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ASSOCIATION OF MONTEREY BAY AREA GOVERNMENTS

STEELHEAD HABITAT MANAGEMENT PLAN
& INSTITUTIONAL/FINANCIAL ANALYSIS

PAJARO RIVER HABITAT
MANAGEMENT STUDY

Prepared by

HARVEY & STANLEY ASSOCIATES, INC.

John T. Stanley Principal in Charge
Jerry J. Smith Principal Investigator
Donald W. Alley Fisheries Biologist

and

HEA, Division of KLEINFELDER AND ASSOCIATES
Barry Hecht Hydrologist

Prepared for

ASSOCIATION OF MONTEREY BAY
AREA GOVERNMENTS

Nicolas Papadakis, Acting Executive Director
Julie Brandlin, Program Manager

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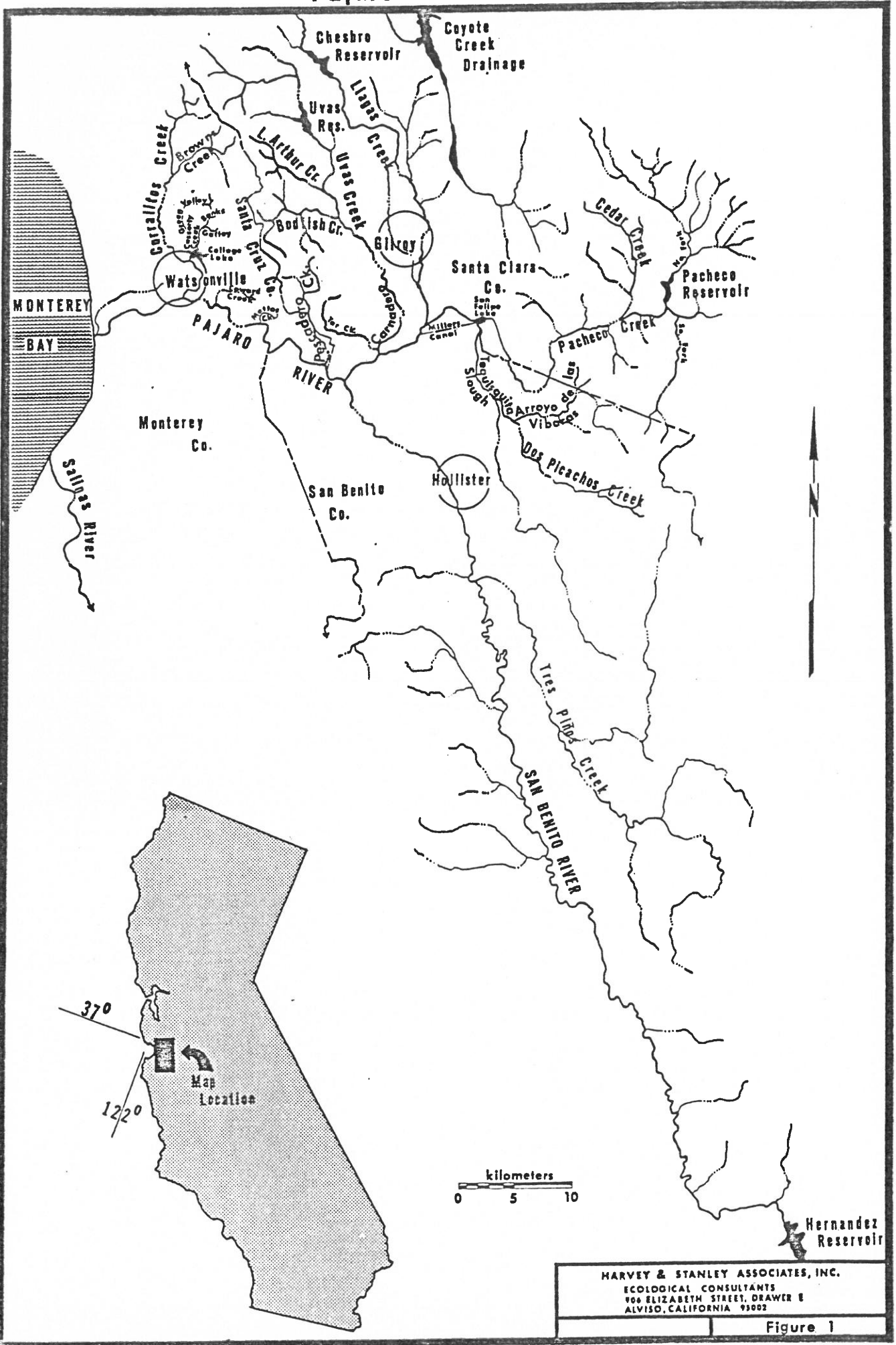
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Pajaro River & Tributaries



HARVEY & STANLEY ASSOCIATES, INC.
 ECOLOGICAL CONSULTANTS
 906 ELIZABETH STREET, DRAWER 8
 ALVISO, CALIFORNIA 95002

Figure 1

INTRODUCTION

Objectives

The Pajaro River and associated tributaries once were important waterways for anadromous fish including steelhead trout and silver salmon. Now, spawning and nursery habitat have been reduced, and only a much smaller population of steelhead continues to utilize the river system. Construction and agricultural activities, flood control measures, dams and diversions, and increasing erosion and sedimentation have all contributed to degradation of stream habitat in the Pajaro Basin. Though severely impacted by man's activities, the waterways and associated riparian corridors still also provide habitat for other game and non-game fish species, and a variety of mammals, reptiles, amphibians and birds, including migratory waterfowl.

In 1981 the Association of Monterey Bay Area Governments (AMBAG) obtained a U.S. Environmental Protection Agency Section 208 grant for water quality planning in the Pajaro Basin. Part of this grant has been used to develop a habitat management plan for the Pajaro River and associated tributaries and their riparian corridors. Emphasis of the management plan investigations has been upon steelhead since their distribution and abundance is the most sensitive indicator of stream habitat quality in the basin.

Three major objectives of this three-year study were: to rate stream reaches for steelhead habitat quality, to describe the environmental factors which presently limit steelhead numbers, and to identify future threats to steelhead habitat in the basin. A fourth objective was to identify, locate, and characterize riparian communities and their associated wildlife resources. The ultimate objective was to develop a set of management options with institutional and financial analyses that would maintain or improve habitat conditions for steelhead and other fish and wildlife resources in and along the Pajaro River and its tributaries.

Available Reports

Since the onset of field investigations in summer 1981, considerable knowledge of the natural resources of the Pajaro River basin has been produced and summarized in several reports (Figure 2). Most of this information is summarized in the Detailed Field Study Report (1983), which

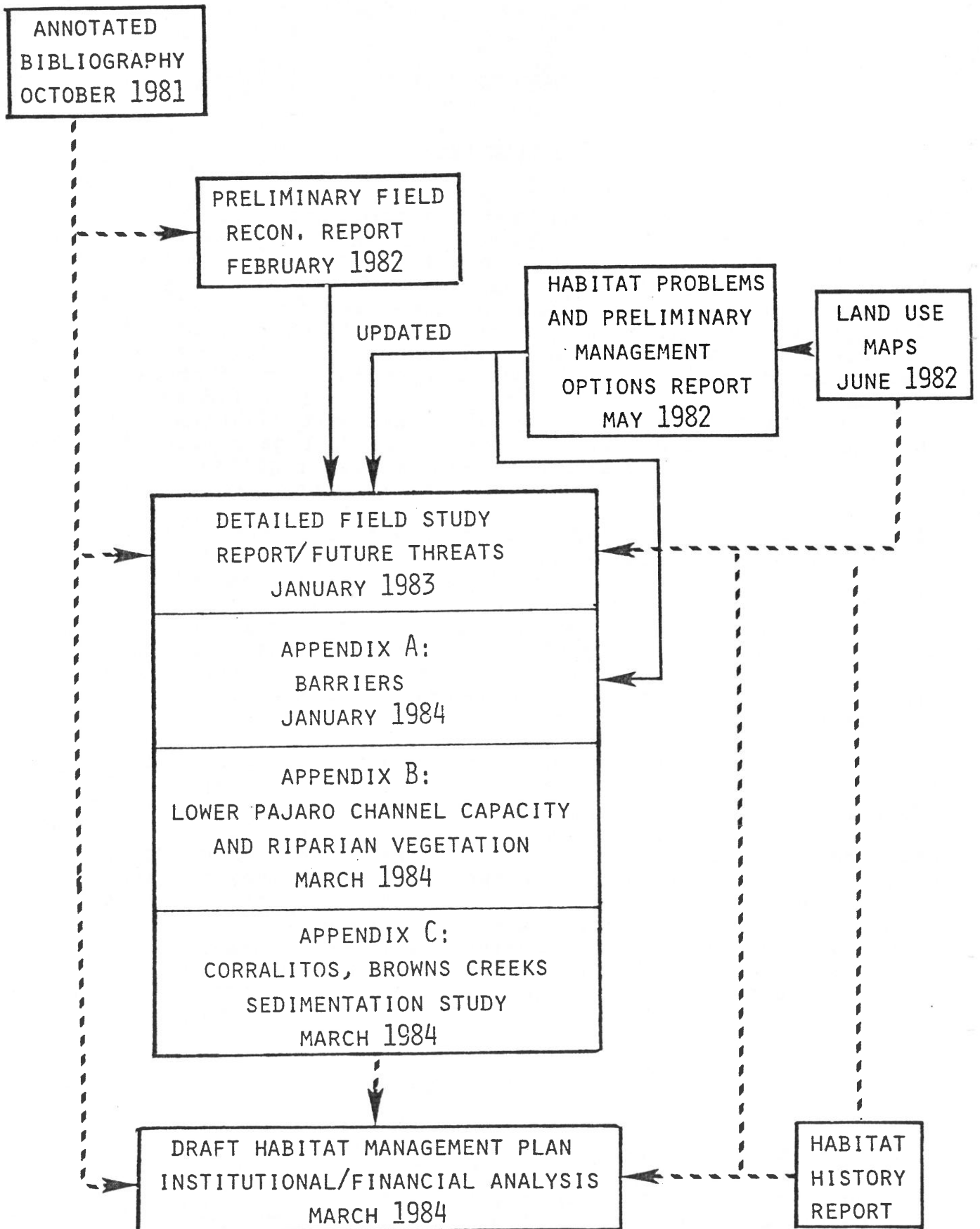


Figure 2. Pajaro River Habitat Management Reports.

contains an analysis of habitat quality for steelhead and the other biological resources.

In the report, steelhead habitat conditions were rated and limiting factors indicated in each stream reach. Habitat problems were classified by stream reach, described, and rated by severity. Future possible threats were described. Riparian plant communities, locally unique plant communities/habitats, rare/endangered plants and wildlife, and locally unique plants and wildlife were also described. Two sets of maps, one showing sensitive habitats and a second showing habitat problems and future threats, were included in the report. In Appendix A, specific barriers to steelhead migration were catalogued, complete with locations, descriptions, passability evaluations and photos. Appendix B was an analysis by the hydrologist of the effects of riparian woodlands on channel roughness and capacity in the lower Pajaro River. Appendix C was an analysis of the effects of sedimentation on Corralitos and Browns Creeks and of the recovery from 1982 flooding and landsliding.

Additional products available from the study are the Annotated Bibliography, the Preliminary Field Reconnaissance Report, the Detailed Land Use Maps, the Habitat Problems and Preliminary Management Options Report, and the History of Habitat Change Report (Figure 2).

Timing of Fieldwork

Plant and terrestrial wildlife inventories by the field biologist were based on field reconnaissance in fall 1981 and on his previous investigations in the region. Steelhead rearing and spawning habitat ratings were based on stream surveys and fish sampling by the principal investigator and the fisheries biologist in summer and fall 1981 and on previous studies by the principle investigator. Streamflows were low in 1981, and steelhead populations were generally less than those in average or wet years, so ratings were tempered by additional habitat observations in 1982 and observations prior to 1981. Additional field reconnaissance was also made in 1982 and 1983 to assess habitat changes produced by the January 1982 storm. Department of Fish and Game personnel surveyed 5 streams in 1982 and resurveyed 5 other streams for barriers in summer 1982. Streambed changes from episodic and chronic sedimentation were monitored in Corralitos and Browns Creeks by hydrologists from February 1982 to November 1983. In 1983 the channel capacity of the Pajaro River near Watsonville was measured by hydrologists to evaluate the effect of riparian management practices upon flood control objectives.

Steelhead Ecology and Habitat Problems

Steelhead appear anatomically identical to rainbow trout, but differ in their migratory instincts. The anadromous steelhead usually spends 1-3 years in the stream where it was hatched, and then "smolts" and migrates to the ocean to spend 1-3 years before returning to its native stream to spawn. Steelhead do not necessarily die after spawning like Pacific salmon; most return to the sea, and many are able to spawn again. Steelhead are native to Pacific coastal streams from southern California to Alaska.

