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Ms. Karen Niiya, Senior Engineer
State Water Resources Control Board
Division of Water Rights
1001 I Street, 2nd floor
Sacramento, California 95814

Public comments on the Policy for Maintaining Instream Flows in Northern California Coastal Streams

Dear Ms. Niiya,

Our research group at the University of California, Berkeley, and the Hopland Research and Extension Center has been studying stream ecohydrology and water management primarily in the Russian River watershed since 2000. We have specifically studied streamflow and its links to aquatic organisms, and the interactions of those natural phenomena with management practices, in field applications in the study region; and we have constructed an extensive geographic information system to study the spatial context of natural and human systems, test management scenarios, and develop predictive models that incorporate systemic trends. We believe that our research may provide insights into the new instream flows policies that may be useful to ensure sufficient resources to meet human and ecosystem needs.

We were pleased with two particular developments in the new AB2121 guidelines. The first is that the new equation for calculating Q_{mbf} was derived using empirical data directly related to the ecosystem threshold it is intended to measure; and these data were from pertinent locations in the drainage network, incorporating small headwater streams and lower reaches alike. This marks an important improvement relative to the 1997 draft guidelines (even if some data used to derive the equation are from beyond the study region) and provides a suitable preliminary estimate for the flow magnitude required for salmonids to migrate upstream; the opportunity for water right applicants to determine that actual flow threshold (with an appropriate scientific representative) represents an important adaptive component of the new policy to reflect actual conditions as much as possible. The second is the idea of the Watershed Approach. The Watershed Approach allows flexibility for managing water across parcels and among users in a watershed; it is especially important for people who have need for water during periods of low natural availability (i.e., the growing season), but who do not have suitable conditions for storing water during periods of abundance. Further, it requires additional data reporting (e.g., streamflow monitoring, biotic habitat assessments) in addition to the requirements for surface water appropriation described in the new Ab2121 Draft Policy to document the regional protective criteria in the AB2121 Draft Policy. This approach is an important first step toward comprehensive watershed assessment that is essential for sustainable water management, and can become the framework for a public process for watershed planning that would allow for assessment and proposed alterations needed to recover stream flows in watersheds containing critical habitat. Such a planning process could be coordinated in a similar multi-agency effort as the former Coastal Watershed Planning and Assessment Program and would focus on recovering natural flow regimes across the entire year for salmon recovery in addition to other restoration treatments needed to address other limiting factors. This approach would allow greater representation in the watershed planning process as well.

In addition to these brief comments, we have four additional thoughts that may benefit aquatic ecosystem conservation and the task of managing water resources in the region.

Policy scope

One of our principal concerns is related to disconnect between the general objectives and reach of the new policies. California Water Code section 1259.4 states that these policies will serve as "principles and guidelines for maintaining instream flows in coastal streams from the Mattole River to San Francisco and in coastal streams entering northern San Pablo Bay." The terms and conditions described in the 2007 Draft Policy focus on preserving winter flows and proscribe additional spring, summer, and fall diversions. These are all important steps for maintaining instream flows to support anadromous salmonids, but they address only a portion of the constraints that water management practices have on instream flows. Most significantly, they do not address existing water use in spring and summer: we have documented examples of instream and near-stream diversions causing flow to fall to near zero in many small streams, months earlier than would occur naturally (Figure 1; from Deitch 2006, and upcoming in Deitch et al., *River Research and Applications*). Zero streamflow in March or April, where flow would otherwise persist into July, August, or September, may both reduce the viability of redds in those reaches and reduce food supply for juvenile salmonids in summer months. Maintaining winter flows and prohibiting additional "out-of-season" diversions are important, but neglecting the existing pressures already on streamflow prevents the proposed policies from maintaining all ecologically relevant instream flows in coastal streams. The cumulative magnitude of diversion exceeds expected discharge in spring and summer in almost all of the major tributaries to the Russian River (Figure 2; from Deitch 2006, and upcoming in Deitch et al., *Aquatic Conservation: Marine and Freshwater Ecosystems*), suggesting this is a regionwide problem.

