

Stressor Categories	Stressor Subcategories	Description of Stressors	Example Restoration Actions	Location
	Migration Barriers	Migration barriers or delays caused by physical structures, insufficient flow over shallow areas, inadequate attraction flows, adverse water quality conditions, delayed flooding of marshlands, or other factors. Increased predation due to migration delays.	Structure and operation of ACID.	Sacto. River Mainstem
			Options for passage and reduction of predation at RBDD.	Sacto. River Mainstem
			Evaluate operation of Englebright Dam and Reservoir.	Yuba River
			Replace fish ladder at Iron Canyon.	Big Chico Creek
			Install discharge bypass at One Mile Recreation Area.	Big Chico Creek
			Replace fish ladder at One Mile Pool.	Big Chico Creek
			Improve fish passage at Saelzler Dam.	Clear Creek
			Conduct an options, feasibility, and engineering analysis of fish passage problems and habitat restoration opportunities on Antelope Creek.	Antelope, Cow, Cottonwood, Little Chico Creeks
			Reintroduction of steelhead above Folsom Dam	American River
			Plan for the removal of barriers on diked bay lands which block movement of smelt.	North Bay
			Make a plan for the removal of barriers for steelhead passage. (RCD already has documents for this kind of project.)	North Bay
			Put balls on power lines to alert birds.	North Bay
			Erect wildlife passage areas on highways.	North Bay
			Operate the Delta Cross Channel gates to prevent migration delays of fish. Also consider Georgiana Slough modifications.	Delta
			Fund land retirement adjacent to temporary barriers.	Delta
			Evaluate pulse flow effects on fish migration.	Delta
			Provide dissolved oxygen, migration barrier relief through modifications at the head of Old River.	Delta
			Fund Nature Conservancy and other projects specific to barriers and diversions.	Butte Creek
			Modifications to Clough Dam	Mill Creek
			Evaluate habitat above Barrier Falls at Chimney Rock.	Butte Creek
Floodplain and Marshplain Changes	Hydrological isolation of floodplain or marshplain	Lack of flow over floodplains and marshplains, lack of return flow to main channel.	Stanislaus channel and floodplain maintenance policy	San Joaquin River

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	Physical isolation of floodplain or marshplain	Habitat fragmentation.	Increase size of drains to the marsh lands along highway 37 to improve drainage.	North Bay		
			Modify drainage in the Yolo Bypass to reduce fish stranding.	Delta		
			Establish setback levees to create shallow water habitat and other priority habitat types. Consider possible adverse trade-offs between habitat types that may be created with setback levees.	Delta		
			Create a flood bypass in the southern Delta and on the lower Mokelumne River. Refer to the work of the Levee Technical Committee on this action.	Delta		
			Consider land use changes and restoration in the Yolo Bypass.	Delta		
			Increase area of flooded agricultural lands. Combine with no net loss of agricultural wetlands that provide foraging habitat for migratory birds.	Delta		
			Refer to Habitat Goals Project regarding guidance for land acquisition.	North Bay		
			Support Habitat Goals Project. Pilot studies can be included in the action list.	North Bay		
			Expand San Joaquin National Wildlife Refuge on the Tuolumne and San Joaquin rivers	San Joaquin River		
			San Luis National Wildlife Refuge expansion on the San Joaquin River	San Joaquin River		
			Work with landowners to establish easements for seasonal wetland habitat creation and other priority habitat.	Delta		
			Elimination of fine sediment replenishment	Loss of floodplain and marshplain fine sediment deposition, decreased food production.		
			Land use changes in the floodplain or marshplain	Urbanization, agriculture, grazing.	Fund incentives to increase area of agricultural wetlands and foraging habitat for migratory birds.	Delta
					Fund projects to restore tidal mudflats in shallow water habitat.	Delta
					Fund programs to prevent the loss of tidal mudflats and shallow water habitat.	Delta
Encourage fish compatible project responses to flood damage.	Butte Creek					
Create aquatic habitat that will be useful for foraging.	Delta					
Post-flood assessment	San Joaquin River					