The steelhead of the Pajaro River Basin usually return as adults to their native streams in December through March, when storms raise streamflow levels enough to allow fish passage into tributaries. Steelhead in coastal streams further north have a more extended migration period, partially as a result of greater streamflows, and adult migration may start as early as October.

In the Pajaro system juvenile fish migrate downstream in March through May after spending 1 year in Llagas, Pacheco, or Uvas creeks or 2 years in smaller tributaries.

Three basic parameters affect steelhead success in the Pajaro River system: migration passage, spawning habitat, and rearing habitat. Two kinds of migration problems occur for Pajaro River steelhead. The first is the problem of adult access upstream to spawning areas. Bridge abutments, diversion dams, log jams, and boulder falls present barriers at certain flows or may act as absolute barriers. In addition, many portions of the river system are dry during much of the year. The second major migration problem occurs during downstream migration of smolts in spring. At this time flows are rapidly receding and water temperatures warming; some channels may already be impassible.

Although good steelhead spawning substrate is rare in much of the Pajaro River system, this apparently rarely restricts steelhead production; in most sections spawning appears sufficient to seed the rearing habitat available. It is rearing habitat that limits steelhead numbers for much of the Pajaro River system. The specific limiting factors for rearing include:

- 1) adequate flows for pool development and provision of feeding stations for fish;
- 2) hiding cover as undercut banks, surface turbulence, unembedded (not buried in sand) cobble and boulders, and submerged or overhanging vegetation or debris;

- 3) aquatic and terrestrial insect food; and
- 4) suitable summer water temperatures.

The three habitat problems with the greatest impact on steelhead in the Pajaro River Basin are:

- 1) streamflow reduction from water impoundment, water diversion, and groundwater pumping, which reduces steelhead maintenance and feeding habitat and increases water temperatures.
- 2) increased stream sedimentation which causes pool and cover degradation and reduces insect food; and
- 3) man-made and natural migration barriers.

Other significant problems are stream channelization and grading, streambed excavation or quarrying, fishing pressure, reductions in spawning gravel recruitment, invasion by introduced plant species, landslides, riparian vegetation cutting for flood control or development, wetland drainage associated with stream channel modification, wetland filling, and water quality problems.

Future Threats to Habitat

New habitat problems may arise as population increases, land uses are altered, and water demands are increased. These potential problems were discussed in depth in the Detailed Field Study Report and are briefly summarized here because they should be considered in developing management options. Future flood hazards may increase as storm runoff from impervious surfaces associated with development increase. More intensive flood control measures may cause increased riparian cutting, channel grading or levee modifications. Increased water demands may result in dams or diversions that would make fish passage more difficult or inundate valuable habitats. Future imports of water may result in new fish species introductions which could adversely affect native fish species associations. Homesite and agricultural development, without adequate planning and erosion control, will increase landsliding and erosion in the upper watersheds. Additional bridge and road crossings, if improperly constructed, will increase fish passage problems. Additional small-scale water diversions will further reduce already-low summer streamflows and steelhead rearing habitat. Fishing pressure and poaching may increase. Future logging may increase stream sedimentation from erosion and produce more migrational barriers from slash and stumps. As homesite development invades more riparian corridors and as riparian cutting increases, larger mammals will be mostly eliminated, and important steelhead rearing

microhabitat supplied by overhanging vegetation will be reduced. Further streambed quarrying will cause more channel migration, bank erosion, and stream downcutting. If dams are to be used for hydroelectricity generation, release patterns that would provide peaking power could severely reduce steelhead rearing, spawning habitat, and cause migration problems.

Scope of this Report

This report: 1) outlines agencies which have habitat management jurisdiction in the Pajaro River Basin and describes the extent of their responsibilities; 2) proposes technical management options to maintain and improve habitat and suggests implementing agencies; and 3) rates the proposed options for their potential benefit, effort involved in implementation, cost of implementation, and suggests possible funding sources.

HABITAT MANAGEMENT AGENCIES

A large number of federal, state, local, and private agencies have some jurisdiction over stream and riparian habitats in the Pajaro River System. The extent and types of habitat responsibilities are described below and summarized in Table 1.

Federal Agencies

Environmental Protection Agency (EPA). EPA has authority over federal air quality, water quality, pesticide use, and toxic substances regulations. Under the Federal Water Pollution Control Act, EPA provides (sections 208 and 205j) funding for management planning programs to control nonpoint sources of water pollution and provides (Sections 303 and 402) for development of basin plans to establish water quality standards and regulate waste discharges.

Address: Environmental Protection Agency
215 Fremont Street
San Francisco, CA 94105
(415) 947-8088

Department of Agriculture:

Soil Conservation Service (SCS). The SCS provides private landowners with technical assistance in erosion and sediment control, working through local resource conservation districts. The SCS can also be involved with flood control and channelization activities (as in the present Llagas Creek channelization project).

Addresses: Loma Prieta Resource Conservation District
10th and Chestnut Streets
Gilroy, CA 95020
(408) 847-4161

(Attn: Steve Singer)
Santa Cruz County Resource Conservation
District
323 Spreckels Drive, Suite A
Aptos, CA 95003
(408) 688-1562

Department of the Army:

Army Corps of Engineers (ACE). Based upon Section 404 of the Federal Water Pollution Control Act, the Corps has

permit jurisdiction over excavation of materials from or placement of dredge or fill material or structures in "navigable waters" (streams of mean flow greater than 5 cfs). The Corps also is involved in the Pajaro River system through its participation in flood control projects (such as the channelization projects on Uvas/Carnadero Creek and the lower Pajaro River).

Addresses: Section 404 Permits:
(Attn: Kathy Sponseller, Regulatory
Functions Branch)
San Francisco District
211 Main Street
San Francisco, CA 94105
(415) 974-0418

Environmental Planning:
(Attn: George C. Weddell,
Chief of Engineering Division)
650 Capitol Mall
Sacramento, CA 95814
(916) 440-3263

Department of Commerce:

National Marine Fisheries Service (NMFS). Through their mission to protect and promote the utilization of marine fisheries, the agency's scientists review and comment on public and private projects that may adversely affect anadromous marine and estuarine fish.

Address: (Attn: Paget Leh)
National Marine Fisheries Service
3150 Paradise Dr.
Tiburon, CA 94920
(415) 556-0565

Department of Energy:

Federal Energy Regulatory Commission (FERC). The commission may grant permits and licenses for operation of small hydroelectric projects (such as new diversions or dams or installation of turbines at existing dams). The Department of Fish and Game may condition or oppose the state water rights application (to the State Water Resources Control Board) or the federal permit or license.

Address: (Attn: William Zeitz,
Chief, Public Inquires Branch)
Federal Energy Regulatory Commission
825 N. Capitol, NE
Washington, D.C. 20426

(202) 357-8055

Department of Interior:

Fish and Wildlife Service (FWS). Under the Fish and Wildlife Coordination Act, federal agencies are required to consult the FWS concerning the impacts of existing or future federal projects. In the Pajaro River system, their potential role would be to comment on Bureau of Reclamation water projects, on Soil Conservation Service or Army Corps of Engineers flood control or erosion protection projects, and on Army Corps of Engineers Section 404 permit applications.

Address: Fish and Wildlife Service
Sacramento Area Office
2800 Cottage Way
Sacramento, CA 95825

Bureau of Reclamation (BR). This federal agency is responsible for the San Felipe Water Project, which will bring central valley water into San Benito and Santa Clara counties. The Project is also a potential source of water for Santa Cruz and Monterey counties.

Address: Bureau of Reclamation
7891 Westwood Drive
Gilroy, CA 95020
(408) 847-1225

Bureau of Land Management (BLM). The Bureau administers public domain lands upstream of Hernandez Reservoir (Clear Creek Unit). Although outside the study area, management on these public lands may potentially affect downstream habitats or water quality, such as by affecting streamflow patterns and amounts, or stream turbidities, temperatures or asbestos content.

Address: Bureau of Land Management
Hollister Resource Area
P.O. Box 365
Parkhill
Hollister, CA 95023
(408) 637-8183

State Agencies

State Attorney General's Office (CAG). The Attorney General's office handles lawsuits on behalf of other state agencies, such as in cases of pollution, habitat alteration

without permits, or questions of federal versus state jurisdiction.

Address: (Attn: David Hamilton)
Environment Section
Office of the Attorney General
6000 State Building
San Francisco, CA 94102
(415) 557-2013

California Department of Fish and Game (DFG). The Department of Fish and Game is charged with protecting, managing, and enhancing fish and wildlife resources; policies are established by an appointed Fish and Game Commission. The department sets and enforces fishing and hunting regulations, inventories fish and wildlife resources (such as conducting stream surveys), reviews environmental impact reports, recommends minimum streamflow and fish passage requirements to maintain fish and wildlife resources in water permits (Fish and Game Code Sections 5900-6100), protects rare and endangered species (Fish and Game Code Sections 2050-2055), and regulates streambed alterations (Fish and Game Code Sections 1600-1606) such as logjam removal, channel grading, quarrying, etc. Under Fish and Game Code, sections 5650-5652, the department enforces a state prohibition against adding or allowing to pass into the waters of the state any substance or material deleterious to fish, plant life, or bird life. The department also provides money under the Salmon and Steelhead Cooperative Restoration Grant Program ("Bosco-Keene") for habitat rehabilitation and fish propagation.

Address: (Attn: Mike Johnson, Ken Boettcher)
California Department of Fish and Game
2201 Garden Road
Monterey, CA 93940
(408) 649-2870

State Water Resources Control Board (SWRCB). The SWRCB has responsibility for the state's water quality and water rights programs. Under the Porter-Cologne Water Quality Control Act the board adopts water quality policies and programs which are implemented by the Central Coast Regional Water Quality Control Board (see below). The SWRCB may grant water rights appropriations (dams and diversions for other than riparian water rights) after considering benefits derived from appropriative use and flows required to protect instream beneficial uses (including recreation and fish and wildlife resources). The Board's staff and the Department of Fish and Game make recommendations for protecting instream fish and wildlife beneficial uses, and these

requirements are normally a condition of the water permit unless the Board determines that they are not in the public interest.

Address: (Attn: Ray Dunham, Instream Use Protection)
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95801
(916) 445-7765

Central Coast Regional Water Quality Control Board (RWQCB).
This board prepares basin water quality plans to protect beneficial uses of streams and groundwater, including fish and wildlife, recreation, and agricultural, industrial and domestic water supply. The board regulates (and may prohibit) waste discharges to surface waters.

Address: (Attn: Paul Jagger)
Regional Water Quality Control Board
1102A Laurel Lane
San Luis Obispo, CA 93401
(805) 549-3147

Department of Forestry (CDF). The department's duties, under the Z'berg-Negedley Forest Practices Act of 1973, include regulation of logging operations on non-federal lands and technical assistance to landowners in forest and watershed management. In 1982, sole authority to regulate timber harvest plans was granted to the Department (this eliminated county ordinances which regulated logging activity). In consultation with the Department of Fish and Game, fisheries values must be considered in evaluating timber harvest plans. Funds from the California Forest Improvement Program, financed from the revenue of timber sales on state-owned forests, are available for fish and wildlife habitat restoration.

Address: (Attn: David Soho)
Department of Forestry
Central Coast Region Headquarters
2221 Garden Road
Monterey, CA 93940
(408) 649-2801

Department of Water Resources (DWR). The department is the water supply agency for the state. It develops the California Water Plan and oversees the State Water Project. Its actions can potentially affect water projects such as the San Felipe Project.

Address: (Attn: Victor McIntyre)
3374 E. Shields Ave.

P.O. Box 570
Fresno, CA 93755
(209) 445-5372

Department of Parks and Recreation (DPR). The recent additions to Coe State Park include the watershed of North Fork Pacheco Creek. Although the park is outside the boundary of the present study zone, park activities such as controlled burning, regulation or elimination of grazing, and fish stocking or management may affect downstream habitats, through alteration of streamflow, stream turbidity or temperature, or fish species composition. The mouth and lagoon of the Pajaro River are bordered on the south by Zmudowski State Beach.

Address: (Attn: James Trumbly)
Department of Parks and Recreation
P.O. Box 2390
Sacramento, CA 95811
(916) 322-8560

Department of Transportation (Caltrans). Caltrans designs, constructs, and maintains state highways. Highway design, construction, and maintenance can affect streams through erosion and sedimentation and cutting of riparian vegetation for new roads or for flood protection of bridges.

