EXHIBIT CT10

Written Testimony of Ed T. Zapel

STATEMENT OF QUALIFICATIONS

Education and Training

I hold a B.S. degree in Civil Engineering from Washington State University (1984), graduating with honors. I also hold a M.S. degree in Hydraulic Engineering from Washington State University (1987), graduating *cum laude*. I am currently completing a Ph.D. program in Fisheries Science from the University of Washington (anticipated completion date 2005).

Publications

I have authored or co-authored a number of publications relating to hydraulic design of fish passage facilities, including the following:

*Larson, L.W., Zapel, E.T., S. J. Schlenker, R.T. Lee, S.C. Milligan; "Predictive Numerical Computer Models of Adult Fishways and Application at US Army Corps of Engineers Dams." Proceedings of the Bioengineering Symposium at 132nd Annual American Fisheries Society Meeting. Baltimore, Maryland, August, 2002. (*under peer review at this time)

*Zapel, E.T., T.R. Molls, S.V. Johnston, P.A. Nealson, M.A. Timko, and M. G. LaRiviere; "Juvenile Salmonid Acoustic Tracking Correlation with CFD-Model Predicted Velocity Fields at the Mayfield Dam Louvered Intake." Proceedings of the Bioengineering Symposium at 132nd Annual American Fisheries Society Meeting. Baltimore, Maryland, August, 2002. (*under peer review at this time)

Ahmann, M.L., and E.T. Zapel, "Stepped Spillways, a dissolved gas abatement alternative." Proceedings of the International Workshop on Hydraulics of Stepped Spillways. Zurich, Switzerland, March, 2000.

Zapel, E.T. "F.A. Goetz, and P.J. Hilgert. "Development of a Downstream Fish Passage System for Anadromous Salmonids at a High-Head Dam." Proceedings of BioEngineering Symposium at 127th Annual American Fisheries Society Meeting. Monterey, California, August, 1997.

Zapel, E.T. "Howard A. Hanson Dam Juvenile Fish Bypass System." Fish Passage Workshop. Milwaukee, Wisconsin, May, 1997.

Skills, Knowledge, and Expertise

I am a civil engineer with 19 years of experience in hydraulic, hydrologic, and fisheries engineering developed in a variety of engineering assignments throughout the western United States. These include fish passage facilities for low and high-head dams and reservoirs for both juvenile and adult salmonids, major flood control dam outlet works design, flood control pump station design. I have extensive experience with fish exclusion screen design for water intake structures and reservoir outlet works, sedimentation and erosion analysis and remediation, river

engineering, watershed and basin hydrologic analysis, dam safety inspection and remediation, and levee system design, inspection, and repair. He also has significant experience in watershed restoration planning studies, and stream habitat analysis and restoration.

Specific Areas of Expertise: Relative to the Central and South Coast River Systems

I have accumulated approximately 10 years of experience working on rivers and streams of the San Francisco Bay area, and the central and south coasts of California. Specifically, he has experience on the Sacramento River, American River, Mokelumne River, Petaluma River, Guadalupe River, Guadalupe Creek, Salinas River, Santa Ana River, Los Angeles River, Poway Creek, and several streams in the inland southwest. Various studies have included restoration of juvenile rearing and adult steelhead spawning habitat, fish ladders, fish passage barrier removal, incorporation of SRA into flood damage reduction channel designs, inspection and evaluation of channel flood capacity, fish collection and behavioral study weirs, and fish screening and water intake facility design. In addition to my 10 years of California hydraulic and fish passage engineering experience, I have nearly 20 years of experience with the design of fish passage facilities for dams and barriers ranging in hydraulic height from 5 feet to 400 feet. These facilities have included the analysis and design of modifications to complex adult fish attraction, collection, and ladder systems carrying up to 7,500 cfs on the mainstem Columbia River dams. In addition, I have developed designs for fixed and floating juvenile and adult fish collection, bypass, and transport systems for more than half a dozen large flood control and water supply dams throughout the Pacific Northwest. Several of these dams are very similar to Bradbury and Gibraltar Dams, with seasonal forebay elevation variation of up to 125 feet, reservoirs up to 1.2 million acre feet in volume, and upstream watershed areas ranging from tens to hundreds of square miles. I have designed and evaluated the effective passage efficiency of juvenile collection and bypass systems for average smolt migrations ranging in size from 25,000 to 50 million fish. In addition, I have designed and evaluated modifications to adult trapping and collection systems for hatcheries, truck haul, and broodstock collection systems. I have also designed and evaluated adult fish trapping systems ranging from simple floating picket weir assemblies deployed seasonally in small streams to large permanent barrier dam and fixed trap systems. I have also designed numerous habitat enhancement and restoration projects throughout the Pacific Northwest and California. These have included channel reconfiguration projects, large woody debris installations, channel stabilization and riparian zone restoration, and spawning channel construction.

Membership in Professional Societies and Professional Registration

I am a member of the American Society of Civil Engineers, and also the American Fisheries Society. I presently serve on the BioEngineering Committeee of the American Fisheries Society. I am a registered Professional Engineer in the State of Washington.