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Water Diversions	Flows	Inadequate flow, flow variability, flow timing, stranding due to flow fluctuation, lack of flushing flows, lack of attraction flows, saltwater intrusion.	Conduct winter rice flooding and waterfowl pilot project to assess priority locations and flow needs.	Sacto. River Mainstem
			Support switch from use of potable water to reclaimed water in parks and golf courses.	North Bay
			Consider water acquisition in Central Valley.	North Bay
			Support water conservation education.	North Bay
			Help Sonoma hospital change over to reclaimed water since it is a major local river water user.	North Bay
			Develop a water budget for low water years.	North Bay
			Fund programs to keep the USGS stream gages.	North Bay
			Support local water conservation organizations and water management plans.	North Bay
			Water acquisition for all life stages (AFRP)	San Joaquin River
			Tuolumne River flow enhancement study	San Joaquin River
			Study in-stream flow needs for smolt survival	San Joaquin River
			Assessment/Feasibility of channel maintenance flows	San Joaquin River
			Evaluate reoperation of New Melones to mimic seasonal flow variability	San Joaquin River
			Assess ground water management, water transfers, distribution system efficiency	San Joaquin River
			Evaluate additional water exchange to ensure passage during critical migration periods.	Deer Creek, Mill Creek
			Convert pumps used in water exchange program from diesel to electrical power source.	Deer Creek, Mill Creek
			Real time flow monitoring	Mill Creek
			Land retirement to decrease the need for water diversion.	Delta
			Extend and expand flow agreement with PG&E.	Battle Creek
			New flow standards	American River
			Flow Fluctuation Criteria	American River
			Roseville Reclamation Pipeline	American River
			Dry Year Pulse Flow Evaluation	American River
			Water conservation actions.	Delta
			Manipulation of flow timing.	Delta
			Water acquisition.	Delta
			Study options for operations for the Old River barrier.	Delta
Study flows in the Yolo Bypass and San Joaquin River for potential splittail spawning.	Delta			

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			Study the effectiveness of pulse flows in the San Joaquin system and their relation to potential improvements in survival.	Delta
			Provide adequate flow (> minimum) for spawning habitat and rearing.	Sacto. River Mainstem
			Reestablish channel maintenance flows	Clear Creek
	Entrainment	Unscreened diversions, impingement.	Assess feasibility, prioritize, install, upgrade, and maintain fish screens.	San Joaquin River
			Conduct screen rehabilitation.	Sacto. River Mainstem
			Install new screens.	Sacto. River Mainstem
			Conduct screen options feasibility study (consolidate diversions, construct in-gravel wells).	Sacto. River Mainstem
			Complete fish screens and ladder at Durham-Mutual Dam	Butte Creek
			Complete fish screen and ladder at Adams Dam	Butte Creek
			Complete fish screen and ladder at Gorrill Dam	Butte Creek
			Site survey and engineering analysis for remaining diversion structures along lower Butte Creek (including White Mallard fish screen and ladder, and Drumheller Slough outfall culvert reconstruction).	Butte Creek
			Purchase screened portable pumps as alternative to Little Dry Creek Diversion.	Butte Creek
			Fish screen and ladder at Eagle Canyon Diversion.	Battle Creek
			Options and feasibility analysis for additional fish screens, ladders, and a flow allocation methodology above Eagle Canyon	Battle Creek
			Screen unscreened diversions.	Feather River, Yuba River
			Implement the Daguerre Point Dam Project listed in the spring run chinook report (fish screen, fish ladder, and dam modifications).	Yuba River
			Fish Screen Improvement (Fairbairn WTP)	American River
			Address problems with unscreened diversions, especially on the Napa River.	North Bay
			Establish a cooperative effort to study and implement screening of diversions, including consolidation of diversions where appropriate and screen maintenance.	Delta
			Change operations and physical facilities at the State and Federal pumps to reduce entrainment.	Delta
			Evaluate possible changes and operations of other diversion facilities to reduce entrainment.	Delta