Address: (Attn: Burch C. Bachtold)
District Director, CALTRANS
P.O. Box 7310
San Francisco, CA 94120

California Coastal Commission (CCCm). Under the California Coastal Act, this commission established policies governing land use in the coastal zone. Policies are now (Santa Cruz County) or will be (Monterey County) implemented locally following the adoption of local Coastal Plans. The commission, however, retains permit jurisdiction over public trust lands; these include tidal portions of Watsonville Slough and the Pajaro River channel upstream to Highway 1.

Address: (Attn: Bill Allayaud)
Coastal Commission,
Central Coast District
701 Ocean Street, Room 310
Santa Cruz, CA 95060
(408) 426-7390

California Conservation Corps (CCC). The Corps provides public service assistance in the areas of resource management and conservation, including log jam removal.

Address: Central Region Deputy,
Division of Field Operations
California Conservation Corps
1530 Capitol Avenue
Sacramento, CA 95814
(916) 322-6790

California Youth Authority (CYA). The CYA provides assistance in logjam clearance for habitat restoration. In Santa Cruz County much of the stream clearance has been conducted by the CYA, with and without direct county staff supervision.

Address: California Youth Authority
Ben Lomond Youth Conservation Camp
13575 Empire Grade Road
Santa Cruz, CA 95060
(408) 423-1652

University of California, Cooperative Extension (UC). The Sea Grant Advisory Program provides educational and technical assistance to fishermen, fish propagators, and others involved in utilizing marine resources. Sea Grant also funds fisheries research related to salmon and steelhead.

Address: (Attn: Ed Melvin)
University of California, Agricultural
Extension
1432 Freedom Blvd
Watsonville, CA 95076
(408) 724-4734

Local Agencies

Association of Monterey Bay Area Governments (AMBAG). AMBAG is an intergovernmental agency which conducts regional planning for the Monterey Bay Area. The agency is presently in charge of EPA grants to develop plans for dealing with Pajaro Basin groundwater management, agricultural erosion, integrated pest management, and steelhead preservation and enhancement.

Address: (Attn: Julie Brandlin)
Association of Monterey Bay Area Governments
P.O. Box 190
Monterey, CA 93940
(408) 624-2117

Counties of Santa Cruz (SCr), Santa Clara (SCl), San Benito (SB) & Monterey (Mo):

Boards of Supervisors. The Boards of Supervisors are the governing bodies of the counties. They set policies for county departments, commissions and special districts, and hear appeals from decisions of the Planning Commission.

Addresses: Santa Clara County Board of Supervisors
70 West Hedding Street
San Jose, CA 95110
(408) 299-2323

San Benito County Board of Supervisors
Courthouse
Hollister, CA 95023
(408) 637-4641

Monterey County Board of Supervisors
P.O. Box 1819
Salinas, CA 93901
(408) 424-8611

Santa Cruz County Board of Supervisors
701 Ocean Street
Santa Cruz, CA 95060
(408) 425-2201

Planning Commissions and Planning Departments. The Planning Commissions and Departments regulate landuse in the counties, according to policies established by the Boards of Supervisors. The Commissions conduct hearings on landuse questions such as zoning designation, building permits, quarrying permits. The Planning Departments serve as staff to the Planning Commission.

In Santa Cruz County the Commission and Department administer the Erosion Control Ordinance and the Riparian Corridor Protection Ordinance. The department presently has an active stream logjam clearance program (funded partially by "Bosco-Keene" money).

In Santa Cruz County former Flood Control and Water Conservation District responsibilities for water management are now within the purview of the Planning Department.

Addresses: (Attn: Terry Butler)
Santa Cruz County Planning Department
701 Ocean Street, Room 420
Santa Cruz, CA 95060
(408) 425-2862

(Attn: Ransom Bratton)
Santa Clara County Planning Department

70 West Hedding Street
San Jose, CA 95110
(408) 299-2521

(Attn: Rob Mendiola)
San Benito County Planning Department
3220 Southside Road
Hollister, CA 95023
(408) 637-5313

Monterey County Planning Department
Courthouse
Salinas, CA 93901
(408) 422-9018

County Departments of Public Works (Co PW). The Departments of Public Works maintain storm drains (potential sediment source) and county roads and bridges (potential fish barriers). In Santa Cruz County, the Pajaro Storm Drain Maintenance District provides maintenance of the flood control channel on Salsipuedes Creek and the Santa Cruz County side of the flood control channel on the lower Pajaro River.

Address: Santa Cruz County Department of Public Works
701 Ocean Street
Santa Cruz, CA 95060
(408) 425-2133

County Fish and Game Advisory Commissions (Co F&G). Advise the Supervisors on the use of the County Fish and Game Preservation Funds (one-half of the county Fish and Game fines money) and on policy matters related to Fish and Wildlife. The County Fish and Game Preservation Fund must be used for propagation and conservation of fish and wildlife.

Addresses: (Attn: Vicky Lindeman, sec.)
Santa Clara County Fish and Game Commission
70 West Hedding Street
San Jose, CA 95110
(408) 299-4321

(Attn: Richard Beller, Chairperson)
Santa Cruz County Fish and Game Advisory
Commission
701 Ocean Street
Santa Cruz, CA 95060

(Attn: Richard Gularte, Chairperson)
San Benito County Fish and Game Advisory
Commission

Courthouse, Room 206
Hollister, CA 95023

(Attn: Burton Anderson, Chairperson)
Monterey County Fish and Game Advisory
Commission
P.O. Box 1819
Salinas, CA 93901

Santa Clara County Parks and Recreation Department (SCl Co P&R). Mt. Madonna Park encompasses portions of Banks Canyon, Bodfish, and Blackhawk Canyon creeks, which are significant steelhead streams. The park also operates Sprig Lake, a small seasonal reservoir on Blackhawk Canyon Creek; the lake presently serves as a steelhead nursery area and as a location for a catchable trout fishery for children under 13 years old.

Address: (Attn: Henry Coletto)
Santa Clara County Parks and Recreation Dept.
995 Hellyer Avenue
San Jose, CA 95111
(408) 225-0226

Monterey County Flood Control and Water Conservation District (MCFC). MCFC is responsible for maintaining flood control capacity on the Monterey County side of the lower portion of the Pajaro River. Monterey County has also applied for water rights for the construction of a dam on Pescadero Creek.

Address: (Attn: Joseph Madruga)
Monterey County Flood Control and
Water Conservation District
P.O. Box 930
Salinas, CA 93902
(408) 424-0866

Gavilan Water Conservation District (GWD). Gavilan Water District operates Uvas and Chesbro Reservoirs and groundwater percolation facilities on Uvas and Llagas creeks.

Address: (Attn: Jack Sturla, Mgr.)
Gavilan Water Conservation District
401 E. 10th Street, #7
Gilroy, CA 95020
(408) 847-7881

Pacheco Water District (PWD). Pacheco Water District operates North Fork Pacheco Reservoir and percolates water in Pacheco Creek.

Address: (Attn: Pat Clay, Secretary)
Pacheco Water District
649C San Benito Street
Hollister, CA 95023
(408) 637-5317

Pacheco Storm Water District (PSWD). The Pacheco Storm Water District maintains flood control capacity in the San Benito County portion of Pacheco Creek. They are planning to riprap portions of the lower banks along the creek to reduce bank erosion.

Address: (Attn: Joe Conconi, Chairman)
Pacheco Storm Water District
8247 Lovers Lane
Hollister, CA 95023
(408) 637-2167

San Benito County Water Conservation and Flood Control District (SBWD). This agency operates Hernandez Reservoir and percolates water in the San Benito River. The SBWD also has jurisdiction over San Benito County's share of San Felipe water, portions of which will be percolated in Pacheco Creek and in Arroyo dos Picachos.

Address: (Attn: George Thomas)
San Benito County Water Conservation and
Flood Control District
30 Mansfield Road
Hollister, CA
(408) 637-8218

Santa Clara Valley Water District (SCVWD). Santa Clara Valley Water District has flood control jurisdiction in Santa Clara County, including in areas served by Gavilan and Pacheco Water districts. The district provides channel maintenance on Llagas and Uvas creeks and on the Pajaro River.

Address: (Attn: Bernard Goldner)
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118
(408) 265-2600

City of Watsonville (Wat). The city of Watsonville regulates landuse along portions of the lower reach of the Pajaro River and along Salisipuedes Creek.

Address: Watsonville Planning Department
250 Main Street

Watsonville, CA 95077
(408) 728-6021

Watsonville Water Department (WWD). The Watsonville Water Department maintains water diversions (with dams and fish ladders) on Corralitos and Browns creeks for municipal water supply.

Address: (Attn: Embert Knauss)
Watsonville Water Department
P.O. Box 149
250 Main Street
Watsonville, CA 95077
(408) 728-6071

City of Morgan Hill (MH). Morgan Hill regulates landuse (subdivisions, riparian vegetation removal, etc.) along portions of Llagas Creek.

Address: Morgan Hill Planning Department
17555 Peak Avenue
Morgan Hill, CA 95037
(408) 779-7248

City of Gilroy (Gil). Gilroy regulates landuse (subdivisions, riparian vegetation removal, etc.) along portions of Uvas and Llagas creeks. Gilroy (with Morgan Hill) operates a sewage treatment plant with percolation/evaporation wastewater ponds adjacent to the lower portion of Llagas Creek.

Address: (Attn: Mike Dorn, Director)
Gilroy Planning Department
7351 Rosana Street
Gilroy, CA 95020
(408) 842-2137

Gilroy Department of Parks and Recreation (GP&R). Gilroy operates Christmas Hill city park on Uvas Creek and is developing the Uvas Creek Preserve city park on Uvas Creek. Christmas Hill city park presently operates a seasonal (earthen) dam on the creek, and an additional seasonal in-channel recreation/percolation pond is planned for the Uvas Creek Preserve.

Address: (Attn: Bill Ayer, Director)
Gilroy Department of Parks and Recreation
7351 Rosana Street
Gilroy, CA 95020
(408) 842-0221

Private Organizations

Monterey/Santa Cruz Anadromous Fisheries Advisory Committee (AFAC). The citizens advisory committee was established in 1983 to advise the Department of Fish and Game on local preferences in fisheries management questions. It consists primarily of representatives of sportmen's groups, commercial fishermen's associations, and county Fish and Game Commissions. Present interests are in fish rearing and stocking, habitat enhancement, and sport regulations and their enforcement. Since most local sportmen's groups send representatives to this committee, it is a logical focal point for organizing volunteer efforts in habitat enhancement, stream surveys, public education, etc.

Address: (Attn: Rick Peretto, Chairman)
Monterey/Santa Cruz Anadromous Fisheries
Advisory Committee
1376 Pacific Avenue
Santa Cruz, CA 95060
(408) 475-7161

Monterey Bay Salmon and Trout Project (MBS&T). The Monterey Bay Salmon and Trout Project presently operates a hatchery and pond rearing program for steelhead and silver salmon for planting in streams tributary to Monterey Bay. Present funding sources include County Fish and Game Advisory Commission ("fines") money and a Salmon and Steelhead Cooperative Restoration Grant ("Bosco-Keene").

Address: (Attn: Dave Streig)
Monterey Bay Salmon and Trout Project
P.O. Box 272
Salinas, CA 93902
(408) 458-3095

Table 1. Agencies involved in fish and wildlife habitat in the Pajaro River System.

Responsibilities	Federal Agencies										State Agencies				Local Agencies										
	EPA	SCS	ACE	NF'S	FERC	FWS	BR	BLM	CAG	DFG	SMRCB	RNOCB	COF	DMR	DPR	TRANS	CCCm	CCC	CYA	UC	AMBAG	County	Water	D. City	
<u>Habitat Management</u>																									
Streamflow				X	X	X	X	X	X	X	X	X	X									X	X	X	X
Water Quality	X			X		X	X	X	X	X	X	X	X												X
Landuse								X					X	X	X	X	X					X			X
Logging								X	X	X	X	X	X												
Erosion Control	X							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Riparian Vegetation	X							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Channel Modification	X	X	X			X		X	X	X	X	X	X	X	X	X	X							X	X
<u>Habitat Improvement</u>						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<u>Fish and Wildlife Protection</u>				X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<u>Research</u>				X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<u>Education</u>				X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<u>Technical Assistance</u>				X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<u>Financial Assistance</u>				X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Bedrock and boulder falls are common, especially in steeper headwaters. Removal of boulder falls in most of the steeper habitats is not worthwhile because the improvement would be temporary and limited habitat and numerous other barriers are usually present upstream. On Cedar Creek 2 boulder falls are present in low-gradient habitat; removal would probably assure future access, but habitat is limited upstream. On upper Bodfish Creek a series of boulder falls blocks access to about 2 miles of potential steelhead spawning and rearing habitat. The falls occur in a short, steep section of stream, where landslide debris periodically covers Highway 152 and enters the stream.

