occur monthly during the period of algal production (late spring through early fall). Experimental studies of water quality will occur opportunistically depending on flows and releases.

JOB 5. Tributary-main stem relationships

OBJECTIVE: Determine habitat use including quantity and quality in tributaries relative to dynamics of the fish populations within the lower river.

PURPOSE: This information will be used to assess the degree to which individual tributaries function as independent steelhead/trout rearing habitats by answering the following questions: Do steelhead/trout spawned in tributaries that typically dry up have a tendency to “escape” to the main stem as stream flow decreases and water temperature increases seasonally (see Erman and Leidy 1975)? Conversely, do those spawned in perennial tributaries remain there to rear until ready to emigrate? Can any significant benefit be gained from flow augmentation in tributaries, such as that proposed for Hilton Creek? How would habitat management activities in the tributaries influence overall management of the lower Santa Ynez River system including influences on flow and other potential modifications in the lower river?

PROCEDURES: Habitat potential in the tributaries will be identified during habitat surveys described in Job 1, including passage barriers, rearing habitat, and potential opportunities for improvements (structural or land use).

The activities described in Job 2 will provide the data necessary to evaluate the habitat use in the tributaries. Trapping and tagging will detect the movement of spawners in the stream. Redd monitoring in selected habitat units will determine the location of spawning activity. Snorkeling in the selected habitat units will provide abundance estimates on fry and parr over time as stream flow and water temperature change. Trapping will determine the magnitude and timing of emigration in relation to streamflow and temperature changes. Flow-habitat evaluations in Hilton Creek, the only tributary that can receive flow augmentation, would be evaluated.

SCHEDULE: See schedules under Job 2.

JOB 6. Verification of habitat-flow relationships

OBJECTIVE: Verify streamflow relationships developed in Jobs 3 and 4.

PURPOSE: Determine if the streamflow versus habitat availability/use relationships based upon consideration of flow ranges (Jobs 3) and temperature conditions (Job 4) accurately predict the response in habitat conditions/use.

PROCEDURES: Seasonal, WR 89-18, and Fish Reserve Account releases from Bradbury Dam will be used to empirically verify flow versus habitat relationships identified for target fish species/life stages. Special study elements will be added if needed to answer specific questions.

Reach-specific flows will be determined during releases from Bradbury Dam. Habitat data will be collected at low and intermediate flows (between 5 and 35 cfs) to compare with existing data at higher and lower flows. Observers will record when various reaches of the river go dry during the summer.

In reaches where ground access is not available, existing aerial photos will be reviewed to identify surface area of different habitat types (1994 @ 140 cfs and 1996 @ 50 cfs). Additional aerial photos will be obtained at lower flows (less than 50 cfs). Habitat conditions in these inaccessible regions will be examined using data from the T. Payne/DWR study and the 1996 Jones & Stokes riparian study.

<u>Habitat measures</u>

Habitat units for study will be selected using the geomorphic habitat data (aerial photo analysis from Job 1) to subsample units from the snorkel survey sites. A fixed reference point will be established at each habitat unit with a staff gage so measurements at different times (= flows) would be at the same place. Some features that are fairly stable over time, barring flood flows (canopy cover, bank composition, and substrate, unit length) will only be measured once in a water year. Pebble counts should be used to estimate substrate composition. Other habitat features that vary with flow (depth, top width, velocity percent unit cover) will be measured during each survey at different flows. Ten fixed transects will be distributed uniformly along the unit's length, including transects at the upper and lower boundaries. During each flow condition, measurements will include (1) velocity in the thalweg for each transect, (2) five depth measurements across the transect, and (3) assessment of percent cover for the entire habitat unit.

<u>Algae flushing</u>

Dense algal growth during the late spring to fall can negatively impact water quality (e.g. low dissolved oxygen (DO) at night). Flows to flush algae from the upper mainstem reaches to Solvang will be tested during the summer. Several pools with low DO (vertical profile measured before dawn) will be selected between the Dam and Solvang. DO (pre-dawn vertical profile) and percent algal cover will be measured prior to the experimental release. The exact amount and duration of release(s) will be determined for each study, but will likely range from 10-30 cfs (as measured by releases at Bradbury), raised at increments of 5 cfs. At each study pool, flow and percent algae cover will be measured for each release level. Once flushing is complete, experimental releases will be ramped down (5 cfs/day) to baseflow. After a three day equalization period flow, DO, and percent algal cover will be measured again. The final ramp-down and post-release measurements may not occur if the study is immediately followed by the WR 89-18 release.

