

HANSON ENVIRONMENTAL, INC.

PROFESSIONAL SERVICES, CAPABILITIES & EXPERIENCE

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HANSON ENVIRONMENTAL, INC.

Hanson Environmental, Inc. provides environmental consulting services to industrial, governmental, and municipal clients. The firm provides services encompassing a range of specialized senior-level consulting applications involving emphasis in environmental regulatory compliance, resource management, and expert witness testimony. The firm also provides field sample collection and analysis related to fisheries and water quality issues.

The organization and operations of Hanson Environmental, Inc. are based on a management philosophy which emphasizes a high professional standard of performance, excellent long-term client relationships, and consistent delivery on technical, schedule, and budget commitments.

PROFESSIONAL SERVICES

Hanson Environmental consultants are primarily applied scientists with an emphasis in aquatic and wildlife biology and quantitative science. Our areas of expertise are:

- Endangered species Section 7 consultations, biological opinions, and habitat conservation planning including participation in evaluating data used for species listings and development of species recovery plans and monitoring programs;
- Fisheries and aquatic biology in marine, estuarine and freshwater environments;
- Water quality;
- Instream flow and stream habitat restoration;
- Riparian and wetland resource management and restoration;
- Design, management, statistical analysis, and interpretation of environmental monitoring programs;
- Regulatory compliance and permitting;
- Expert witness testimony in public hearings and litigation.

Our professional staff has been involved in water quality and biological monitoring programs, water rights and NPDES permitting, and compliance programs in California since 1975. Over these years we have established our professional credentials and reputation in working on behalf of municipal and industrial clients with key regulators in State and Federal agencies. We have experience working with a broad range of clients including electric power utilities, municipal water districts, various manufacturing industries, agricultural industries, aquaculture industries, the petroleum industry, mining industries, and private developers.

The breadth of experience in dealing with environmental and regulatory issues includes:

- The effects of acid-mine drainage on fisheries populations and aquatic communities inhabiting large river and reservoir systems;
- The effects of agricultural drainage discharges, including elevated concentrations of selenium, on aquatic organisms, wetland vegetation, and waterfowl health and reproduction;
- The effects of elevated water temperature exposure associated with point-source thermal discharges, reservoir and impoundment operations, and instream flow conditions on growth, survival, reproductive success, and health of fish and invertebrates;
- Stream habitat characterization and evaluation of instream flow requirements;
- Wetland characterization, management, mitigation, and U.S. Army Corps and State permitting issues;
- Intake screening, entrainment, and water diversion impact assessment associated with NPDES permitting and mitigation obligations;
- Streambed alteration agreements and mitigation for wetland and riparian vegetation impacts;
- Water quality and point-source discharge investigations.

The majority of our professional activities are in response to the need for compliance with many of the major State and Federal regulations including:

- Corps of Engineers Section 10 and 404 permitting;
- National Environmental Policy Act (NEPA);
- Section 7 Endangered Species Consultation, and Section 10 Habitat Conservation Planning;
- California Environmental Quality Act (CEQA);
- State Water Resources Control Board water rights decisions and water quality control plans;
- Federal Energy Regulatory Commission (FERC) permitting and monitoring;
- Natural Resource Damage Assessment (NRDA); and
- Regional Water Quality Control Board basin planning, NPDES monitoring and compliance, and Waste Discharge Requirements (WDR).

PERMITTING

Hanson Environmental is experienced and highly qualified to assist with all aspects of permitting and regulatory compliance including:

- Permit identification;
- Permit acquisition strategy;
- Permit application preparation and tracking;
- Compliance program development;
- Compliance documentation and reporting.

We assist clients in identifying specific regulatory responsibilities and provide technical knowledge and experience required to successfully acquire State and Federal permits and supporting environmental documentation. We often assist clients in formal and informal negotiations on permit terms, monitoring requirements, and identifying mitigation obligations. Negotiation may include expert witness testimony or the development of cost-effective environmental compliance monitoring programs and programs to minimize and mitigate project impacts.

BASELINE AND COMPLIANCE MONITORING

As part of many environmental monitoring programs the staff of Hanson Environmental has designed and conducted baseline investigations performed both prior to development and as part of ongoing compliance monitoring programs. Typical projects conducted by Hanson Environmental include:

- Determine the species composition, distribution, and abundance of fish and other aquatic organisms, wetland and riparian vegetation, waterfowl, and wildlife;
- Identify the presence of threatened or endangered species;
- Identify and delineate wetland areas and other sensitive habitats;
- Determine life history and habitat requirements of selected target species;
- Design habitat enhancement and restoration programs;
- Assess project mitigation responsibilities.