Because surface water diversions during spring and summer are widespread through the AB2121 region, it is possible (and we believe, likely) that the management guidelines described in the 2007 Draft Policy are insufficient to create flow conditions necessary for salmonid recovery in the region. Therefore, it must be understood that a biological criterion such as higher abundance of salmonids (e.g., as described in Section 10 of the R2/Stetson August 2007 report) cannot be used as an indicator of the success of these new guidelines. The 2007 Draft Policy outlines the practices necessary to maintain suitable flow conditions during winter, but our data (including those described above) suggests that the primary hydrological impediment to salmonid persistence stems from loss of spring and summer streamflow.

Realities of the regional protective criteria

We also have comments on the specific components for preserving winter flows and their technical implications. As they stand, the minimum bypass flow threshold and maximum cumulative diversion seem appropriate for maintaining conditions suitable for the persistence of salmonids in the region. The combined effects of these standards, however, may place unexpected constraints on water management practices. For example, consider a small water project in the headwaters of Pena Creek, tributary to Dry Creek below Warm Springs Dam in Sonoma County, at a location with an upstream catchment of 1.0 mi^2 (Figure 3). We calculated the minimum bypass flow for this location to be approximately 21 ft^3/sec. Scaling streamflow in a normal-type year (using water year 1981, which is the year with median annual discharge over the 12-year period of record) proportionally by watershed area and precipitation from the historical Pena Creek gauge to this location in the Pena Creek watershed, the flow bypass flow would be exceeded only 4 days. Given this hydrologic scenario, water users would have an opportunity to divert on 4 days at this location.

We ran similar calculations for a point farther upstream in the Pena Creek drainage, at 0.5 mi^2 (Figure 3). At this point, the calculated minimum bypass flow is approximately 15.5 ft^3/sec; this flow magnitude is exceeded only two days, based on historical mean daily flow data for the median-discharge year. Considerations to streams of this size are important because our GIS research indicates that more than 90% of the 1000 reservoirs in the Sonoma County portion of the Russian River watershed have upstream catchments less than 0.5 mi^2.

The intent of this discussion is not to argue whether the minimum bypass flow and maximum cumulative diversion constraints are suitable. Rather, we believe it is imperative for water right applicants to understand the practical implications of these constraints in the context of the stream hydrology expected at the proposed point(s) of diversion. To address this, we urge the Division to consider adding an additional requirement to the Instream Flow Analysis required for all new appropriations: applicants must determine the number of days over which water could be diverted at the proposed point of diversion, given Q_{mbf} and streamflow records from the nearest gauge, in a normal-type year; and multiply that number of days by the Q_{mcd} to determine the total cumulative abstraction, annually, that may occur above the proposed point of diversion. It is also useful for applicants to perform similar analyses for a typically dry year (such as that with a total annual discharge exceeded by 75% or 80% of the years of record). Many of the data necessary for these calculations will already be assembled (streamflow at the nearest USGS gauge, proposed POD catchment area, USGS gauge catchment area, and the Q_{mbf} estimate), so it would simply require counting the number of exceedence days at the proposed POD for two different years. Applicants in small headwater streams must be aware that they may have few possible days to divert in a typical year, and this analysis would provide the opportunity to perform this self-check. These additional steps will help applicants determine whether the project as proposed can realistically meet its intended objectives.

Additional guidelines: specifics for small reservoirs

Though our intent in this discussion is not to argue whether the regional protective criteria are suitable for ecosystem conservation, we do believe that they may be prohibitive for water users to meet their water needs. Because these criteria become so restrictive in headwaters, we think it may be useful to consider an exception rule for very small reservoirs located in headwater reaches where their impacts to streams with anadromous fishes would be low. The conditions for appropriation presented in the 2007 Draft Policy describe important for maintaining flows relative to instream diversions, but the 2007 Draft Policy does not specifically address the conditions for approval of onsite dams on Class III streams beyond the regionally protective criteria. The rationale for creating a small reservoirs rule is that small reservoirs far above anadromy may provide opportunity to store water during high flows, despite that defined thresholds at that point may not be exceeded; and taking water when abundant in winter is critical for mitigating the impacts of diversions in spring and summer. Water needs during the growing season will be met one way or another, and rules designed to minimize the cumulative effect of small reservoirs in a watershed on streamflow at anadromy reaches provide a more viable alternative for salmonid persistence than diversions in spring and summer under a legal gray area.