Flashboard dams, especially those with two-step concrete aprons, are potential barriers on upper Bodfish and Little Arthur creeks if barrier removal downstream is undertaken. Otherwise, the only flashboard dam that presents a problem is on lower Bodfish Creek. A concrete and culvert ford (Bm1) on Llagas Creek is a significant potential barrier.

Removal or easing passage at many of the Pajaro River system barriers will not only improve fish access, but will greatly reduce poaching, which is concentrated at several of the worst barriers.

Other native fish species have been affected by many of the barriers present in the Pajaro River system. During the drought of 1976-77 many stream sections dried up, and species were locally lost. Barriers have prevented the natural recolonization of upper Little Arthur Creek by threespine stickleback, upper Uvas Creek by Sacramento squawfish, and Llagas Creek by California roach. It is likely that man-made barriers have been a factor in the absence of native fishes at other apparently suitable sites as well.

Technical Options

GENERAL OPTIONS

1. Establish a program to train members of sportmen's groups (members of groups in the Santa Cruz/Monterey Anadromous Advisory Committee), and others interested in logjam removal work. Volunteers could provide the work force for much of the logjam work needed in the region. The county, Department of Fish and Game, or "certified" volunteers could provide supervision.

Agencies: Santa Cruz County Planning Department

PROPOSED MANAGEMENT OPTIONS.

The following management options are proposed to maintain, restore, and enhance fish and wildlife populations in the Pajaro River and its tributaries and in their riparian corridors. Details of present habitat conditions, fish and wildlife status, and potential future problems are in the Detailed Field Study Report; summaries of the conditions that the options are designed to address are given here as "background." Agencies with responsibilities for implementing each proposed technical option are listed with each option. A summary of responsibilities by agency is in Table 2.

Barriers

Background

Steelhead access to much of the potential spawning and rearing habitat of the Pajaro River system is blocked or restricted by barriers. Uvas Reservoir blocks access to over 7 miles of potential spawning and rearing habitat. The small dam on Little Arthur Creek blocks access to over 3 miles of potential spawning and rearing habitat. Pacheco and Chesbro dams block access to relatively limited steelhead habitat present above the reservoirs on North Fork Pacheco Creek and Llagas Creek, respectively. Diversion dams on Browns and Corralitos creeks are laddered, but fish passage is still a problem under certain flow conditions.

Culverts restrict steelhead passage on Corralitos Creek, Shinglemill Gulch, and Casserly Creek. On Corralitos Creek one culvert is a problem due to the high jump required, high culvert velocities at high flows, and shallow culvert depth at low flows. The other two culverts present passage problems due to concrete aprons, which prevent pool development and present velocity and depth problems. A concrete sill on the Southern Pacific trestle on Uvas/Carnadero Creek blocks access at low flows, as concrete blocks below the sill prevent efficient jumping.

Logjams, acting as complete or partial barriers, are relatively common on most of the smaller streams. Some of the partial logjam barriers represent no significant problem; in fact, much of the log debris in the streams improves steelhead habitat by providing escape cover and causing pool formation and deepening. Other logjams are major or complete barriers.

California Youth Authority
Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

2. Surveys should be done at least every three years (starting in 1986) on the major tributaries (Browns Creek, Ramsey Gulch, Gamecock Canyon, Casserly Creek, Corralitos Creek, Shinglemill Gulch, Bodfish Creek, and Pescadero Creek) to locate new barriers to steelhead access.

Agencies: Santa Cruz County Planning Department
Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

SANTA CRUZ COUNTY

3. Modify box culvert (BM3) on Corralitos Creek to reduce jump required and to reduce velocity and depth problem in culvert.

Agencies: Santa Cruz County Planning Department
Santa Cruz County Public Works Department
California Department of Fish and Game

4. Modify culverts and aprons on Shinglemill Gulch (BM1) and Casserly Creek (BM1) to ease passage.

Agencies: Santa Cruz County Planning Department
Santa Cruz County Public Works Department
California Department of Fish and Game

5. Modify boulder falls (B2) and abandoned dam (BM4) on Shinglemill Gulch to ease fish passage.

Agencies: Santa Cruz County Planning Department
Department of Fish and Game

6. Remove logjams (B1 - B7) on lower 0.9 miles of Ramsey Gulch and logjams (B1 - B6) on lower 0.9 miles of Gamecock Canyon (tributaries to Browns Creek).

Agencies: Santa Cruz County Planning Department
California Youth Authority
Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

7. Remove logjam (B3) on Casserly Creek.

Agencies: Santa Cruz County Planning Department
Department of Fish and Game

Agencies: Department of Fish and Game
Santa Clara County Fish and Game Advisory Com.
Monterey/Santa Cruz Anadromous Advisory Com.

15. (If option 14 is done) Place flashboard dams on Little Arthur Creek (BM3, BM4, BM5, BM6, BM7, BM8, BM10A and BM10) under Department of Fish and Game regulation to prevent blocking of fish passage. Modification of some structures (BM5, BM10, BM10A) should be required.

Agency: Department of Fish and Game

16. (If option 14 is done) Remove or modify barriers BM9 (dribbler dam) and B11 (tree root/boulder) on Little Arthur Creek.

Agencies: Department of Fish and Game
California Youth Authority
Monterey/Santa Cruz Anadromous Advisory Com.

17. Require modification of barrier BM2 (2 step concrete base for flashboard dam) on Bodfish Creek.

Agency: Department of Fish and Game

18. Remove logjams (B1 and B3) on lower Bodfish Creek.

Agencies: Department of Fish and Game
California Youth Authority
Monterey/Santa Cruz Anadromous Advisory Com.

19. Remove logjams downstream of B3 on Blackhawk Canyon Creek and logjam above B6 on Bodfish Creek (Mt. Madonna County Park).

Agencies: Santa Clara County Department of Parks and Recreation
Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

20. Modify steep-section barriers of Bodfish Creek (B6 through B11) to allow fish passage.

Agencies: Santa Clara County Department of Parks and Recreation
Department of Fish and Game
Santa Clara County Fish and Game Advisory Com.
Monterey/Santa Cruz Anadromous Advisory Com.
California Department of Transportation

8. Modify bridge crossings and drop structures (BM1 and BM2) on Green Valley Creek.

Agencies: Santa Cruz County Planning Department
Santa Cruz County Department of Public Works
Department of Fish and Game

9. The Department of Fish and Game should require the Water Department to check fish ladders and weirs on Corralitos and Browns creek diversion dams after storms to ensure that they are not jammed or damaged. The Water Department should inspect pools of Browns Creek fish ladder annually and remove rocks when necessary to ensure adequate pool depth.

Agencies: Watsonville Water Department
Department of Fish and Game

SANTA CLARA COUNTY

10. Modify trestle slab and concrete blocks (BM1) on Uvas/Carnadero Creek to ease passage.

Agencies: Southern Pacific
Department of Fish and Game

11. Require modification of concrete and culvert ford (BM1) on Llagas Creek to ease fish passage.

Agency: Department of Fish and Game

12. Survey Uvas and Croy creeks (and other tributaries) upstream of Uvas Reservoir to determine locations of natural and man-made barriers, habitat conditons, and present and potential future problems.

Agencies: Department of Fish and Game
Santa Clara County Fish and Game Advisory Com.

13. Construct a fish trap below Uvas Reservoir to permit transport of adult steelhead upstream to the first bridge crossing above the dam (there is an impassable, two-step concrete barrier immediately upstream of the reservoir). Upstream fish transport can be conducted by Gavilan Water Conservation District personnel.

Agencies: Gavilan Water Conservation District
Santa Clara County Fish and Game Advisory Com.
Monterey/Santa Cruz Anadromous Advisory Com.
Department of Fish and Game

14. Construct a fishway to allow fish passage through the dam (BM1) on Little Arthur Creek.

21. (If option 20 is done) Remove logjams on upper Bodfish Creek.

Agencies: Department of Fish and Game
California Youth Authority
Monterey/Santa Cruz Anadromous Advisory Com.

22. (If option 20 is done) place flashboard dams on upper Bodfish Creek (BM15 and BM16) under Department of Fish and Game regulation to prevent blocking of fish passage. Require modification or removal of BM14.

Agency: Department of Fish and Game

23. If a flashboard dam is constructed on Uvas Creek in the City of Gilroy Uvas Park, ensure that it does not restrict fish passage.

Agencies: Gavilan Water Conservation District
Gilroy Parks and Recreation Department
Department of Fish and Game

24. Modify abandoned dam (BM1) on Pacheco Creek to ease passage.

Agencies: Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

25. Modify two step drop structure (BM1) at Miller Canal Bridge.

Agencies: Department of Fish and Game
San Benito County Department of Public Works
Monterey/Santa Cruz Anadromous Advisory Com.

26. Remove boulder falls (B1 and B2) on Cedar Creek.

Agencies: Department of Fish and Game
Santa Clara County Fish and Game Advisory Com.
Monterey/Santa Cruz Anadromous Advisory Com.

27. If changes in management on the new additions to Henry Coe State Park, such as controlled burning or changes in grazing use, result in improved streamflow and stream habitat, evaluate the feasibility of constructing a fish trap at Pacheco Dam to allow transport of adult steelhead to habitat above the dam.

Agencies: Department of Parks and Recreation
Department of Fish and Game

Diversions
(Small-Scale)

Background

There are many small-scale riparian diversions on Pajaro River tributaries, which mostly have very small effects upon stream habitat. On Little Arthur Creek, however, riparian water use is already sufficient to cause friction among the many landowners in drier years (like 1981); fish habitat is likewise severely threatened in drier years. Potential expansion of agriculture, especially vineyards and orchards, along smaller tributaries may result in significant future riparian diversions and fish habitat reductions.

The City of Watsonville maintains diversions on Corralitos and Browns creeks, and pipes the water downstream to Corralitos for treatment. Streamflow in the two creeks usually exceeds the City's water right, so some flows are bypassed in one or both of the streams in most years. Summer streamflows in Corralitos Creek are much higher than those in Browns Creek, and the Water Department often does not divert any water from Browns Creek in late summer.

Technical Options

- ① Support efforts to provide statutory right of the Department of Fish and Game to apply for reservation of instream flows for fish and wildlife maintenance.

Agencies: All

- ② If fish passage is provided on Little Arthur Creek (Barrier option 14), the Department of Fish and Game should either apply for water rights to maintain fish habitat on the creek (if they are granted statutory right to do so -- see option 1, above) or use the riparian rights of the most downstream riparian user (Dr. Pickel?) to insure that summer streamflows provide for adequate fish habitat on the creek.

Agencies: Department of Fish and Game
State Water Resources Control Board

3. If streamflows exceed Watsonville's water right on Browns and Corralitos creeks, bypass flows should preferentially be allowed on Browns Creek, since fish habitat downstream of the Browns Creek diversion is presently much better for steelhead than that downstream of the Corralitos Creek Diversion.

*do not delete
compatibility
of
processes
policies*

Agencies: Watsonville Water Department
Department of Fish and Game

4. If habitat downstream of the Corralitos Creek diversion dam substantially improves in the future (see options associated with sediment sources), an evaluation should be done of instream percolation and groundwater pumping and of diversion at the town of Corralitos as alternatives to the present diversions.

Agencies: Watsonville Water Department
Department of Fish and Game
State Water Resources Control Board

Diversions (Reservoirs)

Background

Reservoirs on North Fork Pacheco, Uvas and Llagas creeks, and on the San Benito River have greatly altered natural streamflow regimes. Winter flood peaks have been reduced (along with the streambed stirring and flushing they produced), but summer streamflows have been increased, since stored water is released for instream percolation. The timing and amounts of releases are presently determined by the water districts based upon: the needs of groundwater and riparian water users, instream percolation capacity, and flood control considerations. An agreement with the DFG specifies minimum spawning/migration releases (20 cfs, Dec 15 - Apr 30) and rearing releases (10 cfs, rest of year) from Uvas Reservoir. (These releases are based upon inflow of 11,000 acrefeet at the reservoir by April 16th; lesser amounts of runoff would result in proportionate reductions in releases.) There are presently no agreements for minimum releases from Chesbro and Pacheco Reservoirs. Extent and quality of steelhead rearing habitat downstream of Uvas, Chesbro, and Pacheco reservoirs is critically dependent upon streamflows sufficient to keep water temperatures down, provide surface turbulence as overhead cover, and provide riffle depths and velocities suitable for feeding fish. In many years present operational demands result in water cutoffs in spring or fall. Spring cutoffs can result from the need to fill capacity left empty in late winter as flood protection (Chesbro Reservoir on Llagas Creek), to store water until agricultural demand requires water releases (Hernandez Reservoir on the San Benito River and Pacheco Reservoir), or to allow inchannel maintenance or

construction. Fall cutoffs can occur when agricultural demand ceases (Pacheco and Hernandez reservoirs) or when the remaining storage is to be reserved for the following year.