Our goal for all of these environmental investigations is to produce results which are statistically defensible and provide a sound basis for resource management decisions and compliance with State and Federal regulations. Detailed consideration of sampling and experimental design, statistical analysis, population dynamics, computer modeling, and data interpretation are integral components of our biological investigations. Results of these investigations are documented in clear, concise, reports, exhibits, and testimony for presentation to State and Federal regulatory agencies.

IMPACT ASSESSMENT

A logical extension to the baseline monitoring programs conducted by Hanson Environmental are analyses and evaluations of project impacts and development of measures to minimize and mitigate project impacts. Typical environmental impact assessments conducted by Hanson Environmental include the following:

- Assessing the effects of acid-mine drainage, including copper, cadmium, nickel, and other metals on freshwater fish and invertebrate communities;
- Assessing the effects of industrial or municipal discharges on water quality, habitat, and biological communities;
- Evaluating impingement and entrainment losses of fish and macroinvertebrates at water intake or diversion facilities located in freshwater, estuarine, and marine environments;
- Assessing the effects of wetland and riparian habitat alterations associated with variation in stream flow, channelization, dredging, filling, and drainage activities;
- Evaluating the effects of variation in water temperatures and point and non-point source chemical discharges on the health and condition of fish and macroinvertebrates.

A main emphasis of Hanson Environmental is in the development of environmental protection and enhancement measures through a combination of siting, engineering, and operational modifications to reduce potential environmental impacts to a minimum. Direct and indirect project-related impacts, which cannot be avoided are mitigated through a combination of habitat improvement and enhancement activities, off-site mitigation, the use of hatcheries, and other effective mitigation and enhancement techniques.

SELECTED PROJECT DESCRIPTIONS

EXPERT WITNESS TESTIMONY: LEGISLATIVE & STATE WATER RESOURCES CONTROL BOARD HEARINGS

State Water Contractors
Sacramento, California

On behalf of the State Water Contractors, Dr. Hanson prepared and presented expert witness testimony in water quality and water right hearings before the State Water Resources Control Board. Hanson Environmental, Inc. provided technical review of reports and analyses, prepared cross-examination of witnesses during public hearings on water policy, water quality, and fishery-related issues. Through development and interpretation of fishery and water quality monitoring and survey programs conducted in the Sacramento-San Joaquin river/Delta system and San Francisco Bay, Hanson Environmental, Inc. also provided input in the evaluation of fishery management regulations for striped bass and Chinook salmon.

EXPERT WITNESS TESTIMONY

East Bay Municipal Utility District,
Oakland, California

In association with the law firm of Best, Best, and Krieger, Dr. Hanson provided litigation support to the East Bay Municipal Utility District (EBMUD) in their successful defense to exercise an historical water right to divert from the American River at the South Folsom Canal. Dr. Hanson provided expert witness testimony on fisheries and water quality issues related to the water withdrawals. Dr. Hanson also assisted in preparing questions for deposition and cross-examination of intervening witnesses.

SALMON AND STEELHEAD INSTREAM FLOW AND WATER QUALITY REQUIREMENTS — MOKELUMNE RIVER

East Bay Municipal Utility District,
Oakland, California

Hanson Environmental, Inc., Inc. serves on the Mokelumne River Technical Advisory Committee which includes representation from the California Department of Fish and Game, the U.S. Fish and Wildlife Service, the State Water Resources Control Board, and the East Bay Municipal Utility District. Dr. Hanson's involvement on the Mokelumne River, under contract to EBMUD, has involved evaluation of the instream flow requirements for upstream salmon and steelhead trout passage over various barriers and critical riffles (including beaver dams and other obstacles), the performance of upstream migrant fish ladders, the instream flow requirements for attraction of migrating adults to the Mokelumne River and successful spawning, egg incubation, and juvenile rearing including the successful passage of downstream migrating fry and smolts. In addition to consideration of instream flow requirements, we have been involved in evaluating various habitat requirements including riparian vegetation, insect production, stream gravels, water temperature, dissolved oxygen concentrations, various metal concentrations, and other physical and biological factors which influence production of steelhead trout and Chinook salmon in the Mokelumne River.