STATEMENT OF EXPERT OPINION

I have reviewed the list of documents cited in the literature list below this section. Based on this review of available documents, studies, and proposed actions relating to the Santa Ynez

River, I believe additional studies regarding the feasibility of restoring passage to upstream habitat above one or more of the three storage reservoirs for anadromous steelhead trout are justified and necessary. Specifically:

1) Adult fish passage around Bradbury Dam and Lake Cachuma, Gibraltar Dam and Gibraltar Reservoir, and Juncal Dam and Jameson Reservoir. There are at least several feasible methods of trapping and collecting upstream-migrating adult steelhead at or near the toe of Bradbury Dam and hauling upstream to tributary release points above the dam. These range from seasonal use of very simple floating picket weir designs that can be installed by hand or with limited machinery assistance with hand collection and transfer of fish into waiting light-duty tank trucks, to large barrier dams and fixed trap system capable of withstanding design flood flows. The estimated costs provided should be considered with an additional contingency of up to 100% to account for unanticipated expenditures.

    a) For example, a simple floating picket weir and temporary trap could be installed in Hilton Creek and perhaps across the mainstem below Bradbury Dam for a cost of about $100 per lineal foot of channel width. A light-duty 1-ton tank truck or other transport tank system with 300 to 500 gallon aerated and refrigerated tank would suffice for annual collection of up to about 1,000 adult spawners. Total installed cost of a simple system such as this would be in the range of $50,000 to $100,000, with an annual labor requirement of approximately 1.5 to 3 partial year FTE's (from $75,000 to $150,000). Annual repair and maintenance costs for this system are minimal.

    b) A moderate duty system designed for up to 2,000 annual adult spawners would likely include two light-duty tank trucks or other two-transport tank system, a semi permanent barrier weir and trap across both Hilton Creek and the mainstem, and water-to-water transfer of captured fish from trap to transport tank and from transport tank to tributary release point. Pump-back attraction flow might be desirable to enhance adult fish attraction efficiency. Total installed cost for such a system would be in the range of $300,000 to $600,000, with an annual labor requirement of approximately 2 to 4 partial year FTE's (from $100,000 to $200,000). Annual repair and maintenance costs for this system would likely be in the range of $30,000 to $50,000.

    c) A large, high service trap system designed for up to 10,000 or more annual adult spawners would likely consist of a permanent concrete barrier dam at Hilton Creek and across the mainstem at the foot of Bradbury Dam, a permanent trap and holding tank system, hopper hoist system, brail crowder panels, handling equipment, etc., and at least three 1,000 to 2,000 gallon aerated and refrigerated tank transport

systems. Pump-back attraction flow might be desirable to enhance adult fish attraction efficiency. The transport tanks would require 2.5 ton truck chassis, or other similar capacity air or land transport vehicles. Total installed cost for such a system would be in the range of $1.5 to $3 million, with an annual labor requirement of approximately 3 to 6 partial year FTE's (from $150,000 to $300,000). Annual repair and maintenance costs would be in the range of $40,000 to $70,000.

2) Juvenile Fish Collection and Bypass Systems for Bradbury Dam, Gibraltar Dam, and Juncal Dam. As above for adult fish collection systems, there are several feasible alternatives for collecting and bypassing juvenile steelhead outmigrants from each of these three dams and reservoirs. These range in complexity and cost from zero to several tens of millions of dollars, depending on the desired rate of survival from fry to smolt delivered to the lower river mainstem. Based on my review of the Santa Ynez River hydrology above the dams, instream collectors are not recommended. Woody debris, sediment, and high flows would make these designs unreliable. Instead, I recommend development and evaluation of floating collectors located either at the inlet of each tributary below adult release points into the respective reservoirs, or at each dam, depending on the efficacy of through-reservoir migration survival. These floating collectors would include attraction flows provided by low-head electric pumps supplied with power from either fixed grid service lines or portable power generation plants of 50 Kw to 400 Kw size range, depending on the desired attraction flow rate (from about 30 cfs to as much as 250 cfs). Each collector would include a barge with transfer boat and holding tanks, sorting and handling facilities, and water-to-water transfer of juvenile fish to downstream transport tank systems, or bypass pipe to shore based facilities.

   a) The simplest collector systems would include a single floating collector at each dam, located near the existing outlet works. Reservoir migration survival studies would be required to verify the feasibility of this option. Total installed cost of each collector with fish transfer to the top deck of the dams provided by a fixed or portable crane would range from about $2.5 to $5 million. The same tank transport system used for adult fish would be utilized for juvenile fish on the return trip. Average annual labor requirements would be accommodated by operators of the adult trap and haul facility. Annual repair and maintenance costs would range from about $50,000 to $100,000 for each collector.

   b) Should through-reservoir survival studies prove the at-dam collector undesirable or infeasible, individual collectors would have to be located in the reservoir at the inlet of each tributary into which adults had been released. Accompanying each collector would be a 100%

exclusion barrier net deployed across the width of the inlet embayment and vertically from the surface to the bottom of the reservoir. The net and collector would be positioned far enough out in the reservoir to lower average net approach velocities to well below the structural capacity of the net material. Total installed cost of each collector and its accompanying net and barge transfer and holding system would range from approximately $5 million to $10 million. Annual labor requirements would necessitate the addition of from 1 to 2 partial year FTE's ($50,000 to $100,000) to that required for the adult trap and haul system, since the same crew would do both tasks.