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Channel Form Changes	Alteration of channel form	Loss of shallow water habitat, channel deepening, lack of floodplain, degradation of instream habitat conditions, loss of lotic conditions.	Channel restoration and reconfiguration projects.	San Joaquin River
			Reclaim historic floodplain within current flow context.	Sacto. River Mainstem
			Restore floodplain function by moving/removing private levees.	Sacto. River Mainstem
			Conduct project levee or other rock removal/relocation projects.	Sacto. River Mainstem
			Conduct Yolo Bypass feasibility of establishing floodplain-like conditions at a lower flow split between the bypass and the river.	Sacto. River Mainstem
			Manage hydrograph to allow maximum overbank flooding within flow peak potential.	Sacto. River Mainstem
			Initiate land acquisition in floodplain.	Sacto. River Mainstem
			Revise floodplain management.	Sacto. River Mainstem
			Obtain floodplain easements.	Sacto. River Mainstem
			Evaluate feasibility of reestablishing an interaction between the river and the floodplain.	Butte Creek
			Wetland/Slough Complex Restoration	American River
			Acquire land on Napa and Petaluma rivers from willing private land owners.	North Bay
			Restore other land.	North Bay
			Convert land (approximately 7,000 acres) to tidal wetlands.	North Bay
			Develop plans to buy specific properties that are targets for development before they become unavailable.	North Bay
			Flood Control Channel Improvement	American River
			Continue to fund site specific actions.	Butte Creek
			Evaluate feasibility of easements and buffer zones in the upper canyons above Hwy. 99.	Butte Creek
			Prevention of channel meander	Channelization, loss of shallow water habitat and channel complexity, reduced gravel recruitment, riparian encroachment, bank armoring.
	Apply biotechnology techniques to prevent bank erosion.	North Bay		
	Establish setback levees.	North Bay		
	Maintain meander belt where presently active.	Sacto. River Mainstem		
	Allow wider meander belt where possible (by land acquisition or discontinuing levee armoring).	Sacto. River Mainstem		

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			Endorse/partner with ACOE and Rec. Bd. study on re-evaluation of floodplain protection strategy.	Sacto. River Mainstem
			Protect mainstream meander belt as a source of gravel.	Sacto. River Mainstem
	Isolation or elimination of sidechannels and tributaries	Loss of woody debris recruitment, loss of rearing and spawning habitat, loss of refuge habitat, decreased food production.	Improve rearing habitat by increasing structural complexity.	Sacto. River Mainstem
			"Tailrace Habitat" Utilization (below Nimbus)	American River
	Reduction of gravel recruitment	Loss of spawning habitat, increased gravel armoring.	Merced River Ranch - purchase dredger tailings	San Joaquin River
			Spawning gravel introduction near LaGrange	San Joaquin River
			Goodwin Canyon gravel replenishment and monitoring	San Joaquin River
			Identify gravel sources for restoration	San Joaquin River
			Coarse sediment deficit/replenishment criteria : Merced	San Joaquin River
			Coarse sediment deficit/replenishment criteria: Stanislaus	San Joaquin River
			Identify locations to introduce gravel: Tuolumne., Merced	San Joaquin River
			Knights Ferry gravel replenishment and monitoring	San Joaquin River
			Take actions to protect gravel sources in tributaries.	Sacto. River Mainstem
			Restore and replenish spawning gravel in North Fork.	Battle Creek
			Replenish riverine gravels, monitor gravel movement, and schedule Keswick flow for gravel submergence and redistribution.	Sacto. River Mainstem
	Channel aggradation due to fine sediments	Accelerated erosion, changes in channel form caused by deposition of fine sediments due to increased sediment loads or decreased sediment transport capacity.	Gasberg Creek sediment control	San Joaquin River
			Pilot gravel cleaning project	San Joaquin River
			On-farm ag drainage treatment (pilot project)	San Joaquin River
			Sediment management plan for Merced watershed (identify sources)	San Joaquin River
			Pilot gravel ripping study on Stanislaus	San Joaquin River
			Stanislaus Watershed Projects: East Stanislaus RCD	San Joaquin River
			Watershed Projects: Tuolumne and Calveras counties RCD	San Joaquin River
			Increase tributary sediment control.	Sacto. River Mainstem
			Resolve erosion problems.	Deer Creek, Mill Creek
			Implement road related fixes for erosion problems.	Deer Creek, Mill Creek
			Fund recommendations coming out of the local watershed groups.	Battle Creek