Percolation operations on Uvas and Llagas creeks are partially integrated. A pipeline from Uvas Reservoir can pump water to the Llagas Creek groundwater subbasin to take advantage of the greater runoff in the Uvas Creek watershed and the greater percolation capacity (both length of streambed for percolation and depth of the groundwater basin) in the Llagas Creek groundwater subbasin. However, more steelhead rearing habitat is maintained and improved when the water is released down Uvas Creek. Water from Anderson Reservoir is also percolated in the Llagas Creek subbasin. San Felipe Project water will be percolated in the Llagas Creek subbasin.

The reservoirs also have effects on stream temperatures. In spring, surface spilling can result in stream temperatures 10 degrees or more higher than bottom releases or pre-impoundment conditions. Spring and summer releases of bottom water are usually cooler than "normal" while the reservoir is still quite full. Temperatures of the releases warm up as reservoir depth drops; by late summer of most years, even releases off the bottoms of the reservoirs are quite warm. Not only do the reservoirs delay stream warming in spring and summer downstream, but they delay fall cooling; releases from near-empty reservoirs stay relatively warm into November. Stream temperatures are important for steelhead, since they affect their food demands; higher temperatures increase food demands and result in higher streamflow requirements to provide the fastwater feeding areas where food demands can be met.

Pescadero Creek is the proposed site of a dam for Monterey and/or Santa Cruz County. The stream provides important steelhead spawning and rearing habitat, most of which would be inundated or blocked to steelhead access.

Future increases in electricity prices could make retrofitting of hydroelectric turbines economically feasible, especially at Uvas and Chesbro dams. If flows are altered to meet electricity demands, especially for peak power, steelhead rearing habitat could be greatly degraded. Any installation of hydro capability at existing dams requires a Federal Energy Regulatory Commission (FERC) license, which can be conditioned to provide flow releases for fish and wildlife.

Technical Options

UVAS RESERVOIR

1. Establish an advisory group consisting of members of the Department of Fish and Game, Gavilan Water District, and others to adjust releases from Uvas Reservoir to optimize steelhead production within the constraints of yearly runoff. The group should meet in December through April to determine the extent to which available water should be directed towards maintaining: A) suitable adult attraction and migration streamflows from the Pajaro River upstream to the dam during January through March; B) suitable spawning and incubation streamflows from the dam to Highway 152 during January through April; C) suitable smolt outmigration streamflows from the dam downstream to the Pajaro River from March through May; and/or D) summer rearing streamflows from Miller Avenue or Highway 152 upstream to the dam.

Approximate minimum streamflows needed to ensure spawning, incubation, and migration are:

January, February, and March:

one 3-day period of 30 CFS each month (for migration)
immediately followed by one 4-day period each month
of 20 CFS (for spawning)

January through May:

10 CFS (for egg incubation and smolt outmigration)

Agency: Gavilan Water Conservation District
Department of Fish and Game

2. When storage is insufficient to meet minimum release requirements, adjust releases from Uvas Reservoir so that they span the entire critical rearing season for steelhead (usually through November). Avoid severe streamflow reductions in spring which would result in high stream temperatures in the downstream portion of the steelhead rearing habitat on Uvas Creek (Highway 152 to Miller Avenue). Avoid cutoffs in fall while stream temperatures are still high enough (60-65 degrees) for the young steelhead to require abundant insect food, fast riffles to feed in, and surface turbulence as cover.

Approximate minimum streamflows needed (measured at Highway 152) to maintain steelhead rearing habitat downstream to Highway 152 are:

2.0 CFS when afternoon water temperature is less than
55 degrees
3.0 CFS when WT is 55 - 63 degrees
5.0 CFS when WT is 63 - 70 degrees
10.0 CFS when WT is 70 - 75 degrees

Minimum streamflows needed (measured at Highway 152) to maintain steelhead rearing habitat downstream to Miller Avenue vary with percolation rate but are approximately:

- 4.0 CFS when afternoon water temperature is less than 55 degrees
- 5.0 CFS when WT is 55 - 63 degrees
- 10.0 CFS when WT is 63 - 70 degrees
- 20.0 CFS when WT is 70 - 75 degrees

Higher flows than those indicated above would improve both steelhead abundance and their growth rate.

Agency: Gavilan Water Conservation District
Department of Fish and Game

3. To the extent possible (as constrained by percolation capacity), percolate storage of Uvas Reservoir water in Uvas Creek, rather than transferring it for percolation in Llagas Creek.

Agency: Gavilan Water Conservation District

4. When San Felipe Project water becomes available, alter Uvas to Llagas basin transfer operations in order to percolate more Uvas Reservoir water in Uvas Creek.

Agency: Gavilan Water Conservation District

5. If Uvas Reservoir water is to be transferred to Llagas Creek for percolation, adjust operations so that most of the transfer is done at the end of the percolation season, so that Uvas Reservoir depth is maintained as long as possible. This will keep bottom releases at Uvas Reservoir cooler for longer to improve juvenile steelhead survival and growth in Uvas Creek. (This action might also result in reduced flows in Llagas Creek from the dam to the pipeline near the end of the percolation season, and reduce rearing quality of Llagas Creek.) When San Felipe water becomes available for percolation in Llagas Creek or Llagas groundwater basin, it should be percolated in early summer, if possible, so that Uvas Reservoir water is reserved for late summer percolation.

Agency: Gavilan Water Conservation District

6. Develop an instream percolation pond on the lower portion of Uvas Creek (in the Gilroy Uvas Preserve) to improve percolation capacity in Uvas Creek. This will result in greater summer releases and expansion of steelhead rearing habitat downstream.

Agencies: Gavilan Water Conservation District
Gilroy Department of Parks and Recreation
Department of Fish and Game

7. For the percolation pond indicated above, use a flashboard dam rather than a system (such as a gravel dam) which which requires streamflow cutoffs for seasonal installation or dismantling. Streamflow cutoffs increase water temperatures and reduce rearing habitat and would drastically affect steelhead survival and growth rates in much of Uvas Creek.

Agencies: Gavilan Water Conservation District
Gilroy Department of Parks and Recreation
Department of Fish and Game

8. Release water from the bottom of Uvas Reservoir, rather than allowing surface spills of warmer water in spring. If a fish trap is used to provide for spawning and rearing upstream from the reservoir (Barrier option 12), use a combination of surface spilling (to provide for smolt out-migration) and bottom releases (to maintain downstream water temperatures at 55 degrees or less for egg incubation, hatching, and fry rearing).

Agency: Gavilan Water Conservation District

9. In unusual years (like 1983) when the groundwater basin is full in early summer and little or no percolation is possible, provide releases sufficient to maintain surface flow and to prevent excessive mortality of young steelhead due to high water temperatures (see option 2).

Agency: Gavilan Water Conservation District

CHESBRO RESERVOIR

10. To the extent possible, provide releases from Chesbro Reservoir to maintain: A) suitable adult migration streamflows from the Pajaro River upstream to the dam during January through March; B) suitable spawning and incubation streamflows from the dam to Santa Teresa Blvd. during January through April; and C) suitable smolt outmigration streamflows from the dam downstream to the Pajaro River from March through May.

Approximate minimum streamflows needed to ensure spawning, incubation, and migration are:

January, February, and March:
one 3-day period of 25 CFS each month (for migration)

immediately followed by one 4-day period each month
of 15 CFS (for spawning)
January through May:
7 CFS (for egg incubation and smolt outmigration)

Note: the migration releases should coincide with those
from Uvas Reservoir, to attract steelhead upstream
through the Pajaro River.

Agency: Gavilan Water Conservation District

11. To the extent possible, adjust releases from Chesbro Reservoir so that they span the entire critical rearing season for steelhead (usually through November). Avoid severe streamflow reductions in spring which would result in destruction of insect populations in the portion of the stream suitable for steelhead rearing (dam to Monterey Highway). Avoid cutoffs in fall while stream temperatures still are high enough (60-65 degrees) for the young steelhead to require abundant insect food, fast riffles to feed in, and surface turbulence as cover.

Approximate minimum streamflows needed (measured at Watsonville Road) to maintain steelhead rearing habitat downstream to Monterey Highway are:

2.0 CFS when afternoon water temperature is less than
55 degrees
4.0 CFS when WT is 55 - 63 degrees
8.0 CFS when WT is 63 - 70 degrees
15.0 CFS when WT is 70 - 75 degrees

Agency: Gavilan Water Conservation District

12. Release water from the bottom of Chesbro Reservoir, rather than allowing surface spills of warmer water in spring.

Agency: Gavilan Water Conservation District

PACHECO RESERVOIR

13. To the extent possible, maintain: A) suitable adult migration streamflows from San Felipe Lake upstream to the dam during January through March; B) suitable spawning and incubation streamflows from the dam to Casa de Fruta during January through April; and C) suitable smolt outmigration streamflows from the dam downstream to the Pajaro River from March through May. These flows can be as runoff from the South Fork Pacheco Creek or as releases from North Fork Pacheco Reservoir.

Approximate minimum streamflows needed (measured at Casa de Fruta) to ensure spawning, incubation, and migration are:

January, February, and March:

one 3-day period of 25 CFS each month (for migration)

Immediately followed by one 4-day period each month of 15 CFS (for spawning)

January through May:

7 CFS (for egg incubation and smolt outmigration)

Agency: Pacheco Water District

14. To the extent possible, adjust releases from Pacheco Reservoir so that they span the entire critical rearing season for steelhead (usually through November). Avoid severe streamflow reductions in spring which would result in high stream temperatures in the portion of the stream which serves as steelhead rearing habitat (downstream to Highway 156). Avoid cutoffs in fall while stream temperatures still are high enough (60-65 degrees) for the young steelhead to require abundant insect food, fast riffles to feed in, and surface turbulence as cover.

Approximate minumum streamflows needed (measured at Casa de Fruta) to maintain steelhead rearing habitat downstream to Highway 156 are:

- 1.5 CFS when afternoon water temperature is less than 55 degrees
- 3.0 CFS when WT is 55 - 63 degrees
- 6.0 CFS when WT is 63 - 70 degrees
- 12.0 CFS when WT is 70 - 75 degrees

15. In unusual years (like 1983) when the groundwater basin is full in spring and early summer and no percolation is possible, provide releases sufficient to maintain surface flow and to prevent excessive mortality of young steelhead due to high water temperatures. When the groundwater basin is full, surfacing groundwater forms small, cool-water pockets in the bottoms of some pools, providing a refuge for young steelhead even at low flows. Approximate streamflow needs (measured at Casa de Fruta) under these conditions are: 2.0 CFS.

Agency: Pacheco Water District

16. Release water from the bottom of Pacheco Reservoir, rather than allowing surface spills of warmer water in spring.

Agency: Pacheco Water District

HERNANDEZ RESERVOIR

17. To the extent possible, adjust releases from Hernandez Reservoir so that they are spread over the entire spring through fall period, with no severe spring or fall cutoffs.

Agency: San Benito County Water Conservation and Flood Control District

PROPOSED PESCADERO RESERVOIR

18. If a dam is built on Pescadero Creek do not allow operations which would significantly impact juvenile and adult steelhead upstream and downstream migration in the Pajaro River. Mitigate the substantial habitat loss due to blocked access and inundation, such as by habitat improvement downstream of the dam through inchannel water conveyance, pool depth and cover improvements, etc.

Agencies: Department of Fish and Game
State Water Resources Control Board
Santa Cruz County Planning Department
Monterey County Flood Control and Water Conservation District

Diversions (Imported Water)

Background

San Felipe Project water will be brought in to supply Santa Clara and San Benito counties in the near future. In Santa Clara County the imported water may be percolated in Llagas Creek and its tributaries on the valley floor. Many of these tributaries are channelized and all are poorly shaded, so unless flow rates are high and the water is cold at the point of discharge, any possible steelhead rearing directly resulting from the discharge of imported water would be limited. However, imported water will allow Gavilan Water Conservation District some flexibility in how it handles percolation of water stored in Chesbro and Uvas reservoirs (see Diversion (reservoirs) option 5). In San Benito County there may be some potential for San Felipe water to provide steelhead rearing habitat with instream percolation in Pacheco Creek and Arroyo Dos Picachos.

If Monterey and Santa Cruz decide to import San Felipe water, there may be some cost savings possible if they utilize instream conveyance (Pacheco Creek and the Pajaro River) and divert the imported water near Watsonville. Such

a project has tremendous potential for providing improved steelhead rearing habitat in Pacheco Creek, if the water is discharged near the Pacheco Tunnel instead of far downstream and if the discharged water is cool and clear. Instream conveyance through the Pajaro River probably has limited potential for providing substantial steelhead rearing habitat there. Water temperatures and turbidities would probably be high, and stream substrates are generally unsuitable for steelhead spawning and for insects, which would serve as steelhead food items. However, habitat for other native (and introduced) species would be greatly improved.