ANALYSIS OF FISH SCREENING ALTERNATIVES

Metropolitan Water District of Southern California
Los Angeles, California

Dr. Hanson directed an assessment of fish screening alternatives at a site in northern San Diego County to develop a suitable design, which could be employed by the Metropolitan Water District to reduce the seasonal upstream migration of fish from Lake Skinner into the San Diego Canal. The assessment of alternative technologies was based on the consideration of State and Federal guidelines for intake structure designs combined with engineering and biological

constraints gained from extensive experience in current fishery protection management practices. The assessment included site visits, a literature review of current physical and behavioral barrier screening technologies, and consultation with water district and other agency contacts, including various equipment vendors, manufacturing representatives, and screen maintenance personnel. Results of the evaluation were summarized in a technical report to the water district which provided a recommendation for the preferred intake technology alternative and its proportionate contribution to the anticipated environmental benefits.

WATER DIVERSION FISHERY IMPACT ANALYSIS: SACRAMENTO AND SAN JOAQUIN RIVERS

State Water Contractors
Sacramento, California

Hanson Environmental, Inc. staff have participated in the State Water Resources Control Board Sacramento - San Joaquin Bay-Delta Water Quality and Water Rights Hearings which began in 1987 and are continuing to date. This involvement includes providing expert witness testimony on striped bass, Chinook salmon, Delta smelt, splittail, and steelhead in the Sacramento and San Joaquin Rivers. Under contract to the State Water Contractors, a consortium of California Water Districts, we provide scientific and technical input to the five-agency salmon work group, provide scientific presentations to the State Water Resources Control Board Public Trust work group on the effects of water temperature and flows on salmon and steelhead, and have been actively involved in evaluating the effects of municipal, industrial, and agricultural water diversions and flood control water storage facilities on striped bass, salmon and steelhead passage, spawning success, and juvenile rearing, within the Sacramento and San Joaquin river-Delta system. Dr. Hanson also served on a committee chaired by the California Department of Fish and Game with participation from the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the California Department of Water Resources, on evaluating alternative fish diversion and fish protection facilities designed to improve the passage and survival of both upstream and downstream migrating salmon and steelhead trout in the Sacramento and San Joaquin rivers.

WETLAND HABITAT CHARACTERIZATION AND CORPS OF ENGINEERS PERMITTING

Richmond Sanitary Services
Richmond, California

An investigation was conducted to assess regulatory permitting requirements associated with the proposed discharge of storm water runoff from a hazardous materials collection site into a surrounding wetland habitat. The project included site characterization and delineation of wetland areas, development of a specific project proposal and identification of sensitive issues and potential impacts, and technical briefings with staffs of the U.S. Fish and Wildlife Service, the California Department of Fish and Game, the Corps of Engineers, and the Regional Water Quality Control Boards.

AGRICULTURAL DRAINAGE AND WATERFOWL IMPACTS

Tulare Lake Drainage District
Corcoran, California

A series of analyses were performed to evaluate available biological data on the potential effects of agricultural drainage water, containing elevated concentrations of selenium and other chemical constituents discharged into evaporation basins, on the health, condition, and reproductive success of migratory waterfowl. The evaluation included species-specific information on selenium concentrations in body tissues (e.g., muscle and liver tissue) in addition to egg and embryo body-burdens. Information on embryonic development at specific sites and regions, in combination with associated data on water chemistry and habitat characteristics, was included in the evaluation. Bioaccumulation through food ingestion including plant materials, aquatic insects and macroinvertebrates, and fish inhabiting areas receiving drainage waters was evaluated as a potential pathway for chemical transfer and concentration. Results of this evaluation were presented in documentation reports submitted for peer review by the U.S. Fish and Wildlife Service and other investigators, and presented as expert witness testimony in public workshops held by the Regional Water Quality Control Board - Central Valley Region. Results of these analyses were documented in a series of 13 Environmental Impact Reports prepared by Hanson Environmental which identified existing significant environmental impacts resulting from evaporation basin operations and both on-site mitigation measures and compensatory wetland habitat. The on-site actions have been implemented at a number of facilities and are being evaluated. Waterbird abundance, reproductive success, and embryonic toxicity are being evaluated at the TLDD compensation wetland habitat. The required actions and associated monitoring plans for these basins were incorporated by the California Regional Water Quality Control Board - Central Valley Region in Waste Discharge Requirements (WDR) for the operating evaporation basins.