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			Identify sources of erosion and develop projects and actions for decreasing erosion.	Battle Creek
			Evaluate flood management practices in Lindo Channel	Big Chico Creek
			Develop a watershed plan.	Big Chico Creek
			Reestablish channel integrity	Clear Creek
			Provide assistance to local watershed groups.	Clear Creek
			Erosion control projects.	Clear Creek
			Evaluate feasibility of off-channel and sidechannel restoration.	Yuba River
			Fund all or parts of watershed analyses.	Antelope, Cow, Cottonwood, Little Chico Creeks
			Include implementation actions in watershed analyses.	Antelope, Cow, Cottonwood, Little Chico Creeks
			Encourage consolidation of local efforts when reasonable.	Antelope, Cow, Cottonwood, Little Chico Creeks
			Support local stewardship groups.	North Bay
			Support local education on erosion control.	North Bay
			Support local land owner education efforts.	North Bay
			Conduct studies on erosion containment, transport, and flow dynamics.	North Bay
			Develop models for sediment sources.	North Bay
			Assess and monitor sediment sources and impacts.	North Bay
			Strengthen enforcement of best management practices on land development and public and private roads.	North Bay
			Fund storm water erosion enforcement.	North Bay
			Facilitate public outreach and discussion with regulators, regulatees, and resource specialists.	North Bay
			Merced River watershed assessment	San Joaquin River
			Stanislaus watershed assessment	San Joaquin River
			Channel maintenance flow assessment	San Joaquin River
	Loss of existing riparian zone or lack of regeneration potential	Loss of food supply, loss of SRA, loss of channel complexity.	Assist RCDs to do outreach to land owners for riparian fencing and range land management training.	North Bay
			Fund vegetation and maintenance in riparian urban corridors.	North Bay
			Develop setbacks for every acquisition.	North Bay

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			Support vineyard disease research on Pierces disease in a riparian friendly way.	North Bay
			Study the extent of the Napa riparian zone.	North Bay
			Restore vegetation and complexity to the riparian systems to help cool the water and provide protection for steelhead.	North Bay
			Purchase and restore land at Basso Bridge	San Joaquin River
			Manage post-flood land use for riparian growth	San Joaquin River
			Riparian restoration and revegetation projects	San Joaquin River
			Protect, restore, and re-establish SRA where possible.	Sacto. River Mainstem
			Conduct feasibility study on revegetation of project levees or rocked levees.	Sacto. River Mainstem
			Protect/restore riparian forest habitats.	Sacto. River Mainstem
			Instream Cover (Woody Debris)	American River
			Shaded Riverine Aquatic Habitat Protection/Management	American River
			Restore riparian vegetation	Feather River, Yuba River
			Restore riparian vegetation.	Deer Creek, Mill Creek
			Reestablish and revegetate riparian areas.	Big Chico Creek
			Spawning Habitat Management	American River
Water Quality	Increased Contaminants	Acute or chronic toxicity caused by agricultural chemicals, urban runoff, mine drainage, refineries, sewer treatment plants, and other point or non-point pollution sources.	Expand Real-time Water Quality Management Network	San Joaquin River
			Incorporate Tuolumne model with RTWQMN	San Joaquin River
			Reduce non-point pollution - expand contaminant project work team scope (IEP review and guidance)	San Joaquin River
			Establish monitoring for physio/chemical/temperature contaminants, including bioassays, dairy waste, impacts on food supply and dormant pesticide dispersal	San Joaquin River
			Non-point source agricultural runoff: use BMPs, expand riparian buffer zone.	Sacto. River Mainstem
			Address agricultural chemical toxicity from Colusa Drain.	Sacto. River Mainstem
			Develop a Highway 32 toxic spill contingency plan	Deer Creek
			Evaluate need to fund pathogen control for private aquacultural facilities. Review status with CVPIA programs.	Battle Creek
			Establish a Delta "streamkeeper".	Delta
			Research and develop TMDL's for all non-point and point sources of pollution.	Delta
			Scientifically designed sampling program based on a scaled down RMP program.	North Bay