Technical Options

1. To the extent possible, utilize groundwater percolation of San Felipe water in Santa Clara County in ways which will improve potential rearing habitat in Llagas and Uvas creeks (see Diversion (reservoirs) option 5).

Agency: Gavilan Water Conservation District

2. If Monterey and/or Santa Cruz counties decide on San Felipe Project as a future source of water, consideration should be given to instream conveyance in Pacheco Creek and the Pajaro River. Imports should be integrated with operations of Pacheco Water District and with San Benito County Water Conservation and Flood Control District to provide high streamflows and the coolest possible water temperatures throughout the rearing season.

Agencies: Santa Cruz County Planning Department
Monterey County Flood Control and Water
Conservation District
San Benito County Water Conservation and
Flood Control District
Pacheco Water District

3. If Monterey and/or Santa Cruz counties decide on San Felipe Project as a future source of water, they should investigate possible integration of importation with Gavilan Water Conservation District to see if water transport efficiency and steelhead habitat can be improved. For example, it might be possible for Gavilan Water Conservation District to release water down Uvas Creek to the Pajaro River (and improve steelhead rearing in lower Uvas Creek) in exchange for San Felipe water.

Agencies: Santa Cruz County Planning Department
Monterey County Flood Control and Water

Conservation District
Gavilan Water Conservation District

Excavation and Quarrying

Background

Portions of Llagas, Pacheco, and Uvas creeks offer potential for gravel extraction in the active streambed and adjacent flood plains. However, most potential quarrying sites are in or along stream portions which serve as important steelhead spawning and rearing habitat. Quarrying can potentially result in unstable stream channels, especially braiding and widening. Unstable channels result in loss of riparian vegetation as shade and cover, altered pool/riffle configurations, altered percolation rates, and increased stream temperatures. Even small changes in pool/riffle configuration and percolation rates might be significant; on lower Pacheco Creek, and possibly on lower Uvas Creek, undergravel flow resulted in cool-water pockets at the bottoms of some pools in 1983, and provided a refuge for young steelhead during periods of low streamflow and high water temperatures. Increased stream turbidities can often result from gravel extraction and washing operations. When quarrying takes place in the flood plain there still remains the potential for channel shifts during floods, such as occurred in Pacheco Creek in 1982. Lowering the active channel can also result in channel adjustments in tributaries; Bodfish Creek is actively incising its lower channel in response to past quarrying and other channel modifications in Uvas Creek.

Deep, instream quarries provide some fish habitat. However, on the three streams mentioned, high water temperatures in flooded quarries are likely to prevent substantial steelhead rearing. Warmwater fishes, including Sacramento squawfish and introduced sunfishes and bass, can build up large populations in the deep-water habitat provided by flooded quarries; besides providing a warm-water sportfishery they also may pose a significant competition and predation threat to young steelhead.

Deep, instream quarries act as sediment and gravel traps and may alter stream substrates and turbidities downstream. Spawning quality might decline downstream of quarries at some locations. At other locations, the trapping of fine sediment might result in improved substrate and pool depths.

Technical Options

1. Allow no quarrying in the active streambed or adjacent flood plain of Pacheco Creek downstream to the constricted channel at Casa de Fruta, or in Uvas Creek downstream to Miller Avenue, which would result in adverse effects upon steelhead due to channel change or instability or to increased stream temperatures or turbidities.

Agencies: Santa Clara County Planning Department
Department of Fish and Game
Army Corps of Engineers

2. Allow sand quarrying in the lower portion of the San Benito River (downstream of Hollister) during the summer period when the channel is dry; excavations would serve as sediment traps and help to reduce sediment accumulations in the lower Pajaro River. Sand excavation should be conducted so as not to affect bank stability, and sand wash-water should not be allowed to enter the stream or streambed, where it would increase water turbidities.

Agencies: San Benito County Planning Department
Department of Fish and Game
Army Corps of Engineers

Fishing Pressure

Background

Summer fishing pressure on young steelhead has been heavy in Uvas Creek because of the recent urbanization along the stream. If Llagas Creek steelhead populations are restored, fishing pressure could be a problem. The Department of Fish and Game has closed (for the 1984 season) Llagas, Pacheco, and Uvas creeks, and their tributaries, downstream of the reservoirs to summer fishing. However, significant summer fishing occurred on Uvas Creek in 1983, despite closure.

Sprig Lake in Mt. Madonna County Park (Santa Clara County) provides summer fishing for catchable trout for children 12 years and under. The lake also provides very important rearing habitat for juvenile steelhead which are of catchable size in late summer. In some years significant fishing pressure on young steelhead occurs; in recent years the Park has closed the lake to late summer fishing.

Poaching of adult steelhead is fairly common at the more difficult barriers on Corralitos, Browns, and Uvas creeks. Adult fish are also especially vulnerable to poaching in several shallow tributaries or stream reaches used for spawning.

Technical Options

1. Support the CALTIP program for reporting of poaching violations; distribute and post information concerning the program.

Agencies: Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

2. Post Uvas, Llagas, and Pacheco creeks and their tributaries as closed to summer fishing (including permanent, painted signs at bridges).

Agencies: Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

3. Continue to close Sprig Lake to late summer fishing (after mid-July) to protect juvenile steelhead.

Agency: Santa Clara County Parks and Recreation Department

4. Provide offstream fishing sites, such as percolation ponds, for summer fishing as an alternative to present (illegal) summer fishing on Uvas and Llagas creeks.

Agencies: Gavilan Water Conservation District
Gilroy Parks and Recreation Department

Fish Rearing and Planting

Background

In most years rearing habitat appears to limit production of steelhead in tributaries of the Pajaro River. A program of annual hatchery rearing and planting of steelhead would usually only increase the number of returning adults in a "put and take" fashion and have very limited long-term impact. Fish rescue operations or instream egg-rearing devices would likewise provide very limited long term benefits. However, fish rescue or egg rearing may provide benefits when: 1) significant rearing habitat is available

but spawning habitat is limited by lack of habitat or by reservoir operations--it is possible that Llagas Creek may fit this category; or 2) spawning habitat or adult access is temporarily limited by sedimentation episodes (such as caused by fire or landslides) or by temporary barriers. Hatchery rearing might also be useful in specific situations, such as: 1) to provide temporary mitigation for loss of rearing due to sedimentation events, droughts, or fish kills from pesticides, sewage treatment plant failures, etc.; or 2) to provide for reestablishment of runs eliminated by severe droughts--Llagas and Pacheco creeks lost their steelhead runs for several years following the 1975-1977 drought.

Steelhead in much of the Pajaro River system utilize habitats with relatively high summer water temperatures and with stream passage problems that require early spring outmigration. The native strains of steelhead in the Pajaro River system are undoubtedly quite different genetically from steelhead of northern California, and probably from local steelhead from streams with different rearing and stream passage conditions. Rearing operations which use non-local strains may be very inefficient in providing mitigation or restoration of runs. Introduced strains may even have adverse effects on steelhead production, if they transmit disease or if they compete for rearing habitat but have poor outmigration success, poor ocean survival, or high rates of adult straying.

Technical Options

1. Stock no steelhead in the Pajaro River system unless they are of Pajaro River system strains or are of strains from very similar streams in the region.

Agencies: Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

2. Establish a set of contingency plans for the trapping of adult steelhead for transport or egg-taking (and early rearing) to provide for seeding streams with temporary lack of spawning success due to sedimentation or lethal water quality events or lack of access due to drought or temporary barriers. Possible egg-taking sites include (but are not limited to) the fish ladders on Browns and Corralitos creeks and the proposed fish trap at Uvas Reservoir (barrier option 12).

Agencies: Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

3. Establish a set of contingency plans for the rearing of steelhead if temporary mitigation or restoration becomes desirable due to drought, sedimentation events, fish kills, etc. Possible temporary rearing sites include (but are not limited to) Sprig Lake, the concrete pool at the base of Uvas Reservoir, and the hatchery at Big Creek.

Agencies: Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.
Santa Clara County Parks and Recreation Dept.
Gavilan Water District

4. If future investigations of Llagas Creek demonstrate that poor spawning success is responsible for lack of steelhead production in the stream, due to lack of suitable gravels or late spring reservoir operations, evaluate the use of egg taking and early rearing to provide fry to seed the available rearing habitat.

Agencies: Department of Fish and Game
Monterey/Santa Cruz Anadromous Advisory Com.

Fish Species Reestablishment

Background

Despite substantial habitat change in the Pajaro River system and the introductions of numerous exotic species, the native fish assemblages in the system are still substantially intact. The greatest alteration in both the fish community and stream habitat has been in the Pajaro River, itself, where carp are now abundant, summer streamflows are low, and turbidities are high. In most other San Francisco Bay area and Central Valley stream systems much greater losses of the the native fish assemblages have occurred.

Tule perch and Sacramento perch are no longer present in the Pajaro River system. Their final loss, and that of speckled dace in the lower Pajaro River, may have been due to a 1968 pesticide kill in the Pajaro River. Tule perch, Sacramento perch, and speckled dace are now gone or rare in much of their native range in the Bay area and the Central Valley. Speckled dace are still common in the San Benito River system. Restoration of dace, tule perch, and Sacramento perch is probably possible in the Pajaro River. Tule perch and Sacramento perch could also probably be established in Uvas or Pacheco creeks or in ponds within the Pajaro River watershed.

Speckled dace and riffle sculpins have been lost from Llagas Creek, possibly during siltation and dewatering that accompanied construction of Chesbro Reservoir. During the 1976-77 drought, stickleback were lost from upper Little Arthur Creek, and two of the three stickleback plate phenotypes were lost from Llagas Creek. The drought also caused the loss of squawfish and roach from Llagas Creek below the dam and squawfish from above Uvas Reservoir.

Steelhead probably utilized Arroyo Dos Picachos until relatively recently. Drought may have eliminated the run, just as it temporarily did to runs in Pacheco and Llagas creeks during 1975-80. The long stretch of seasonally dry streambed and the difficult potential passage of outmigrating smolts makes permanent reestablishment unlikely unless the Pacheco Creek run can be substantially increased and secured, such as through inchannel conveyance of San Felipe water (Diversion (importation) option 2); then periodical loss of the Arroyo Dos Picachos run would probably be quickly reestablished by strays from Pacheco Creek.

Green sunfish commonly occur as fugitives from farm ponds and represent a competition and predation threat to steelhead and other native fishes, especially in small or intermittent streams. In most cases, they are also a relatively undesirable gamefish because of their small size.

Technical Options

1. If inchannel conveyance of San Felipe water or other actions increase the Pacheco Creek steelhead run substantially, introduce Pacheco Creek steelhead to Arroyo Dos Picachos to reestablish the run there.

Agency: Department of Fish and Game

2. Establish as a management goal the maintenance and restoration of native fishes in the Pajaro River system. (See Detailed Field Investigations Report for locations of significant remaining native fish assemblages.)

Agency: Department of Fish and Game
Santa Cruz County Planning Department
Santa Clara County Planning Department
San Benito County Planning Department
Monterey County Planning Department

3. Reintroduce tule perch, Sacramento perch, and speckled dace to the Pajaro River. Dace (from the San Benito River) should be introduced at Aromas. Tule perch (from Alameda Creek?) and unparasitized Sacramento perch (source?) should be introduced at Highway 101.

Agency: Department of Fish and Game

4. Reintroduce speckled dace to upper Llagas Creek, California Roach and riffle sculpin to Llagas Creek below the dam, and stickleback to upper Little Arthur Creek.

Agency: Department of Fish and Game

5. Reintroduce Sacramento squawfish to Uvas Creek above the reservoir.

Agency: Department of Fish and Game

6. Introduce tule perch and Sacramento Perch to Uvas Creek (quarry area), to Pacheco Reservoir, and to Pacheco Creek (below North Fork Pacheco Reservoir).

Agency: Department of Fish and Game

7. Introduce tule perch and Sacramento perch to ponds in the Pajaro River watershed, including ponds in Henry Coe State Park.

Agencies: Department of Fish and Game
Department of Parks and Recreation

8. Introduce speckled dace to an appropriate (presently fishless) Pajaro watershed stream in Henry Coe State Park.

Agencies: Department of Fish and Game
Department of Parks and Recreation

9. Discourage the use of green sunfish in farm ponds and recommend their elimination wherever possible.

Agencies: Department of Fish and Game
Department of Parks and Recreation

Fish Stocking (New Species)

Background

Introduction of new species to the Pajaro system might adversely affect steelhead populations or populations of other native species. Brown trout, white bass, or striped bass, and other possible introductions could compete with or prey on juvenile steelhead.

