HUMBOLDT STATE UNIVERSITY
Environmental Resources Engineering

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Division of Water Rights
State Water Resources Control Board
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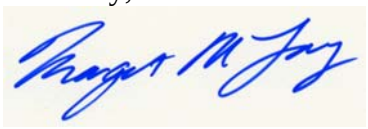
Dear Ms. Niiya:

Attached please find my comments on the draft Policy for Maintaining Instream Flows in Northern California Coastal Streams. If the draft policy is adopted and consistently enforced it would be a major step forward for the protection of anadromous fisheries resources for Northern California Coastal Streams.

Please feel free to contact me with questions or clarifications.

Sincerely,



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**Review Comments for the Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams**

## General Comments

The draft policy *Policy for Maintaining Instream Flows in Northern California Coastal Streams* is a major step forward in the protection of anadromous fisheries resources for Northern California Coastal Streams. If the proposed regulations are adopted and enforced this could mean a significant improvement for aquatic resources in the region.

Research efforts to verify the many assumptions needed to quantify water availability and flow needs for aquatic resources are also important, with watershed scale issues and lack of long-term data for small watersheds being especially important. Climate change was not mentioned in the draft policy, and MBF and MCRs may mitigate against possible climate change influences, but recognition that past conditions may not be representative is important. This could be especially relevant for site-specific studies relying on historical data or the regional regression equations of Waananen and Crippen (1977), which have not been updated for over 30 years.

Though difficult to directly address through regulation, the draft policy could be strengthened and supported by clear monitoring goals. Monitoring goals are especially important because over-allocation of water has already occurred in many watersheds and unpermitted diversions present an additional stress. Other reviewers have recommended development of monitoring strategies to evaluate and verify policy assumptions and to support an adaptive management strategy for implementing this policy. Monitoring needs and opportunities are outlined where appropriate in discussion of specific topics below.

Another issue that was not addressed by the draft policy is a periodic re-assessment of the policy. Previous reviewers (Moyle, Kondolf and Williams) suggested an adaptive management framework for implementing the policy. Success of adaptive management relies on clear policy objectives and data as well as regular evaluation and reassessment of the policy's objectives. A schedule for review or regular summary of the policy effectiveness, perhaps with specific projects as examples, is recommended.

## Requested Topics Comments

### 1. Setting seasonal limits on diversion

The draft policy sets the seasonal limit on diversion as October 1 through March 31. DFG/NMFS and others recommended a seasonal limit of December 15 through March 31 because, in most years, reliable rainfall does not begin until late-November to mid-December. Thus, the December 15 start date is much more likely to prevent water diversion during the extreme low flows present before the onset of consistent rainfall.

The minimum bypass flow requirements may prevent diversion before instream flows are sufficient to meet a diversion need, but the MBFs were selected to provide minimal flow requirements to meet spawning and upstream passage needs. There is new but very

convincing evidence that there are other important benefits to instream flows (e.g. food production/availability, maintaining water quality) that are especially important to late summer/early fall conditions in Northern California coastal streams. As an example, Harvey et al. (2006) found that resident salmonids had growth rates 8.5 times greater over a 6-week period in undiverted reaches of the same stream, at a northern California coastal site. In these experiments, the flow diversion rate decreased the water velocity in the riffles but did not significantly decrease available habitat area or volume. The invertebrate drift, or food availability, was much higher in the undiverted stream reaches. The experimental stream reaches in the study were adjacent and within the same stream. Growth of salmonids is very highly related to survival; thus, the assumption that maintaining instream flows only for upstream passage and spawning is protective of anadromous salmonids may not be appropriate. Additional research on these issues is ongoing (Harvey, Pers. Comm 2008).

There is also evidence that spring (March) flow is also important for similar reasons. Lobon-Cervia (2003) observed that in a northern Spanish stream "increased discharge in March apparently increased essential resources for brown trout at or just after emergence." The emergence timing of brown trout and Mediterranean climate of northern Spain are similar to California's hydrologic climate and anadromous salmonid emergence timing, respectively. As far as I am aware, local or regional research on these issues is not available.

An additional concern is that for many diverters the likelihood of having water available for diversion in October is low. For most watersheds, the early fall storms replenish soil moisture but do not significantly increase instream flows. Thus, expectations should be clearly spelled out to applicants. A possible alternative is to tie diversion timing to actual and persistent flow increases.

**2. Establishing minimum bypass flow requirements (MBFs)**

I have several concerns about the minimum bypass flow requirements:

1) the value adopted

2) the data used to determine the MBF value for a particular stream, and

3) the assumption that the MBFs should be set only for protection of fish passage and spawning.

MBFs are essential for regulating instream flows because they provide a target for both regulators and diverters. However, the value presented in the draft policy ($0.6Q_m$ or a function of drainage area) are not very protective of fisheries resources. Of the studies summarized in the Task 3 Report, Appendix A, p. A-3, the lowest minimum fraction of $Q_m$ suggested for protection of suitable habitat was $0.68Q_m$. Setting the MBF at $0.6Q_m$ provides very minimal protection for fish populations.

The draft policy's method for estimation of the minimum bypass flows is also likely to have considerable error for many streams. The draft policy's recognition that larger relative flows are needed for passage and spawning in smaller watersheds and

developing relationships that include this drainage area dependence is a major improvement. However, few data are available to verify these relationships. Additional data collection on small stream hydrology and fish usage is needed to verify these relationships.

The recommended methods for establishing $Q_m$ in the absence of actual gage data may have significant error. Scaling by watershed area and mean annual precipitation works reasonably well for peak and major storm flows dominated by the rainfall generated runoff (assuming the storm influences at nearby gaged sites are consistently similar to the watershed of interest) but at lower flows, more subtle factors such as watershed geology, slopes, ground cover, soil thickness, etc. influence the stream flow. The mean annual flow is as much a function of storm flows as low flows that do not generally correlate as well to drainage area. These relationships also need additional data collection and verification.