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			Locate and inventory storm drains emptying into the Delta.	Delta
			Promote educational efforts to prevent inappropriate use of storm drains.	Delta
			Develop and fund a storm water monitoring program.	Delta
			Develop and fund water quality monitoring programs in coordination with existing USGS or other agency upstream and downstream monitoring.	Delta
	Increased Salinity	Increased salinity due to water management, operation of diversions or structures, runoff, etc.	Fund land retirement, focusing on high salinity load areas.	Delta
			Determine alternative methods for discharging salts back into bay from salt ponds.	North Bay
			Develop physical infrastructure to remove salt (if necessary).	North Bay
Increased Nutrient or Carbon Input	Increased input of nutrients from ag runoff, wastewater treatment, and other sources. Includes low dissolved oxygen conditions.			
Increased Mobilization of Contaminants due to Dredging	Increased turbidity, contaminant mobilization, dredge spoil disposal.			
Water Temperature		High water temperatures due to lack of riparian shade, lack of flow, increased surface area, warm water inflow, or other factors.	Supplemental money for Grasslands Water District to change water management practices to benefit water temperatures in March and April.	San Joaquin River
			Action to ease water demand from New Melones for agricultural drainage	San Joaquin River
			Temperature management feasibility studies, models, and operations development	San Joaquin River
			Folsom Temperature Control Device (TCD)	American River
			Folsom Reservoir Cold Water Pool Management	American River
			Thermal Refugia Utilization	American River
			Pilot flow study for water temperature.	Clear Creek
			Evaluate the effect of a water temperature control device at Englebright Dam.	Yuba River
Undesirable Species Interactions	Introduction of new exotic species	Introduction of exotic species from ballast water, inadvertent release of exotic species, intentional introduction of species for other reasons.	Conduct public education and enforcement on introduction of exotic fish and plants to the aquatic habitat.	North Bay
			Implement a program to prevent introduction of exotic species into areas that are currently supporting native species.	Delta

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			Establish education programs regarding existing exotic species problems and the need to prevent deter future exotic species introductions.	Delta
			Provide additional resources to increase the enforcement of ballast discharge regulations in areas where introduction of exotic species is a risk.	Delta
	Elevated predation/competition losses due to introduced fish and wildlife species	Striped bass predation, other introduced predatory species, competition for nest sites by introduced bird species, competition for food resources by introduced fish or mollusk species, etc.	Physical removal of predators from gravel pits, including an assessment of impacts on salmon production.	San Joaquin River
	Decrease predation.	Sacto. River Mainstem		
	Provide additional zebra mussel control (refer to the California Task Force for zebra mussel control).	Delta		
	Fund studies to better understand the biology of exotic species in order to support control or eradication efforts.	Delta		
	Fund additional study of the effects of striped bass on salmonid species.	Delta		
	Form a group of cooperating entities into an exotic species "SWAT" team.	Delta		
	Study the effects of inland silverside predation on delta smelt.	Delta		
	Fund control programs.	North Bay		
	Conduct research to determine effects, distribution, and best control methods.	North Bay		
	Fund pilot exotic species eradication programs.	North Bay		
	Community education and manuals to help homeowners to identify and remove exotic species.	North Bay		
	Develop strategy for red fox.	North Bay		
	Establish a trapping program for brown headed cowbirds and starlings which compete with native species in riparian areas.	Delta		
Competition from introduced plants	Invasive aquatic plants such as Hydrilla, invasive riparian zone plants such as Arundo, invasive salt marsh plants.	Remove non-native plants from the riparian zone, re-establish natives.	Sacto. River Mainstem	
Implement projects to reclaim priority habitats from exotic plant species.	Delta			

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Adverse Fish and Wildlife Harvest Impacts		Ocean and freshwater overharvest, poaching, inadequate fishing regulations,	Increase number of wardens	San Joaquin River
			Modify angling regulations	San Joaquin River
			Evaluate biological effectiveness of expanding fisheries law enforcement	San Joaquin River
			Implement a programmatic level increase in law enforcement to reduce poaching.	Deer Creek, Mill Creek, Feather River, Yuba River
			Focus law enforcement efforts on the creek during critical times for salmon.	Big Chico Creek
			Angling Regulations	American River
Population Management		Straying, migratory pathway changes, inadequate reproductive capacity due to small or non-existent spawning populations.	Eliminate inappropriate attraction flow.	Sacto. River Mainstem
			Evaluate need to establish founding population of spring run.	Battle Creek
			Provide input to genetic monitoring of the fish population.	Big Chico Creek
			Evaluate need for founding population of spring run chinook.	Clear Creek
			Evaluate potential for creating more separation of fall and spring-run spawning habitat to reduce or eliminate hybridization.	Yuba River
			Adult salmon counting structures	San Joaquin River
			Improving Stanislaus River escapement monitoring: feasibility of using hydroacoustics	San Joaquin River
			Fall run salmon otolith and scale evaluation	San Joaquin River
			Scale analysis for racial and age composition of chinook	San Joaquin River
			Smolt mortality study	San Joaquin River
			Verification and calibration of screw-trap estimates of Stan. River outmigrants: Feasibility of using hydroacoustics for smolt survival.	San Joaquin River
			Purchase Hills Ferry Barrier land to ensure access and reduce straying	San Joaquin River