Technical Options

1. Allow no stocking of new species in Pajaro River system streams or reservoirs which might result in competition or predation problems for steelhead.

Agency: Department of Fish and Game

Gravel Recruitment and Spawning Conditions

Background

Good quality spawning gravels are relatively rare in many of the the Pajaro River tributaries utilized by steelhead. Despite this, spawning generally appears to be sufficient to seed the available rearing habitat, especially the limited habitat available for smolt-sized fish. However, downstream of Uvas and Chesbro reservoirs the lack of gravel recruitment to replace gradual downstream movement of gravels or their burial in pools does limit spawning success and may reduce steelhead production. In addition to being scarce, the gravels downstream of the reservoirs contain substantial amounts of fine sediment due to lack of flood-flow stirring. The problem is particularly severe in Llagas Creek. Below Pacheco Reservoir gravel recruitment is not a major problem, since the South Fork of Pacheco Creek enters the stream immediately downstream of the reservoir, and provides for gravel recruitment and stirring.

A small unnamed tributary enters Uvas Creek immediately below the dam, and in many years it probably provides an important, or even dominant, part of the spawning habitat available in the first 1 or 2 miles below the dam. Machado Creek, a small and usually dry tributary to Llagas Creek, may provide important spawning habitat in some years.

Technical Options

1. Protect the unnamed tributary immediately downstream of Uvas Reservoir from landuse, water diversions, or other impacts which might impair its contribution to spawning habitat of the Uvas Creek watershed.

Agencies: Department of Fish and Game
Santa Clara County Planning Department
State Water Resources Control Board

2. To the extent possible, operate releases from Uvas Reservoir so that steelhead may utilize the channel between the release valve and the flow measurement weir for spawning.

Agency: Gavilan Water Conservation District

3. Add gravels to the channel between the release valve and the flow measurement weir at Uvas Reservoir to provide for increased steelhead utilization and spawning success. Evaluate rates of gravel loss and degradation with fine sediment.

Agencies: Gavilan Water Conservation District
Santa Clara County Fish and Game Commission
Department of Fish and Game

4. Add gravels to the channel of Llagas Creek downstream of the reservoir to provide for improved spawning success. Evaluate rates of gravel loss and degradation with fine sediment.

Agencies: Santa Clara County Fish and Game Commission
Department of Fish and Game

5. Provide periodic winter flushing flows from Chesbro Reservoir to stir gravels and remove sediment in the reach from the dam downstream to Santa Teresa Blvd. These can be provided without "costing" water by concentrating a major part of winter releases in several pulses.

Agencies: Gavilan Water Conservation District

6. In severe drought years when the Department of Fish and Game determines that steelhead are unable to utilize Llagas and Uvas creeks for spawning and rearing (such as in 1976-77), dewater portions of the streambed to oxidize intragravel organic matter to improve future egg incubation success.

Agency: Department of Fish and Game
Gavilan Water Conservation District

Habitat Improvement

Background

Steelhead rearing habitat is constrained by water diversions, flood control, riparian cutting, and erosion and sedimentation problems; options elsewhere in this management plan deal with minimizing these impacts. However, there is some potential for improving existing habitat. In small streams, limited pool development and cover often limit steelhead rearing success. Instream structures such as boulders or logs can improve pool depth and cover, and properly operated flashboard dams may provide valuable habitat. In the larger streams (Llagas, Pacheco, and Uvas creeks) water temperatures and reservoir releases primarily determine steelhead production by affecting demand for, and availability of, fast-water feeding areas. However, the amount of overhead cover in or near feeding areas is also a major factor limiting juvenile steelhead. Addition of riparian vegetation or instream structures for cover would expand the habitat available to feeding steelhead.

Technical Options

1. Install large boulders in Browns Creek from the diversion dam upstream to Gamecock Canyon to improve pool development and to provide escape cover. Evaluate effectiveness of habitat improvement.

Agencies: Department of Fish and Game
Santa Cruz County Planning Department
Santa Cruz County Fish and Game Advisory Com.
Monterey/Santa Cruz Anadromous Advisory Com.

2. Evaluate the feasibility of installing flashboard dams to produce summer rearing ponds on Corralitos Creek at the road crossing downstream of Eureka Gulch, in the gorge downstream of Clipper Gulch, and at and downstream of the Watsonville diversion dam. Install if feasible and evaluate the effectiveness of habitat improvement.

Agencies: Department of Fish and Game
Santa Cruz County Planning Department
Santa Cruz County Fish and Game Advisory Com.
Monterey/Santa Cruz Anadromous Advisory Com.
Santa Cruz County Department of Public Works
Watsonville Water Department

3. Negotiate the use of the flashboard dam on lower Bodfish Creek (BM2) to provide a summer steelhead rearing pool (see also barrier option 17).

Agency: Department of Fish and Game

4. If fish passage is provided past the dam on Little Arthur Creek (BM1--see barrier options 14 & 15) negotiate the use of the flashboard dams upstream for summer rearing habitat.

Agency: Department of Fish and Game

5. Initiate a program of riparian revegetation and installation of instream cover devices along Uvas Creek from Watsonville Road downstream to Santa Teresa Blvd. Evaluate the effectiveness of habitat Improvements.

Agencies: Department of Fish and Game
Santa Clara Valley Water District
Monterey/Santa Cruz Anadromous Advisory Com.
Santa Clara County Fish and Game Advisory Com.

Riparian Cutting (Flood Control)

Background

At the present time, both the Monterey and Santa Cruz Flood Control and Water Conservation Districts periodically remove portions of the riparian vegetation present on the levees and in the channel of the lower Pajaro River. Removal is primarily of undergrowth on the terraces and levees, and most of the trees remain. Along the lowflow channel a fringe of willows has developed since the last major grading of the channel (1972). The remaining vegetation provides important habitat for wildlife and the fringe of willows in the lowflow channel provides for shading, hiding cover, and pool development for fish. As part of this management study, hydrologist Barry Hecht evaluated the effect of the remaining vegetation upon flood capacity of the Pajaro channel and concluded that the effect on channel capacity was very small. He also found that channel capacity apparently exceeded that required to carry the project design flood; channel degradation may have occurred.

Santa Cruz County also maintains the leveed channel of Salsipuedes Creek by mowing and cutting.

In Santa Clara County the Santa Clara Valley Water District carries out riparian cutting on Llagas and Uvas creeks and along the Pajaro River. Along lower Carnadero (Uvas) Creek and the Pajaro River, from the mouth of Carnadero Creek downstream to Highway 101, much of the riparian vegetation has been removed. On Llagas and Uvas creeks larger trees on the banks are left and riparian cutting is primarily of shrubs and willows within 30 feet of the lowflow channel. Cutting is most intensive near bridges.

The loss of overhanging willow and shrub cover at the edges of the perennial channels in Uvas and Llagas creeks significantly reduces habitat for juvenile steelhead. The loss is most significant when it occurs at the edges of steelhead feeding areas in riffles, fast runs, and at the heads and tails of pools.

Technical Options

1. Maintain present riparian vegetation conditions in the Pajaro River channel: lowflow channel with willow fringe and terraces and levees with cottonwood/willow forest with periodic understory thinning and snag removal.

Agencies: Santa Cruz County Planning Department
Monterey County Flood Control and Water
Conservation District
Santa Clara Valley Water District

2. Allow development of a very narrow fringe of shrubs in the Salsipuedes channel to provide stream shading, overhanging cover, and pool development.

Agency: Santa Cruz County Planning Department
City of Watsonville

3. Alter flood control cutting on perennial portions of Llagas and Uvas creeks to leave a narrow fringe of shrubs (especially blackberry and mulefat) and small willows (especially shrubby sandbar willow) immediately along both banks of the the summer channel. If channel capacity constraints prevent leaving the fringe along the entire channel, leave as much vegetation as possible along the edges of riffles, fast runs and heads of pools.

Agency: Santa Clara Valley Water District

Riparian Cutting (Development)

Background

Santa Cruz County presently has an ordinance which protects the riparian corridor from intrusion by residential and other developments. This ordinance has been instrumental in reducing sedimentation and streambank destruction that often accompany development and result in increased flood hazard, reduced streambed percolation, and destruction of valuable wildlife and fish habitat. The other counties have no such ordinances. In Santa Clara County residential intrusion into the riparian corridor, especially on Uvas and Llagas creeks, has resulted in increased flood hazard and landowner pressure for flood protection, increased bank erosion, increased sedimentation and reduced streambed percolation, loss of riparian vegetation for stream shading and overhead cover for fish, and loss of wildlife habitat.

With increased development an additional problem is the proliferation of stream crossings. These crossings remove substantial portions of the riparian corridor, resulting in bank erosion, loss of stream shading and overhead cover. Crossings also fragment the riparian corridor, reducing its value to wildlife.

Technical Options

1. County and city ordinances should be developed to protect the riparian corridor in Santa Clara County so that streambed percolation can be maintained, future flood control problems minimized, and fish and wildlife habitat preserved.

Agencies: Santa Clara County Planning Department
Santa Clara County Board of Supervisors
Gilroy Planning Department
Morgan Hill Planning Department
Santa Clara Valley Water District
Gavilan Water Conservation District

2. Santa Cruz County should continue to administer their present riparian ordinance to protect the riparian corridor and stream channel quality.

Agency: Santa Cruz County Planning Department

Sediment Sources

Background

Sedimentation of streambeds has been one of the major factors in the reduction of steelhead spawning and rearing habitat in the Pajaro River system. Sediment fills pools, buries larger rocks which might serve as fish escape cover, buries or cements spawning gravels, increases scouring of steelhead nests, increases water turbidity, and may reduce surface streamflow in rock-cut channels by increasing substrate depth. Erosion and sedimentation occur as both episodic events and as chronic contributions. The studies by the hydrologist of the effects and recovery from the 1982 flood and landsliding episodes in the Corralitos and Browns creek watersheds show that episodic events can have devastating, but short-lived, impacts. However, chronic sedimentation problems may have much more significant, long-term impacts upon the stream channel and steelhead rearing habitat.

The most significant present sedimentation impacts upon steelhead habitat in the Pajaro River system are those from road building and residential and agricultural development along Rider Creek (tributary to Corralitos Creek) and Redwood Creek (tributary to Browns Creek). Both tributaries supply large quantities of fine sand and substantially degrade downstream steelhead spawning and rearing habitat. Development in much of the Corralitos and Browns Creek watersheds also reduces water percolation into the sandy soils, which serve as important secondary percolation zones for the lower Pajaro groundwater basin. Lesser erosion and sedimentation problems have accompanied residential and small-scale agricultural development along most Pajaro River tributaries.

Erosion of very fine soils from relatively flat agricultural land in southern Santa Clara County and northern San Benito County has resulted in partial filling of San Felipe Lake, loss of deep pools in the Pajaro River, and high water turbidities in the Pajaro River. The reduction in pool depth and increase in turbidity may have been a factor in the loss of tule perch and Sacramento perch. The extensive sedimentation in the Pajaro River has probably reduced the capacity of the channel in Santa Clara County to carry flood waters.

All four large reservoirs (Chesbro, Hernandez, Pacheco, and Uvas) store turbid storm runoff. Winter releases of turbid water often result in streambed siltation, because the releases and reservoir overflow are insufficient to stir the substrate or flush silt downstream. Late summer releases

from near-empty reservoirs are also occasionally very turbid, resulting in reductions in algal growth and insect populations or possibly even direct fish mortality.

County regulation of logging was preempted by state legislation in 1982. Future logging may potentially cause erosion and sedimentation problems for many of the small tributaries in Santa Cruz and Santa Clara Counties.

Santa Cruz and Monterey Counties have grading and erosion ordinances which attempt to minimize erosion and sedimentation impacts of development.

Technical Options

1. Develop a watershed management plan to deal with sedimentation and erosion problems in the Corralitos Creek and Browns Creek watersheds. The plan should include such possible actions as: regulation of development, enforcement of present grading ordinances, contingency planning for post-fire erosion, revegetation of present landslides, construction of sediment detention basins, etc.

Agencies: Santa Cruz County Planning Department
Santa Cruz County Resource Conservation District

2. Develop an erosion control plan to deal with loss of soil from agricultural land in southern Santa Clara and northern San Benito counties.

Agencies: Loma Prieta Resource Conservation District

3. Develop and enforce erosion control and grading ordinances for Santa Clara County to reduce streambed sedimentation.

Agency: Santa Clara County Planning Department

4. Ensure that timber harvest plans protect important steelhead spawning and rearing tributaries from sedimentation damage.