Because small reservoirs withhold water as it flows proportionally with discharge at a downstream point, rather than diverting it as direct instream diversions operate, a particular maximum diversion magnitude is not entirely compatible with objectives for small reservoirs. For example, very high flow conditions would allow requirements to allow reservoirs to take more water than a defined threshold magnitude would allow; this may not necessarily magnify adverse impacts because more water is available during such high-flow periods. Past efforts to define reservoir and abstraction thresholds have focused on considering the cumulative impairment that all upstream abstractions may cause. It is certainly important to consider the cumulative impairment at a point of interest and the relative storage of each reservoir (i.e., the magnitude of impacts), but it is equally important to consider the duration of impacts that small reservoirs cause on streamflow and aquatic resources.

We believe there should be a defined policy for evaluating small reservoirs on Class-III streams that weighs impacts on local and downstream hyrology, relative to both the magnitude and duration of the effects they may have. For example, new reservoirs could be approved if: (1) they impound no more than a defined portion of the average annual discharge at the proposed dam site; and (2) the total amount of impounded catchment upstream of the transition point from Class III to Class II stream does not exceed a certain percent. The implications of these parameters under a natural flow regime (considering the range of variation from one year to the next, and across the region) have not been tested, but the purpose is straightforward: in a typical year, a large percent of the annual discharge would flow beyond the reservoir locally because it would fill early in the year, and it would ensure that much of the catchment at the Class II-III transition would always be hydrologically and geomorphically connected downstream. Rules such as these could reduce the dependence for a "passive bypass system," which could result in less water actually being stored than expected and have adverse geomorphic impacts as well. Such an exemption for small reservoirs in headwater streams would be a significant policy change any set thresholds should be determined by resource agency experts, hydrologists, and stakeholders familiar with small reservoir management.

A spatial tool for evaluating proposed water rights

Because the task of applying for water rights and evaluating proposed projects has become so complex, we believe it would be useful to develop a thorough spatially explicit comprehensive tool for guiding the water rights process. This need stems from two perspectives. First, the 2007 Draft Policy requires water right applicants to perform a thorough exploration of senior water rights and hydrologic data relative to proposed points of diversion as part of the Instream Flow and Water Availability Analyses. Informal feedback from potential appropriators and researchers has indicated that this is an enormous undertaking for individual applicants; yet we agree that this information is important for understanding how a proposed diversion may affect senior water right holders and hydrological conditions locally as well. Because the data required for these water supply and water availability reports are so extensive, compiling these data may not accelerate the approval or disapproval of pending or future water rights as the policies are intended. Second, from the perspective of agencies charged with evaluating proposed projects, the tools currently employed may not allow for transparency and methods for analysis may be overly time-consuming.

A spatially explicit GIS tool could automate the water right application and evaluation process. Such a tool would merge a spatially inclusive geographic information system with senior water rights and streamflow information from databases within the same server, allowing applicants to access all necessary components for the water supply and water availability reports pertinent to proposed locations chosen by the applicant on the GIS. The new e-WRIMS indicates that the specific details of water rights have been constructed into a GIS; with cooperation of Division of Water Rights staff, our research group or an appropriate research organization could develop a web-based tool that provides all the information for each Report, including impacts of proposed projects on senior water right holders, estimates of the unappropriated water supply at each proposed POD, and remaining unappropriated water supply and project water abstraction; as well as the estimated bypass flow based on nearest USGS gauge and the duration over which such flows would be exceeded at that point. In short, a GIS/database tool with a web-based interface could provide a comprehensive and standard mechanism for creating water supply and availability analyses, which would save applicants from the cost of piecemeal analyses for each new water right, and would save Division staff and other resource agencies from having to review ambiguous reports. All the data for such a tool are available. They just need to be compiled and placed in an appropriate spatial framework.