Data quality is also a concern. Gage data for many watersheds are sparse. The draft policy's suggested estimation methods would require using many gages that have records of less than the 10 years, which introduces major uncertainties.

An additional concern for MBFs is the assumption that protection of fish passage and spawning is the key criteria for establishing the MBF level. These two needs are very important to salmonid viability but there are other needs, e.g. food availability, food delivery from upstream, and hiding cover, that are also important and not as well characterized. See the discussion above under (1) for explanation and references.

**3. Establishing maximum cumulative diversion requirements**

The maximum cumulative diversion requirement proposed, 5% of the unimpaired1.5-yr instantaneous peak flow, is probably a reasonably protective limitation for maintaining channel maintenance flows. The analysis by Stetson Engineers, Inc (Task 3 Report, Appendix F) shows that this diversion limitation did not maintain the natural hydrograph as well as the 15% of the 20th percentile exceedence flow proposed by the DFG/NMFS 2002 Draft Guidelines, but in many years the difference in instantaneous peak flow between the two methods was small. I conducted a quick analysis using the regional regression equations with watershed areas of 1, 10 and 100 $mi^2$; mean annual precipitation of 33, 35, 37.5 and 40 in/yr; and the methods described in Appendix 1, Section A.5.2.3B of the draft policy. This analysis showed that by removing 5% of $Q_{1.5\text{-yr}}$ as the draft policy allows, a flow with return period of 1.59 to 1.63 years is needed to deliver the unimpaired $Q_{1.5\text{-yr}}$. The frequency difference between 1.5 and 1.6 years is likely insignificant. It might be worthwhile to repeat this analysis with data from several specific stream gages.

The draft policy text does not clearly state that maximum cumulative diversion is 5% of the *unimpaired* 1.5-yr instantaneous peak flow and this becomes clear only in Appendix 1, Section A.5.2.3. It should be clearly stated in the policy text, too.

The analysis by R2 Resources and Stetson Engineers, Inc (Task 3 Report, Appendix F) clearly shows that maximum cumulative diversion limits set as volumes failed to meet

the stated criteria of providing for channel maintenance flows. Stating the criteria as a volume would not meet objectives of the policy.

**4. Conducting site-specific studies**

Allowing applicants to perform site specific studies is a good idea if the study quality is confirmed by Water Board staff and other agencies as needed. The potential for data sharing between relevant agencies should also be recognized and taken advantage of when site specific studies are conducted.

Currently, the guidelines for the site specific studies do not include a measure or indication of the climatic conditions under which the site-specific observations were collected. Variances in diversion season may appear favorable if the two years of site specific data were collected in a wet period versus a dry period. General climatic condition could be estimated by comparing a year's actual annual rainfall to the mean annual.

The site-specific analyses rely on the expertise of a Water Board-approved fisheries biologist. For most of the information to be determined by a site specific study (upper limit or anadromy, stream class, etc) this is appropriate; but there are some tasks such as hydraulic analysis and hydrologic assessment and data collection that require expertise other than fisheries biology. Water resources/environmental engineers or hydrogeologists/hydrologists experienced with fisheries resource issues would be better suited for these tasks. The Water Board should recognize the possible need for multidisciplinary contributions to the site specific study when approving professionals for these tasks.

**5. Assessing the cumulative effects of water diversions on instream flows needed for the protection of fishery resources**

Policies to address some of the cumulative effects of diversions are a major improvement of the draft policy. Implementation of a maximum cumulative diversion rate is an important policy. In addition, selection of appropriate and limiting POIs will best monitor and mitigate for cumulative effects. When possible, POIs should be selected with input from DFG/NMFS, and locations where either man-made or natural passage and spawning limitations or problems have been identified in the past should be selected. When identified, these locations should also be considered for permanent monitoring sites.

Requiring applicants to use existing databases such as the CalFish web-based databases (http://www.calfish.org/) to identify known barriers on streams with proposed diversions would help identify possible passage POIs.

**6. Minimizing the effects of onstream dams on fishery resources**

If adopted, the requirements of the draft policy should minimize the effects of onstream dams. Because many of the mitigation policies (e.g., providing fish passage and wood/gravel augmentation) can be quite expensive and the disruption of natural processes by onstream dams is extensive, onstream dams should be discouraged.

**7. Providing passage for fish migration and requiring screening of water diversion intakes**

DFG and NMFS have existing criteria for fish passage and screening and these should be enforced at all diversions that affect fish passage. Section 4.3 of the draft policy allowing applicants to petition these requirements with consultation and assessment of the project by DFG, and sufficient proof from the applicant and DFG of this evaluation is reasonable.

**8. Application of criteria developed to protect anadromous fishery habitat flow needs to fish habitat, in general, within the policy area**

Whether the criteria developed to protect anadromous fish habitat satisfies the needs of other native fish should be addressed by fisheries biologists and appropriate field observations.

**References**

Harvey, B.C., R. J. Nakamoto and J. L. White. Reduced Streamflow Lowers Dry-Season Growth of Rainbow Trout in a Small Stream. *Transactions of the American Fisheries Society* 135:998–1005, 2006

Lobon-Cervia, J. Spatiotemporal Dynamics of Brown Trout Production in a Cantabrian Stream: Effects of Density and Habitat Quality. *Transactions of the American Fisheries Society* 132:621–637, 2003

Waananen, A.O. and J.R. Crippen. *Magnitude of Frequency of Floods in California. Water Resources Investigations* 77-21. USGS, Washington, DC. 1977.