STREAM HABITAT SURVEYS AND DETERMINATION OF INSTREAM FLOW REQUIREMENTS

East Bay Municipal Utility District
Oakland, California

A series of biological investigations have been designed and implemented by Hanson Environmental, Inc., working in cooperation with investigators from the California Department of Fish and Game, the U.S. Fish and Wildlife Service, University of California at Davis, and Sacramento County to assess and evaluate the biological community inhabiting the lower American River and the response of fish and macroinvertebrates to various instream flow and temperature regimes. These studies are being conducted as part of the Superior Court decision regarding EDF v EBMUD. Hanson Environmental is conducting a series of investigations to determine interstitial water temperatures in spawning areas utilized by Chinook salmon and steelhead, spawning gravel characterization, dewatering and stranding as a function of fluctuating water levels, and a general characterization of the species composition, abundance, and distribution of fish and macroinvertebrate communities inhabiting the lower American River. Results of these investigations will be used to recommend instream flow requirements for the protection of the aquatic community inhabiting the lower American River and the management of reservoir storage and release, including consideration of both water flows and water temperature, for protection of public trust resources. Dr. Hanson served as an expert witness on instream flow and water temperature issues during the Superior Court litigation leading to the development of this comprehensive fisheries program and the associated management recommendations.

STREAM HABITAT SURVEYS

Alameda County Water District
Fremont, California

Hanson Environmental, Inc. has participated in fisheries habitat surveys within Alameda Creek since 1990. The fisheries surveys are being conducted on behalf of the Alameda County Water District (ACWD) to evaluate existing habitat conditions for steelhead migration, spawning, and juvenile rearing. The surveys include extensive air and water temperature monitoring, water quality monitoring, streamflow surveys to determine passage conditions for adult steelhead, and detailed habitat mapping, including identification of barriers and impediments to steelhead migration. Information developed through these surveys will be used as part of the overall Alameda Creek fisheries program and the current Army Corps of Engineers feasibility study of opportunities to provide steelhead passage and access to upstream habitat within the creek. Consideration of passage barriers as part of this investigation include the BART weir, ACWD inflatable dams, and other passage impediments within the Niles Canyon and Sunol Canyon areas.

City of St. Helena
St. Helena, California

Hanson Environmental, Inc., on behalf of the City of St. Helena, has conducted a preliminary habitat assessment within York Creek and prepared an initial evaluation of potential steelhead passage at the York Creek Dam site. Hanson Environmental has evaluated habitat conditions upstream of the existing York Creek Dam for steelhead spawning and juvenile rearing as part of the overall evaluation of potential biological benefits associated with dam removal. Hanson Environmental has also participated in various meetings and discussions with representatives of the California Department of Fish and Game and National Marine Fisheries Service regarding fisheries issues associated with York Creek Dam removal. As part of the overall evaluation of habitat conditions within York Creek, Hanson Environmental evaluated a second passage barrier/impediment located approximately one mile downstream of York Creek Dam, as both an impediment to steelhead migration, in addition to a possible source of entrainment mortality as a result of water diversions from the creek for municipal supplies. Information developed through these surveys has been documented and provided to state and federal resource agencies as part of the overall evaluation of the York Creek Dam removal project.

EVALUATION OF POTENTIAL IMPACTS OF SAND MINING ON BAY-DELTA FISHERY HABITAT

Sand Mining Industry

In as part of an evaluation of the potential impacts of sand mining activity on fishery habitat within San Francisco Bay and the Delta, Hanson Environmental Inc. has performed extensive analyses of the fishery monitoring results from the California Department of Fish and Game in San Francisco Bay and Delta. The California Department of Fish and Game has conducted fishery monitoring at a large number of sampling stations, including sampling stations within Suisun Bay, approximately monthly over the 21-year period from 1983 to 2001. Data are available from the studies on the species composition, geographic distribution, seasonal patterns in abundance, and life stages and size distributions, and other

relevant information for fish eggs and larvae, juvenile and larger fish, and shrimp and crabs. Analyses of the California Department of Fish and Game survey data are being used as part of the impact assessment of sand mining activity and have been presented to an interagency technical advisory committee, including participation by the California Department of Fish and Game, NOAA Fisheries, U.S. Fish and Wildlife Service, Regional Water Quality Control Board, Army Corps of Engineers, BCDC, and other agencies. Results of these analyses provide the scientific foundation to assess and evaluate impacts of sand mining activity within Suisun Bay on fishery resources and aquatic habitat.

EVALUATION OF THE IMPACTS OF THE PROPOSED EXPANDED TRACY WASTEWATER TREATMENT PLANT ON FISH AND AQUATIC HABITAT

City of Tracy

Hanson Environmental Inc. performed an impact analysis of the Tracy Waste Water Treatment Plant expansion project on fish and aquatic habitat. The impact analyses evaluated predicted changes in water quality, potential exposure to contaminant constituents, physical changes to habitat associated with construction of the outfall diffuser and changes to local current patterns, and exposure to elevated water temperatures within the discharge plume. Results of the fishery analysis have been presented in a draft and final Environmental Impact Report for the proposed project, which has been certified by the City of Tracy. Results of the fishery analyses are also being used to prepare a biological assessment for submittal to NOAA Fisheries and the U.S. Fish and Wildlife Service to evaluate potential effects of the expanded wastewater treatment plant facilities and their operations on fish species identified for protection under the Endangered Species Act and Essential Fish Habitat.