A suitable GIS tool may also provide a spatial framework for guiding and evaluating the Watershed Approach, for assessing the ecological benefits of shifting water demand from times of need (such as the summer growing season), to periods of relative abundance, and for comparing management scenarios (such as the magnitude of different Q_{mbf} or Q_{mcd} values) across a drainage network. We would welcome the opportunity to develop and test hypotheses of local- and cumulative impacts related to small reservoir construction policies, if the opportunity were to arise.

Sincerely,

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Adina Merenlender, Ph.D.
Cooperative Extension Specialist, University of California, Berkeley

Cited:

Deitch, M.J. 2006. Scientific and Institutional Complexities of Managing Surface Water for Beneficial Human and Ecosystem Uses under a Seasonally Variable Flow Regime in Mediterranean-Climate Northern California. PhD Dissertation, University of California, Berkeley, California USA. (online at http://www.lib.berkeley.edu/WRCA/restoration/pdfs/MDeitch_phd06.pdf)

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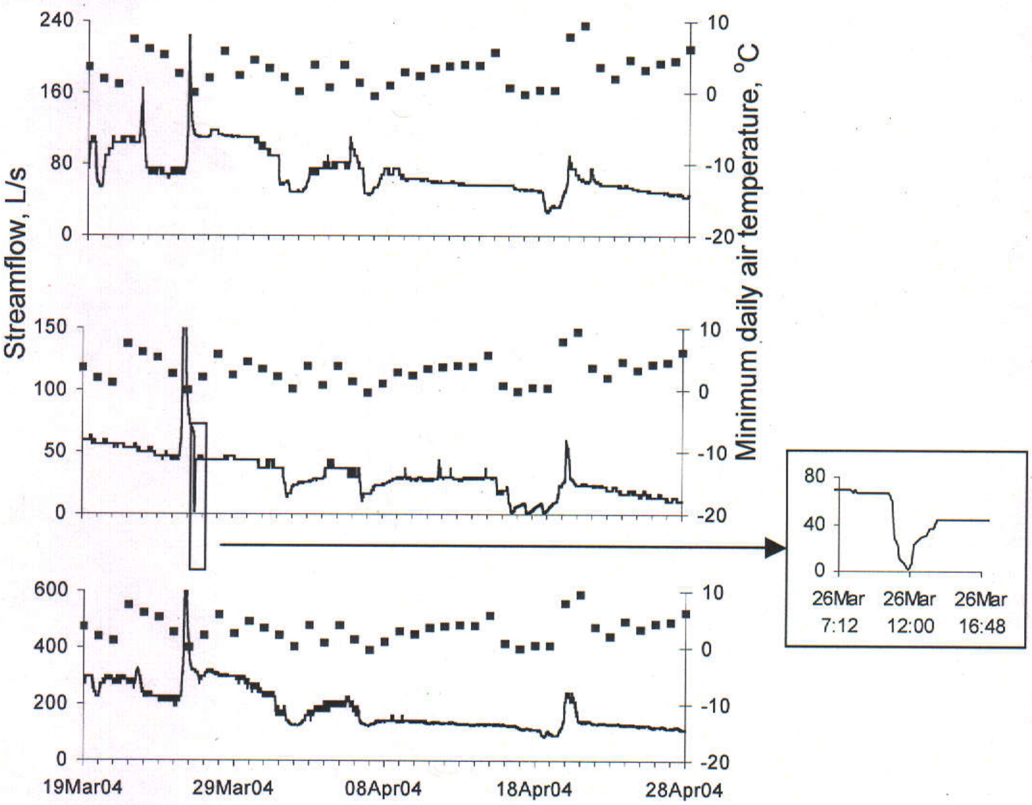

Figure 1. Streamflow hydrographs in the Franz Creek drainage network in water year 2004; and minimum daily air temperature recorded in Santa Rosa (southeastern Sonoma County). From Deitch et al., A.