SCHEDULE: Flow-habitat conditions will be evaluated as soon as practicable after completion of PHABSIM modeling. Flow-specific habitat measures to be recorded prior to or during ascending limb of WR 89-18 releases (summer 1997 and possibly summer 1998) or opportunistically during other releases. Algae flushing studies will be conducted in summer 1997 and possibly repeated in summer or fall 1998.

JOB 7. Molecular genetic analysis of steelhead/rainbow trout

OBJECTIVE: Conduct molecular genetic analysis of tissue samples from rainbow trout/steelhead collected in Job 2.

PURPOSE: Examine the population structure and stock origins of rainbow trout/ steelhead in the lower Santa Ynez River and tributaries.

PROCEDURES: Tissue samples will be collected for genetic analysis from adult rainbow trout/steelhead collected in the upstream trapping program, from juvenile rainbow trout/steelhead collected during downstream migration trapping and lagoon trapping, and during other opportunities (e.g. fish rescue operations). An approximately 1 cm piece of tissue will be taken from the right pectoral fin and air dried. Half of the sample will be used for genetic analysis and half will be given to the DFG regional biologist to archive. Samples will be delivered periodically to Dr. Jennifer Nielsen at the Hopkins Marine Station. If subsampling is necessary, characteristics such as year and month when collected, location, size class, and physical appearance (e.g. clubbed fins suggestive of hatchery origin) will be considered to ensure a comprehensive analysis.

Genetic analysis will be conducted by Dr. Nielsen. The tests will examine the variability of mitochondrial DNA (mtDNA) and microsatellites. Mitochondrial DNA has been used in previous studies of steelhead/rainbow trout from the upper Santa Ynez River above Juncal Dam, Hilton Creek and Salsipuedes Creek. NMFS is also using mtDNA in their status review of steelhead to differentiate distinct population segments or "Evolutionarily Significant Units" (ESUs). Microsatellite analysis will also be conducted to improve resolution of the stock assessment. Genetic data from fish collected during the TAC studies will be compared with previous data from the Santa Ynez River and other rivers (Nielsen et al. 1994).

SCHEDULE: Tissue sampling will occur opportunistically during migrant trapping (approximately January-June) and other activities (e.g. trapping in the lagoon). Analysis of the preserved tissue samples will conducted in summer 1997.

JOB 8. Coordination and collaboration with other study activities

OBJECTIVE: Coordinate TAC studies with other investigations being conducted in the Santa Ynez River watershed, and to incorporate, as appropriate, pertinent data and results.

PURPOSE: Through coordination, eliminate redundancy in efforts, and through collaboration, attain results beyond the scope of the TAC study plan alone.

PROCEDURES: TAC members will gather information on other study activities being conducted in the Santa Ynez River watershed. Study objectives and methods will be compared with those of the TAC's study plan to identify potential duplication of effort or sources of supplemental information. For example, riparian vegetation monitoring along the lower river (mandated in the SWRCB's Water Right Order WR 94-5) may include a habitat mapping element that may overlap or complement that specified in this plan.

Further, the TAC and FWS biologists implementing field data collection will be available to collaborate in activities, with TAC approval, outside the scope of the long term study plan, but which may produce a result of mutual benefit to both TAC study objectives and those of the external agency. Examples are conducting whole or tissue collections of fish for genetics work, such as that being conducted by the Federal government in connection with the steelhead listing process; and DFG-directed management activities in the lower river, such as fish rescues.

SCHEDULE: These activities will be scheduled as they arise.

JOB 9. Annual reporting and evaluation

OBJECTIVE: Summarize and report study results, evaluate study plan implementation, and revise the study plan as needed.

PURPOSE: To keep information development up-to-date, and to provide the opportunity to make midterm evaluations and adjustments to the study plan, as necessary.