SUISUN CREEK FISHERY HABITAT EVALUATION

City of Vallejo Vallejo, CA

On behalf of the City of Vallejo, Hanson Environmental Inc. designed and conducted a series of habitat evaluations to assess habitat quality and availability for steelhead spawning and juvenile rearing within Suisun Creek. The investigations included habitat-typing within the stream corridor, identification of potential passage barriers and impediments to migration, extensive air and water temperature monitoring, water quality monitoring, assessment of relationships between habitat conditions for steelhead and instream flow releases, and vertical temperature and dissolved oxygen profile measurements within Lake Curry. Data from these investigations were used to help identify changes in streamflow releases to conserve cold water within Lake Curry to benefit over-summering juvenile steelhead within the creek. Results of the studies are also being used to prepare environmental analyses for potential alternative water supply and delivery facilities and operations. Results of the studies were provided to the Suisun Creek Restoration Team, which includes participation by local landowners and stakeholders, California Department of Fish and Game, NOAA Fisheries, City of Vallejo, and other interested parties.

ADULT STEELHEAD PASSAGE — SAUSAL CREEK

Gauer Ranch Vineyards

On behalf of Gauer Ranch Vineyards and Chevron Land Development Corporation, Hanson Environmental, Inc. performed a series of fisheries field studies and stream flow measurements on Sausal Creek, a tributary to the Russian River, as part of an evaluation of the potential impacts of water diversions from Sausal Creek on instream flow requirements for adult steelhead migration. Results of the field studies performed during the winter, 1995 were used as a basis for recommending instream flow requirements for adult steelhead passage and modifications to the original design and location of water diversion structures to avoid adverse impacts to migrating steelhead. Results of the field investigations and recommendations were presented by Dr. Hanson in expert witness testimony before the State Water Resources Control Board. A written report documenting the objectives, methods, and results of this investigation was presented as an exhibit in support of oral testimony.

SAUSAL CREEK WATER TEMPERATURE AND JUVENILE STEELHEAD REARING

Kendall-Jackson

Hanson Environmental, Inc. has a series of field fishery and water quality investigations currently underway to evaluate and document summer water temperature conditions and the abundance, distribution, and condition of juvenile steelhead and other fisheries resources inhabiting Sausal Creek. Habitat mapping of Sausal Creek, a tributary to the Russian River, has also been performed as part of the juvenile steelhead investigations. Results of these investigations will be documented and presented to the State Water Resources Control Board and California Department of Fish and Game as part of the basis for evaluating habitat conditions within Sausal Creek and the potential impacts of water diversion and development for vineyard irrigation on fisheries resources within tributaries to the Russian River.

JUVENILE CHINOOK SALMON AND STEELHEAD COLLECTION METHOD EVALUATIONS

California Department of Water Resources

As part of extensive field fisheries investigations being performed by Hanson Environmental, Inc. on the Sacramento River, San Joaquin River; and within the Sacramento-San Joaquin Delta, a series of comparative gear evaluations have been performed, in cooperation with the California Department of Fish and Game and U.S. Fish and Wildlife Service, to determine collection efficiency of various types of trawls. Comparative gear efficiency tests were performed between a Kodiak trawl, otter trawl, tow-net, and mid-water trawl. Side-by-side trawling was performed to compare the collection efficiency of the Kodiak trawl to other methods targeting on juvenile Chinook salmon, steelhead, and Delta smelt. Results of these comparative gear evaluations have resulted in significant changes in routine fisheries sampling methods used by the California Department of Fish and Game and U.S. Fish and Wildlife Service for investigations of salmon, steelhead, and smelt.

JUVENILE CHINOOK SALMON EMIGRATION PATTERNS IN THE SACRAMENTO AND SAN JOAQUIN RIVERS — REAL-TIME MONITORING

California Department of Water Resources/U.S. Bureau of Reclamation

Hanson Environmental, Inc. has conducted extensive field fisheries studies to monitor the outmigration of juvenile Chinook salmon and steelhead from the Sacramento and San Joaquin river systems. During 1993, 1994, and 1995 Hanson Environmental, Inc. staff, working in cooperation with the California Department of Fish and Game and California Department of Water Resources, have collected over 2,500 Kodiak trawl samples within the Sacramento River and Georgiana Slough. Kodiak trawls were also used by Hanson Environmental, Inc. staff as part of a cooperative Inter-Agency Ecological Program (IEP) real-time monitoring effort conducted during the spring 1995 and 1996 in which Hanson Environmental, Inc. staff sampled juvenile Chinook salmon and steelhead populations in the Sacramento and San Joaquin rivers. In developing the real-time monitoring program a variety of alternative collection techniques were evaluated, including the use of otter trawls and other methods, however a Kodiak trawl was selected as the preferred method for sampling as part of this cooperative inter-agency program.