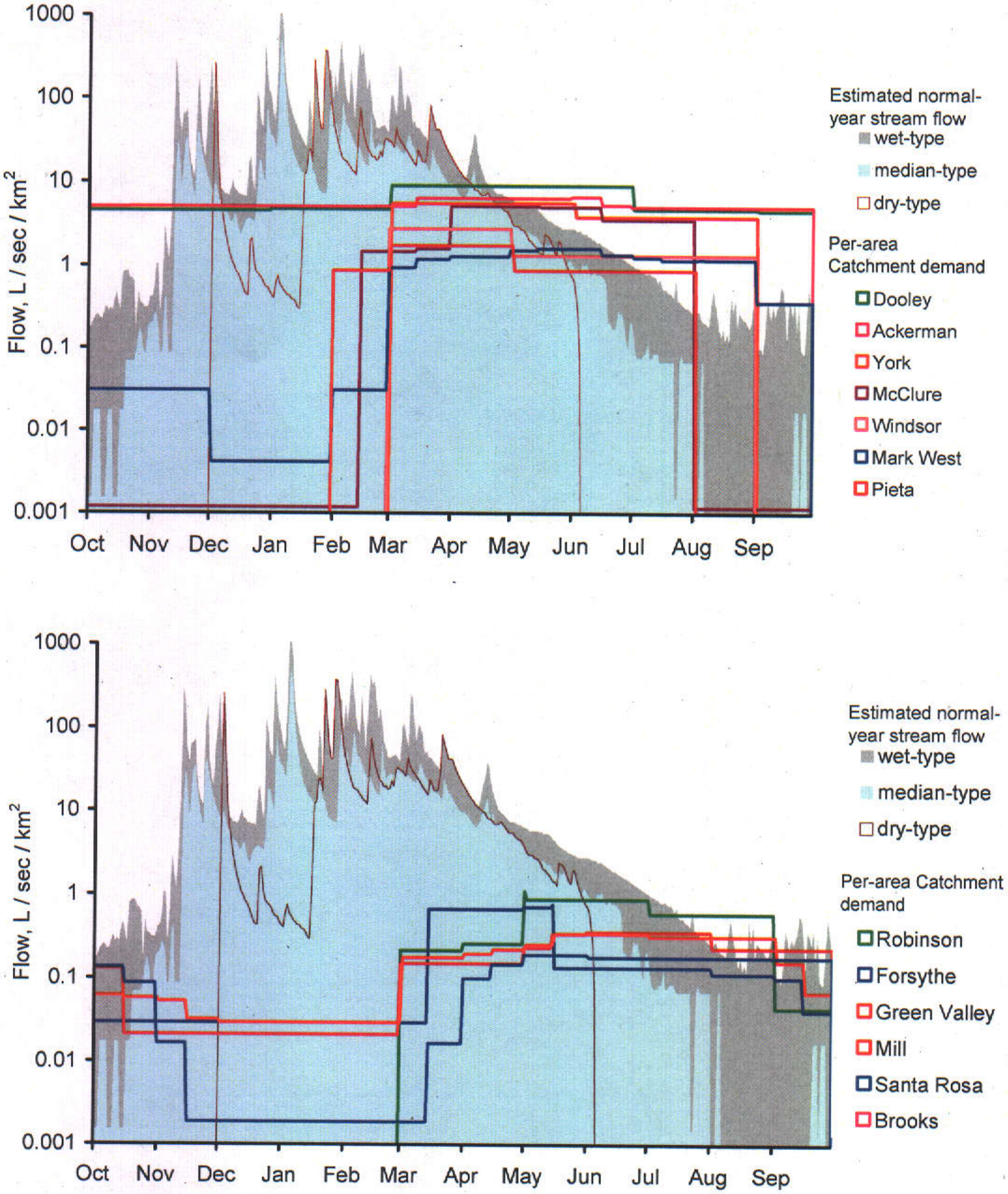

Figure 2. Daily surface water balances through a water year for the thirteen ungauged Russian River tributaries (From Deitch et al. B): estimates of normal-year flow under a wet-type, middle-type, and dry-type flow regime, and surface water demand (as sum of all water right diversions at a daily timestep) from each catchment, both as L/sec/km^2 (plotted on a logarithmic scale). Streams were split between two graphs for visual purposes, grouped as higher and lower demand based on demand during spring and summer (Brooks Creek demand is less than 0.001 L/sec/km^2 throughout the year).