PROCEDURES: Each year, the TAC biologist will prepare a draft report that will summarize the results of the year's work. The draft report will undergo TAC review and comments will be incorporated to produce a final annual report. This review process will provide the TAC an opportunity to evaluate the efficacy of study elements in achieving their desired objectives, and to amend the study plan as needed in an attempt to improve or modify future studies.

SCHEDULE: The draft annual report will be due by 1 October of each study year, and review completed by 1 November. The final annual report and proposed changes to the study plan will be due by 1 December.

JOB 10. Management action analysis

OBJECTIVE: Analyze the various, potential management actions relative to meeting the goals and objectives defined in this proposal and develop a technically-based management recommendation in the context of the evaluation criteria discussed above for consideration by the TAC.

PURPOSE: To summarize through analysis the results of the proposed study in the form of a range of potential management actions for fish populations within the lower Santa Ynez River system.

PROCEDURES: Analytical tools developed to evaluate habitat quantity and quality versus flow, and non-flow habitat, and temperature modifications will be used to identify various alternative management actions and predicted influences (both negative and positive) on fish habitat needs and other uses of the lower Santa Ynez River system. Various scenarios will be contemplated for optimizing fish habitat, including steelhead/trout restoration in the lower river and its tributaries, implementation of non-flow habitat improvements, tributary flow and non-flow habitat based improvements, minimal changes intended only to accommodate existing fish populations in the lower river and the maintenance of a steelhead/trout population in tributaries and the system upstream of Bradbury Dam, and no-action.

Identification of a range of potential management actions and preliminary assessment of biological benefits, operational constraints, and feasibility will be presented in the Management Alternatives report, which will also assess data needs for final evaluation of actions and thus guide refinement of the long-term study plan. This report will form the basis for the final synthesis report to the Consensus Committee in 1999. The final synthesis report detailing the approach and information used to identify a recommended management action will be completed through iterative review by the biological subcommittee and the TAC.

SCHEDULE: The Management Alternatives report will be prepared in summer 1997. The final synthesis report will be completed before the end of 1999.

SUMMARY SCHEDULE FOR LONG-TERM STUDY PLAN

Job	Activity	Schedule	Investigator
Job 1: Habitat inventory	Habitat typing main stem	May-July 1997	DFG, TAC and FWS scientists
	Ground truthing main stem	June-July 1997	DFG, TAC and FWS scientists
	Habitat typing tributaries	June-July 1997	DFG, TAC and FWS scientists
Job 2: Habitat function	Redd survey	Every two weeks Feb 1996–May 1996, Dec 1996–May 1997, Dec 1997–May 1998	TAC and FWS biologists
	Juvenile rearing survey	Monthly, May-Aug 1996 Twice yearly: June & Oct 97-99	TAC and FWS biologists
	Main stem trapping	Daily Dec-May 1996-99	TAC and FWS biologists
	Tributary trapping	Daily Jan-June 1996-99	TAC and FWS biologists
Job 3: Habitat-flow relationships	Data collection for PHABSIM	Opportunistically with suitable flows	TAC and FWS biologists
	PHABSIM modeling	TBA following data collection	DFG, TAC and FWS biologists
Job 4: Temperature and DO work			
	Further data collection	Continuously thru summer 1999	TAC and FWS biologists, Hanson Environmental
	Temp modeling	TBA	TBA
Job 5: Trib-mainstem relationships	Adult trapping, redd monitoring, juvenile surveys, emigrant trapping	See Job 2	See Job 2
Job 6: Flow verification	Water releases, Job 2 activities	Opportunistically, following development of recommended flows	TAC
Job 7: Coordination and collaboration	Coordinating with other study activities in SYR	Ongoing, as information becomes available	TAC, TAC and FWS biologists
Job 8: Genetic analysis	Collect tissue samples for analysis	Opportunistically with migrant trapping	TAC and FWS biologists
	Conduct molecular genetic analysis	Summer 1997	Dr. J. Nielsen
Job 9: Annual reporting	Reporting and evaluating each year's work	Final report and study plan changes due by 1 Dec 96–98	TAC and FWS biologists, TAC Biology Subcomm.
Job 10 - Management action analysis	Preliminary identification and assessment of potential actions	Management Alternatives Report summer 1997	TAC
	Final data synthesis, reporting, and analysis of management actions	Before the end of 1999 (exact date yet to be established)	TAC

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