Agencies: California Department of Forestry
Department of Fish and Game

5. Prevent reservoir releases of extremely turbid water which would result in stream substrate damage or fish mortality.

Agencies: Department of Fish and Game

Gavilan Water Conservation District
Pacheco Water District
San Benito County Water Conservation and Flood
Control District

Wetlands Drainage

College Lake is presently drained in summer for agriculture. San Felipe Lake has been reduced in size by sedimentation and draining, but still provides valuable wildlife habitat. Soda Lake, which represented a valuable alkaline habitat for rare and locally unique plants, has been substantially filled by washings from a gravel operation. A fairly extensive cat-tail marsh is present along the San Benito River downstream of San Benito.

Technical Options

1. Maintain San Felipe Lake as a valuable wetland for wildlife and as an important steelhead migration pathway.

Agencies: Santa Clara County Planning Department
San Benito County Planning Department
Department of Fish and Game
Army Corps of Engineers

2. Maintain the valuable cat-tail marsh wetland along the San Benito River.

Agencies: San Benito County Planning Department
Department of Fish and Game
Army Corps of Engineers

Water Quality

Background

Water quality problems (turbidity, low oxygen levels, high dissolved solids, agricultural runoff) in the Pajaro River system are primarily confined to summer conditions in the Pajaro River, itself. Steelhead do not, at present, significantly use the Pajaro River as spawning or rearing habitat. Steelhead use the Pajaro River as a migration pathway to and from the tributaries in winter and spring, when water quality problems usually do not occur.

A pesticide-caused fish kill in the Pajaro River in 1968 may have been responsible for the loss of tule perch, Sacramento perch, and speckled dace from the Pajaro River. Tule perch and Sacramento perch are now extinct in the river system.

Some potential water quality problems in the tributaries might occur if substantial development using septic tank systems is allowed.

The Regional Water Quality Control Board presently allows no direct discharge of treated sewage into the tributaries of the Pajaro River. The Gilroy/Morgan Hill sewage treatment plant has failed to adequately handle wastewater loads during winter, and some dumping of partially treated sewage into Llagas Creek occurred during 1982-83.

Technical Options

1. Pajaro River water quality should be maintained to protect water supply and fish and wildlife beneficial uses and to maintain the instream conveyance option for San Felipe Project water. The present policy of no direct discharge of treated sewage should be maintained unless advanced treatment processes can be shown to enhance beneficial uses of the Pajaro River.

Agencies: Regional Water Quality Control Board

2. Mitigation for fish kills should include evaluation of possible impacts on steelhead and on other native fishes. Losses of all native fishes should be mitigated.

Agencies: Department of Fish and Game

Table 2. Agencies responsible for implementation of proposed management options.

Agency	Options				Excavation & Quarrying	Fishing Pressure
	Barriers	Small-scale	Diversions Reservoirs	Importation		
<u>Federal</u>						
SCS						
ACE					1,2	
NMFS		1				
<u>State</u>						
DFG	1 - 27	1 - 4	1,2,6,7,18		1,2	1,2
SWRCB		1, 2,4	18			
RWQCB		1				
CDF						
DPR	27					
CALTRANS	20					
CYA	1,6,16,18,21					
<u>Local</u>						
SB Co	25	1			2	
SCI Co		1			1	
SCr Co	1 - 8	1		3		
Mo Co		1	18			
SCr Co PW	4,8					
SCI Co P&R	19,20					3
SCr Co F&G						
SCI Co F&G	12-14,20,26					
GWD	13,23		1 - 12	1,3		4
MCFC			18	2		
PWD			13 - 16	2		
SBWD			17	2		
SCVWD						
Wat	9	3,4				
MH						
Gil						
GP&R	23		6,7			4
<u>Private</u>						
AFAC	1,2,6,13,14,16 18-21,24-26	1				1,2

Table 2 (Continued)

Agency	Options				
	Fish Rearing	Fish Reestablishment	Fish Stocking	Gravel & Spawning	Habitat Improvement
<u>Federal</u>					
SCS					
ACE					
NMFS					
<u>State</u>					
DFG	1 - 4	1 - 9	1	1,3,4,6	1 - 5
SWRCB				1	
RWQCB					
CDF					
DPR		7,8,9			
CALTRANS					
CYA					
<u>Local</u>					
SB Co		2			
SC1 Co		2		1	
SCr Co		2			1,2
Mo Co		2			
SCr Co PW					2
SC1 Co P&R	3				
SCr Co F&G					1,2
SC1 Co F&G				3,4	5
GWD	3			2,3,5,6	
MCFC					
PWD					
SBWD					
SCVWD					5
Wat					2
MH					
Gil					
GP&R					
<u>Private</u>					
AFAC	1 - 4				1,2,5

Table 2 (Continued)

Agency	Options				
	Riparian Cutting		Sediment Sources	Wetlands Drainage	Water Quality
	Flood Control	Development			
<u>Federal</u>					
SCS			1,2		
ACE				1,2	
NMFS					
<u>State</u>					
DFG			4,5	1,2	2
SWRCB					
RWQCB					1
CDF			4		
DPR					
CALTRANS					
CYA					
<u>Local</u>					
SB Co	2			2	
SC1 Co		1	3	1	
SCr Co	1,2	2	1		
Mo Co					
SCr Co PW					
SC1 Co P&R					
SCr Co F&G					
SC1 Co F&G					
GWD		1	5		
MCFC	1				
PWD			5		
SBWD			5		
SCVWD	1,3	1			
Wat	2				
MH		1			
Gil		1			
GP&R					
<u>Private</u>					
AFAC					

ANALYSIS OF POTENTIAL MANAGEMENT OPTIONS

The management options presented in this report already are the product of a screening process that considered what could "reasonably" be done to maintain and improve habitat for steelhead and other fish and wildlife species in the Pajaro River, its tributaries, and their riparian corridors. Options which required substantial effort or money and would produce little long term benefit were not included. It is expected that the benefits of some of the proposed options which have been included will also be judged too limited to justify the required effort and/or cost by the public or by the agencies most directly involved. Table 3 is an attempt to rate the proposed options by their relative long-term benefit to fish and wildlife and by their relative efforts and costs of implementation. The ratings involve some subjective judgements about long-term benefits, as future landuse practices in many of the watersheds can not be well predicted. Ratings of effort and costs were also often difficult to assign, because they depend upon the extent of volunteer involvement.

It is obvious that the highest priority options are those with high potential gain and with low effort and low or no cost. Assigning priorities for options with lesser gain or greater effort and cost will depend upon available funding sources and upon willingness of agencies and volunteers to undertake the options. For a portion of the options no cost (or effort) rating is given because the option either represents present actions or policies by the agencies involved or represents actions which are normal obligations of the agencies. However, financial and staff resources of some agencies may not be sufficient to assume all of the additional "normal" obligations.

Sequencing of adopted options will also be dependent upon extent and rates of funding and labor available. In addition, some of the options depend upon prior completion of other options or upon changes in water development and management. Options assigned low priorities or deleted because of lack of potential funding may also be considered as possible off-site mitigations for future construction and development projects within the Pajaro River basin.

In general, those options with the best benefit/cost relationships are those which: 1) involve removal or modification of barriers with substantial steelhead rearing habitat upstream (for example, a Uvas dam fish trap or culvert modification on Corralitos Creek); 2) alter reservoir operations in ways which improve steelhead spawning and rearing (for example, releases from the

bottoms of reservoirs, rather than surface spilling); 3) protect the riparian corridor from cutting or reduce sedimentation (for example, riparian corridor and erosion control ordinances); and 4) restore native fishes (for example, reintroduction of tule perch and Sacramento perch).

For those options which have significant costs (a project with a cost rating of 5 may involve a cost of \$5000-10,000), the possible funding sources include Department of Fish and Game "Bosco-Keene" monies for restoration of salmon and steelhead. These monies can be granted to private, non-profit organizations, as well as to local agencies, and can be used for labor and construction costs. These funds can not be used for equipment costs. A second major potential funding source is County Fish and Game Advisory Commissions. These commissions may make grants for fish and wildlife propagation and habitat restoration. They can also fund ecological investigations. For some projects private donations of construction materials or loans of equipment should be sought.

Table 3. Relative potential habitat gain, relative effort required, relative cost, and possible funding sources for Pajaro River Basin habitat management options. Options are rated from 1 (low) to 5 (high). Options with * are conditioned on implementation of other management options. Where no rating is given, the option is presently an agency action or obligation.

Option	Potential Gain	Effort Required	Project Cost	Funding Sources
<u>Barriers</u>				
1	4	3	1	DFG-B ¹ , SCr Co, SCr Co F&G
2	3	2	1*-3	Volunteer, DFG-B
3	3	2	2	DFG-B, SCr Co F&G
4	2-3	2	2	" "
5	2	2	2	" "
6	3	3	2*-3	" "
7	1	1	0*-1	Volunteer, DFG-B
8	2-3	4	2*-4	" "
9	0-4	1	—	
10	2-3	3	3	Southern Pacific
11	1-2	2	—	
12	5	2	2-3	Volunteer, SC1 Co F&G, DFG-B GND
13*	2-4?	2	2	Volunteer, SC1 Co F&G
14	4	3	3-5	Volunteer, SC1 Co F&G, DFG-B
15*	3-4	1	—	
16*	2	1	0-1	Volunteer, SC1 Co F&G
17	1-2	1	0-2	Owner, Volunteer
18	2	2	0	Volunteer
19	2	2	0	" "
20	3-4	5	3-4	DFG-B
21*	3	2	0-2	Volunteer, DFG-B
22*	2-3	1	—	
23	0-3	-	—	
24	2	1	0-1	Volunteer, DFG-B
25	1-2	1	0-1	" "
26	2	2	2	DFG-B, SC1 Co F&G
27*	0-4?	4	2	DFG-B, SC1 Co F&G, Volunteer

¹"Bosco" funds

Table 3 (Continued)

Option	Potential Gain	Effort Required	Project Cost	Funding Sources
<u>Diversions (Small-scale)</u>				
1	5	3	0	
2*	3	2	--	
3	0-3	-	--	
4*	2-4?	?	?	
<u>Diversions (Reservoirs)</u>				
1-5	5	1-2	--	
6	3+	2	5	Gi1 P&R, GWD
7	0-4	-	--	
8	3	1	--	
9	2-4	1	?	
10-12	3	1	--	
13	4	1	?	
14	4	1	?	
15	2?	1	?	
16	3	1	0	
17	3	1	?	
18	2-4	-	--	
<u>Diversions (Imported)</u>				
1	3-4?	1	0	
2*	5	2	--	
3*	3?	2	--	
<u>Excavation</u>				
1	3-4	1	--	
2	2-3	1	--	

Table 3 (Continued)

Option	Potential Gain	Effort Required	Project Cost	Funding Sources
<u>Fishing Pressure</u>				
1	2	1	0	
2	2	1	0-1	Volunteer, SC1 Co F&G
3	2	-	--	
4	2	3	?	
<u>Fish Rearing</u>				
1	?	-	--	
2*	2?	2	0-3 ²	SC1 & SCr Co F&G ²
3	4?	2	0-4 ²	" "
4*	3	3	1-3	DFG-B, Volunteer, SC1 CoF&G
<u>Fish Reestablishment</u>				
1*	2-3	1	2	DFG-B, Volunteer
2	3	1	0	
3	4	2	0-1	Volunteer, Co F&G
4	3	1	0-1	Volunteer, SC1 Co F&G
5	2	1	0-1	Volunteer
6	3	2	0-1	Volunteer, SC1 Co F&G
7	2	2	0-1	Volunteer
8	2	1	0-1	Volunteer
9	2	1	?	
<u>Fish Stocking (New Species)</u>				
1	0-5	-	--	
<u>Gravels & Spawning</u>				
1	0-3+	1	--	
2	2	1	0	

²If events make use of contingency plans desirable

Table 3 (Continued)

Option	Potential Gain	Effort Required	Project Cost	Funding Sources
3	2?	2	2	DFG-B, SC1 Co F&G
4	3	2	3	" "
5	3?	1	?	
6	3?	1	0	
<u>Habitat Improvement</u>				
1	3?	2-3	2-3	DFG-B, SCrCo F&G, Volunteer
2*	2-4?	2	2	" "
3	2	1	--	
4	2-4	2	--	
5	3?	4	2-4	DFG-B, SC1Co F&G, Volunteer
<u>Riparian Cutting (Flood Control)</u>				
1	0-4	-	--	
2	2+?	-	?	
3	4	0	0	
<u>Riparian Cutting (Development)</u>				
1	5	3	?	
2	5	3	--	
<u>Sediment Sources</u>				
1	3-5	5	?	?
2	2-3	4	?	?
3	4	3	?	
4	3+	2	--	
5	0-4	2	--	

Table 3 (Continued)

Option	Potential Gain	Effort Required	Project Cost	Funding Sources
<u>Wetlands Drainage</u>				
1	0-4	-	--	
2	0-3	-	--	
<u>Water Quality</u>				
1	0-5	1	--	
2	0-3	0-1	--	