DELTA SMELT GEOGRAPHIC DISTRIBUTION AND ABUNDANCE SURVEYS

California Department of Water Resources

As part of a cooperative fisheries investigation being performed with the California Department of Fish and Game and California Department of Water Resources, Hanson Environmental, Inc. staff conducted fisheries investigations, utilizing a Kodiak trawl, to characterize the abundance and geographic distribution of Delta smelt, a fish species protected by the State and Federal Endangered Species Acts. Surveys were conducted within the Sacramento - San Joaquin Delta during the summer and fall, 1994. Results of these studies provided detailed information on the geographic distribution and density of Delta smelt within various regions of the Sacramento - San Joaquin Delta and was used in evaluating the condition (length-weight relationship) for the Delta smelt population prior to spawning.

SAN JOAQUIN RIVER VERNALIS ADAPTIVE MANAGEMENT PROGRAM (VAMP)

San Joaquin River Group Authority
Modesto, CA

Dr. Bruce Herbold (U.S. Environmental Protection Agency) and Dr. Charles Hanson (Hanson Environmental, Inc.) co-authored the San Joaquin River Vernalis Adaptive Management Program (VAMP). The VAMP program represents a cooperative effort among San Joaquin River Tributary water users, State and federal water project exporters, State and federal resource agencies, and environmental interests as a long-term study (12 year) experimental program to test the effects of San Joaquin River flows and Delta exports on juvenile Chinook salmon survival. The VAMP program was also designed to provide protections for wild Chinook salmon emigrating from the San Joaquin River and its tributaries and to serve as the implementation strategy for the State Water Resources Control Board 1995 Water Quality Control Plan Standards for the lower San Joaquin River. Pilot studies of the VAMP program were initiated in 1997. VAMP reflects an effort to develop a consensus based approach to resolving fisheries issues and implementing fisheries management actions within the overall context of water quality standards and constraints on water supply availability within the San Joaquin River basin.

SACRAMENTO RIVER HABITAT CONSERVATION PLAN (HCP)

Reclamation District No. 108

Hanson Environmental has developed a Habitat Conservation Plan (HCP) for aquatic species inhabiting the Sacramento River in the vicinity of the Reclamation District No. 108 service area. Reclamation District No. 108 provides water for agricultural irrigation and rice straw decomposition within an area of approximately 50,000 acres extending from Knights Landing to Grimes. The HCP will provide assurances and Endangered Species Act protections (incidental take) resulting from continued operations of screened and unscreened water diversions. The HCP has been developed to meet requirements of the California Department of Fish and Game, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and U.S. Bureau of Reclamation. The HCP is based upon fisheries sampling and analyses performed by Hanson Environmental. The HCP has been developed as an extension of environmental documentation (NEPA and CEQA) and Biological Assessments prepared in compliance with the California and Federal Endangered Species Acts by Hanson Environmental.

SHALLOW-WATER FISHERIES HABITAT

State Water Contractors/U.S. Fish and Wildlife Service/California Department of Water Resources

Hanson Environmental, Inc. has been conducting fisheries sampling and compiling scientific information since 1990 related to the development of shallow-water habitat for fisheries resources of the Sacramento and San Joaquin rivers and the Sacramento-San Joaquin Delta. Sampling has been performed for species such as Delta smelt, splittail, juvenile Chinook salmon, steelhead, and other resident and migratory fish species. Consideration has been given to levee setbacks, modifications to flood control operations, levee breaching, Delta island flooding, and protection and creations of existing berms. Consideration has also been given to the use of dredge spoil material in the development and enhancement of shallow-water fisheries habitat. These studies are being conducted as part of a cooperative effort within the context of the Interagency Ecological Program (IEP), CALFED Program, and as part of the development of fisheries management plans and proposals for habitat enhancement within the Sacramento and San Joaquin River basins.

FISHERIES AND AQUATIC HABITAT COLLABORATIVE EFFORT (FAHCE) TO ADDRESS STEELHEAD AND OTHER FISHERIES ISSUES IN THE GUADALUPE RIVER, STEVENS AND COYOTE CREEKS — SANTA CLARA COUNTY.