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Land Use	Grazing	Loss of riparian habitat, increased erosion, decreased water quality.		
	Gravel mining	Decreased gravel recruitment, increased fine sediments, channel instability,		
	Urbanization	Urbanization of the watershed that leads to loss of riparian habitat, habitat fragmentation, wetland drainage, and other impacts.	Educate local government on how to prevent development in critical areas.	North Bay
			Plug into the local master planning process.	North Bay
			Model planned buildout based on master planning at UC Berkeley Urban Planning Institute.	North Bay
			Acquire wetlands so that there is no more building on them.	North Bay
			Help city councils to limit growth in critical habitats.	North Bay
			Identify way to preserve land with less than fee acquisition.	North Bay
			Present riparian core areas as amenities and educate developers to their value.	North Bay
			Identify Off-site Mitigation	American River
			Mitigation/Enhancement Monitoring Plan	American River
			Consultation/Technical Assistance	American River
			Identify lands that have a high potential for mass landslide potential and take early action to prevent erosion.	North Bay
			Acquire floodplain easements.	North Bay
			Forestry and agricultural practices	Forestry and agricultural practices in the watershed that lead to conversion of floodplain to ag use, subsidence, increased erosion, loss of habitat complexity, and water quality degradation.
	Improve agency and public education on forestry issues on a programmatic level.	Deer Creek, Mill Creek		
	Coordinate forestry agency management plans with other agencies and conservancies.	Deer Creek, Mill Creek		
	Fund the Deer Creek watershed conservancy.	Deer Creek		
	Fund the Mill Creek watershed conservancy.	Mill Creek		
	Fund the Butte Creek Conservancy.	Butte Creek		
Encourage continued outreach activities with agricultural interest.	Butte Creek			
Fund watershed plan and conservation easements.	Butte Creek			
Encourage coordination between local groups, Park Service, BLM, and USFS.	Clear Creek			
Acquire buffer zones.	North Bay			

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			Public education on Best Management Practices (BMP) approach to development.	North Bay
			Support local efforts for sustainable agriculture.	North Bay
			Match funding for private landowner actions (for example, "Partners for Wildlife").	North Bay
			Establish buffer areas.	North Bay
			Demonstration farm sites.	North Bay
			GIS database of habitat and fluvial elements for Stanislaus	San Joaquin River
			Prioritize areas for use of dredge material or other mechanisms on subsided islands (refer to the work of the Levee Technical Committee).	Delta
Artificial Propagation of Fish		Genetic changes due to hatchery management, hybridization, altered timing of runs, effects of smolt releases on wild populations, introduction of pathogens, incidental spring run mortality, increased striped bass populations, and other factors.	Interim artificial propagation program	San Joaquin River
			Hatchery fish marking program	San Joaquin River
			Develop a hatchery strategy for the SJR	San Joaquin River
			Review and revise operation plan for Merced River Fish Facility	San Joaquin River
			Tuolumne River Hatchery Plan	San Joaquin River
			Hatchery operation modification.	Sacto. River Mainstem
			Evaluate options to provide an isolated water supply for Coleman National Fish Hatchery.	Battle Creek
			Evaluate Battle Creek plan (AFRP).	Battle Creek
			Evaluate hatchery practices at Feather River Hatchery.	Feather River
			Hatchery Management Practices	American River
			Increase Artificial Production	American River
Climate		Global warming and ocean conditions.		
Human Disturbance		Direct disturbance of fish and wildlife populations by anglers, boaters, and other recreational users.	Tuolumne River Environmental Education Center	San Joaquin River
			Tuolumne River Interpretive Center Conceptual Plan	San Joaquin River
			Resources education program	San Joaquin River
			Public and angler education programs	San Joaquin River
			Information sharing network for the San Joaquin watershed	San Joaquin River
Wildfire		Habitat management through use of fire; increased frequency of fire near urban areas.	Fire Management	American River