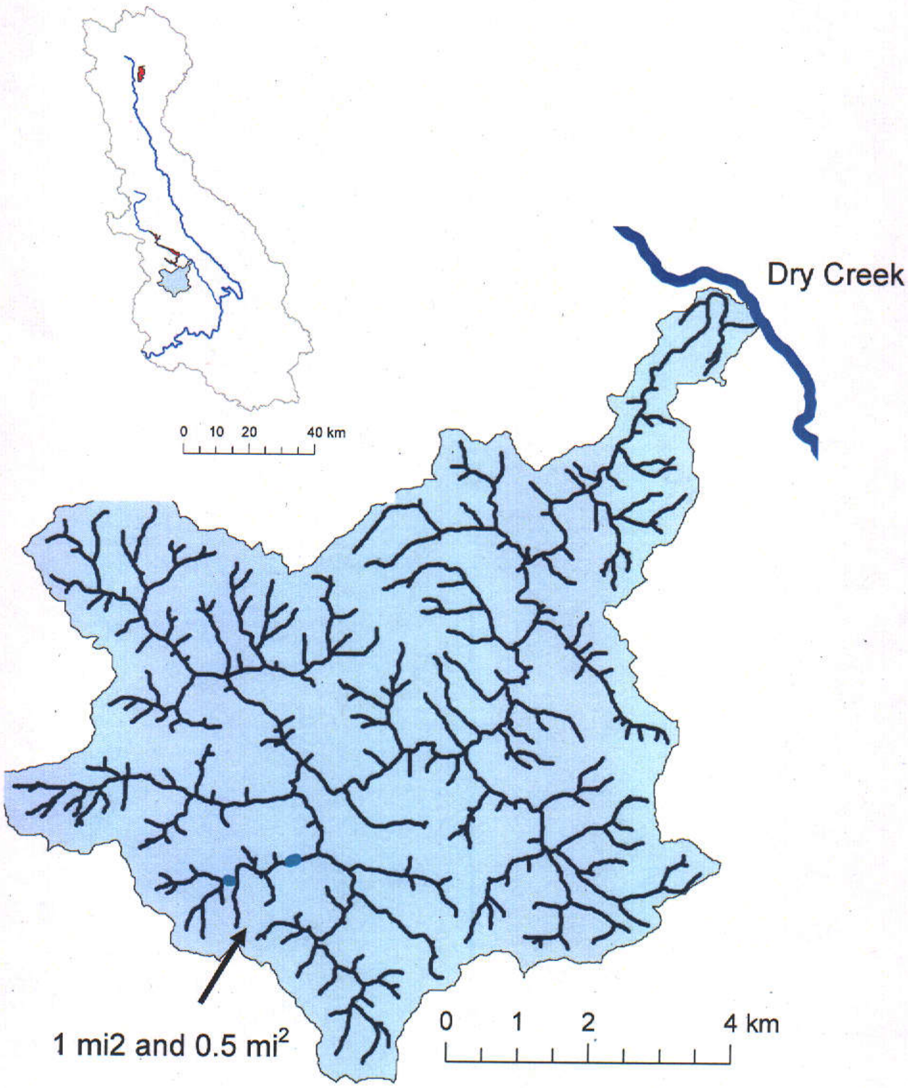

Figure 3. Pena Creek, tributary to Dry Creek in the Russian River watershed with an upstream drainage of approximately 23 mi^2; and reaches at 0.5 and 1 mi^2.