3) Adult fish passage and juvenile fish passage around Alisal Dam. The scale and cost of a passage system around Alisal Dam would be proportionally less than the system designed for the larger storage dams on the Santa Ynez River. Since the reservoir is very small, and the forebay elevation does not generally vary significantly on a seasonal basis, a juvenile collection system may consist of nothing more than bypass outlets that are designed to meet bypass criteria for steelhead smolts (30 fps maximum velocity, smooth interior, gradual bends >3 diameters in radius, no exit plunge in excess of 25 fps, etc.). Since the reservoir elevation is largely fixed, a small fish ladder for adult passage might be feasible. If not, a simple floating picket weir or fixed braille weir would be used. Total installed cost of providing passage around Alisal Dam would likely range from $500,000 to $2.5 million, depending on the height of the dam.

4) Average survival rates for adult trap and haul facilities range from as low as about 90% for fragile sockeye and pink salmon, to as high as nearly 100% for robust fish such as chinook and steelhead. Juvenile salmonid survival through a floating collector and screens ranges from perhaps 80% for coho to as high as 95% or higher for larger steelhead smolts. Collection efficiency may range widely, depending on whether 100% exclusion is provided by the barrier net and collector screen. Overall, a combination of upstream adult fish migrant trap and juvenile fish floating collector can achieve survival and passage efficiency rates ranging from 50% to as high as 95% to 98%. The desired minimum acceptable rate of survival must be determined by evaluating the stock's potential to re-inhabit previously inaccessible habitat and become self-sustaining over time through larger watershed historical survival studies.

5) With regard to the relative success of fully restoring steelhead runs on the Santa Ynez River with the above-discussed passage systems or only with downstream flow augmentation and enhancement, it would appear that a steelhead restoration plan that included passage to the upper basin would be the most successful. According to historical documents reviewed, the upper basin contains the majority of available historically spawning and rearing habitat, therefore one would expect

that the overall success of the Santa Ynez River steelhead run would benefit the most from provision of upstream and downstream passage.

6) Overall, I believe an evaluation of adult and juvenile fish passage around the three storage dams and Alisal Dam is warranted and should be conducted to determine to most effective solution.. This evaluation should consider a range of feasible fish passage alternatives, including all of the above-mentioned juvenile collection systems and adult trap and haul systems. The geographic scope should include Bradbury Dam, Gibraltar Dam, and Juncal Dam, as well as Alisal Dam and Hilton Creek.

7) Should the Water Board decide to move forward with development of fish passage solutions around the dams, a phased approach to implementation is recommended. Each phase would be accompanied with requisite survival and migration success studies to define acceptable and unacceptable performance levels, and to refine the system design to optimize the fish passage system. This approach would consist of the following steps:

   a) Temporary adult fish trap facility at Hilton Creek, with truck transport to mainstem above Bradbury Dam. Smolt sampling collection would be conducted in screw-type or other suitable temporary trap systems in the mainstem just above the inlet to Lake Cachuma to determine net proportion of smolt-ready juvenile fish to resident life history juvenile fish. Through-reservoir survival radio tag tracking studies should be conducted to assess potential predator losses and migration success.

   b) If sufficient numbers of smolt-ready juvenile fish are collected in mainstem sampling trap to justify additional effort at re-establishment of sea-run fish, then install semi-permanent adult trap at Hilton Creek. Captured adult fish would be truck transported to mainstem and other release points above Bradbury Dam and perhaps Gibraltar Dam. If in-reservoir survival or migration success is found to be unacceptable in step a) above, then install floating juvenile collector in Lake Cachuma near inlet of mainstem and, if necessary, in Gibraltar Reservoir near the inlet of mainstem. Barge or bypass pipe transfer smolts to constructed truck transport facility on shore near collectors. If in-reservoir survival or migration success is found to be acceptable in step a) above, install floating juvenile collectors in forebays of Bradbury and Gibraltar Dams.

   c) If success is found with semi-permanent adult trap and floating juvenile collector systems as described in parts a) and b) above, then install full juvenile collection and transport system as discussed above in parts 1c) and 2b) above, and improve adult trap to permanent standards.

LITERATURE REVIEWED

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Turner, John, 1997 (Jan. 16). Comment on December 2, 1996 Revised Draft of Santa Ynez River Report [Letter to Mr. Chuck Hanson, Hanson Environmental, Inc]. Department of Fish and Game, California. [Ex. CT 28-B]

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PERSONAL COMMUNICATIONS

Mark LaRiviere, Tacoma Power (Cowlitz River project)

Paul Hickey, Tacoma Water (Tacoma Water diversion on the Green River)

Kevin Brink, Puget Sound Energy (Baker River project)

Larry Crain, US Army Corps of Engineers - Seattle District (Mud Mountain Dam on the White River)

Bruce Bachen, Seattle Water Department (Cedar River sockeye broodstock collection system)