Santa Clara Valley Water District
Santa Clara County, CA

Hanson Environmental, Inc. participates on the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Technical Advisory Committee which is responsible for designing and conducting fisheries and aquatic habitat investigations within the Guadalupe River, Coyote Creek, and Stevens Creek. The investigations are being conducted, in part, in response to a complaint filed by the Natural Heritage Institute (NHI) on behalf of the Guadalupe-Coyote Resource Conservation District before the State Water Resources Control Board (SWRCB) for violations of Fish and Game Code, Water Code, and Public Trust Doctrine related to incremental and cumulative impacts of operations and facilities by the Santa Clara Valley Water District (SCVWD) on fisheries populations and their habitat. The complaint alleges harm to cold-water fisheries as a result of consumptive urban and agricultural water uses within Santa Clara County. To address this complaint the FAHCE process has been initiated jointly by the Santa Clara Valley Water District and California Department of Fish and Game, with participation by the City of San Jose, National Marine Fisheries Service, U. S. Fish and Wildlife Service, and Natural Heritage Institute. The FAHCE investigations were organized and initiated in 1997 as part of a three-year effort to collect the necessary technical data for (1) resolving the SWRCB complaint and (2) identifying reasonable flow and non-flow measures that will improve habitat conditions for fish populations with specific emphasis on Chinook salmon and steelhead trout.

WATER QUALITY SAMPLING WITHIN ROCK SLOUGH, OLD RIVER, AND MIDDLE RIVER

Contra Costa Water District
Concord, CA

Water quality sampling has been conducted within Rock Slough, Old River, and Middle River within the Sacramento-San Joaquin Delta on a monthly or semi-monthly basis for use in characterizing seasonal and geographic patterns in salinity and other water quality parameters. The surveys are being conducted for the Contra Costa Water District as part of an evaluation of sources of water quality degradation within Rock Slough, one of the primary water supply sources for the Contra Costa Water District, and for use in characterizing regional patterns in salinity distributions in support of decisions regarding surface water intake locations for a proposed expansion of the Los Vaqueros Reservoir. Salinity, measured as electrical conductivity, is the primary water quality constituent measured in the field, although field measurements also include water temperature, pH, and dissolved oxygen. In addition to the field water quality measurements, water quality grab samples are collected for chemical analyses by certified analytical laboratories. These additional water quality samples have been analyzed for fecal coli, total organic carbon, ammonium, and a variety of other water quality constituents. Field water quality measurements and sample collection are performed in compliance with established protocols and standard methods. Water quality measurements and sampling occur from both adjacent levees and by boat. In addition, water quality samples and measurements are taken routinely at agricultural drainwater discharge locations within Rock Slough and elsewhere within the central delta for use in evaluating the contribution of agricultural drainage water return to receiving water quality conditions. The water quality program was initiated in 2001 and is continuing.

REFERENCES AND CONTACTS

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RESUMÉ

Charles H. Hanson
Senior Fishery Biologist

Education

Ph.D. Ecology and Fisheries Biology, University of California, Davis, 1980
M.S. Fisheries Biology, University of Washington, 1973
B.S. Fisheries Biology, University of Washington, 1972

Certification

Certified Fisheries Biologist
American Fisheries Society

Experience

Dr. Hanson has more than 30 years of experience in freshwater, estuarine, and marine biological studies. Dr. Hanson has contributed to the study design, analysis, and interpretation of fisheries, stream habitat, and stream flow (hydraulic) data used to develop habitat restoration strategies, Habitat Conservation Plans, Endangered Species Act consultations, and environmental analyses. Dr. Hanson has conducted evaluations of the effectiveness of various water diversion fish screening systems, assisted in fish screen design and permitting, and developed operational modifications to reduce organism losses while maintaining operational reliability of the water projects and hydroelectric systems. He has directed numerous investigations and environmental impact analyses for projects sited in freshwater, estuarine, and marine environments of the San Francisco Bay/Delta, the central and northern California Coast, Puget Sound, Hudson River, and Chesapeake Bay. Dr. Hanson has participated as an expert witness on fisheries and water quality issues in numerous public hearings and superior court litigation. Dr. Hanson has been extensively involved in incidental take monitoring and investigations of endangered species, development of recovery plans, consultations, listing decisions and identification of critical habitat, and preparation of aquatic Habitat Conservation Plans. Dr. Hanson served as a member of the USFWS Native Delta Fish Recovery Team, numerous technical advisory committees, and as science advisor to settlement negotiations. Dr. Hanson has also participated in the development of adaptive management programs including real-time monitoring, management of power plant cooling water and other diversion operations, and the San Joaquin River Vernalis Adaptive Management Plan (VAMP).

- 1991-Present **Senior Biologist/Principal, Hanson Environmental, Inc.**
Provides services in the design, execution, and interpretation of biological monitoring, fishery sampling, and regulatory compliance programs. Prepares technical compliance reports and exhibits for submittal to regulatory agencies, public hearings, and litigation. Presents findings to the public and press and presents expert witness testimony in litigation and regulatory hearings. Develops the design, implementation, and performance monitoring of habitat enhancement and mitigation projects to benefit fish and wildlife.
- 1982-1991 **Senior Biologist, Vice President, TENERA, L.P.**
Provided services related to the collection, analysis, and interpretation of biological and engineering data, preparation of documents submitted to regulatory agencies, presentation of findings to the public and press, and presentation of expert testimony in regulatory hearings.
- 1978-1982 **Senior Scientist, Ecological Analysts, Inc.**
Responsible for the collection, analysis, and interpretation of data on the abundance, distribution, and dynamics of various fisheries and invertebrate populations for use in evaluating the impact of power plant operations on aquatic populations for more than ten coastal and estuarine power plant sites in California. Prepared various regulatory environmental exhibits, technical reports, and generic and site-specific analyses of biological and engineering information for the applicability of alternative cooling water intake technologies.
- 1975-1978 **Research Assistant, University of California, Davis**

Conducted extensive investigations into behaviorally selected and energetically optimal swimming speeds of juvenile fish in relationship to selected microhabitats to help in establishing a data base and methodology for determining instream flow criteria. Conducted laboratory studies on the swimming performance and behavioral responses of fish to hydraulic gradients to develop biological design criteria for water intake systems.

1973-1975

Research Scientist, The Johns Hopkins University

Conducted fishery and zooplankton surveys in freshwater and marine environments along the Atlantic coast. Evaluated the acute and chronic effects of exposure to elevated water temperatures on freshwater and marine fish and invertebrates. Developed onsite and mobile bioassay laboratory facilities.

1969-1973

Research Assistant, University of Washington

Conducted bioassays to determine the synergism between elevated water temperature and duration of exposure on the toxicity of chlorine to two species of salmon. Determined the effectiveness of various techniques, including use of chlorine and thermal shock treatment in minimizing colonization by marine fouling organisms. Evaluated the acute and chronic effects of exposure to elevated water temperature on freshwater and marine fish and invertebrates. Participated in the evaluation of the behavioral attraction and avoidance of response of juvenile fish to thermal and chemical gradients.

Professional Associations

American Fisheries Society (Life Member)
American Institute of Fisheries Research Biologists (past Program Committee Chairman)
Pacific Fisheries Biologists (past Program Chairman)
Who's Who in the West
San Francisco Bay and Estuarine Society (past President)

Technical Advisory Committees

State Water Resources Control Board Striped Bass Workshop
American River Technical Advisory Committee
Mokelumne River Technical Advisory Committee
Santa Ynez River Technical Advisory Committee
Bay-Delta Oversight Committee (BDOC) Aquatic Resources
USFWS Delta Native Fish Recovery Team
CVPIA Striped Bass Technical Team

Publications

Hanson, C.H. and C.P. Walton. 1990. Potential effects of dredging on early life stages of striped bass (*Morone saxatilis*) in the San Francisco Bay area: An Overview. Pages 39-57 In Effects of Dredging on anadromous Pacific coast fishes. Wash. Sea Grant.

Hanson, C.H. and C.P. Seltenrich. Evaluation of the use of morphometric characteristics of juvenile striped bass in predicting size-specific exclusion capabilities of intake screens used at water intakes and diversion structures. (In preparation).

Hanson, C.H. Energetic considerations in velocity preference and swimming speed selection of juvenile fishes. (In preparation).

Hanson, C.H. and E. Jacobsen. 1985. Orientation of juvenile Chinook salmon and bluegill to low water velocities under high and low light levels. California Fish and Game 71(2):110-113.

Hanson, C.H. and H.W. Li. 1983. Behavioral response of juvenile Chinook salmon (*Oncorhynchus tshawytscha*) to trash rack bar spacing. California Fish and Game 69(1):18-22.

Hanson, C.H., J.R. White, and H.W. Li. 1977. An alternative approach for developing intake velocity design criteria. Trans. Calif.-Nev. Wildl. Soc.:10-18.