Appendix A: California Department of Fish and Wildlife Consideration of Landowner and Stakeholder Input on the September 16, 2014 Draft Big Sur Flow Regime Recommendations Report

The California Department of Fish and Wildlife invited the public to provide input on the September 16, 2014 Draft Big Sur Flow Regime Recommendations Report. CDFW received input from four individuals. That input from the public and CDFW's consideration of that input is provided here in order to provide as more background on CDFW's recommendation.

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Unfortunately, to the extent that the recommendations depend on an application of the Physical Habitat Simulation System (PHABSIM), they are not scientifically supported. PHABSIM is a fatally flawed method that should have been abandoned long since. Although the method has been popular with agencies and consultants because it purports to show the relationship between discharge and stream habitat, it is not scientifically defensible (Castleberry et al. 1996), for reasons detailed in Williams (2011). Habitat selection is conditional: PHABSIM assumes that habitat selection indicates habitat quality, but habitat selection by fish such as juvenile steelhead depends upon factors such as water temperature, food supply, presence of predators or competitors, time of day, light level, and even discharge itself. And, habitat selection necessarily is limited to the available habitat. Habitat selection is based on factors at multiple spatial scales. PHABSIM is a microhabitat model; that is, it assumes that habitat selection depends only on the "microhabitat" variables of local depth, velocity, and substrate at fine spatial scales. In fact, juvenile steelhead select habitat based on factors at multiple spatial scales. Moreover, there is typically a scale mismatch between the biological and physical modeling in PHABSIM (Kondolf et al. 2000; Williams 2001). There is no good evidence that PHABSIM effectively assesses habitat. Claims that PHABSIM has been "validated" are based on studies that used flawed statistical methods, or at best shows that PHABSIM predicts habitat selection better than a random guess; studies using better methods have found that PHABSIM does a poor job of assessing habitat (see Williams (2011), and especially Appendix A, for details.).	The California Department of Fish and Wildlife (CDFW) Instream Flow Program supports the use of a variety of defensible methods to quantify flow regimes for fish, wildlife, and their habitats. The program recognizes that there are a large number of proven, acceptable, and defensible procedures available for quantifying flow needs. PHABSIM 1-D modeling is one of many methods, which include River 2D hydraulic habitat models, critical riffle analyses, wetted perimeter method, flow duration analyses, channel maintenance flow analysis, site-specific equal-area method habitat suitability criteria development, and others employed during the Big Sur flow study. While PHABSIM, and all methods and models have limitations, our study design and approach accounted for those limitations through a rigorous study and sampling design, use of multiple riverine component tools and methods, and through use of quality assurance/quality control. The following information is gleaned from CDFW Instream Flow Program Fact sheet "Common Methods and Models" located at: https://www.wildlife.ca.gov/Conservation/Watersheds/Instream-Flow to respond to this comment: There is no single best or better method, model, or flow. A flow prescription for fish and wildlife should provide for a flow regime based on the five core riverine components using multiple methods and models. Nonetheless, PHABSIM is currently the most common biology method used by western region fish and wildlife agencies (Annear et al. 2009), including CDFW (and Oregon, Washington, British Columbia, and New Zealand), because it is defensible, and because it can be a powerful incremental tool for examining flow and aquatic microhabitat relationships for salmonids and other species. The challenge in doing a flow study is often selecting a *suite* of tools that provides the necessary flow regime information. Four general, but important, considerations as related to your comments on use of PHABSIM, or generally any method, are presented below: - Models manage uncertainty, they do not eliminate it. - The relationship between flow and habitat is not linear and may differ between streams. - A flow that is beneficial for one species may be detrimental to other species. For example, more flow is not always better. - Model accuracy depends on the accuracy of the data input. Models have specified limits. Due to interactions not fully accounted for or understood, models only address a portion of a system, and may not be able to predict the precise behaviors or relationships of a whole system. - Nonetheless, models are the best tools we have to adequately quantify boundary conditions and render reasonable decisions about flow prescriptions.

Better methods are available. The main defense of the use of PHABSIM has been that better methods are not available. This is false. Even within the basic framework of PHABSIM, logistic regression has been shown to perform better that the "habitat suitability indices" used in PHABSIM. Other better methods, described in Williams (2011), include the DRIFT methodology, developed in South Africa, Demonstration Flow Assessment, Bayesian Networks, and Bayesian Hierarchical modeling. A new methodology, incorporating both Bayesian Networks and Bayesian Hierarchical modeling, has been developed in the Australian state of Victoria over the last decade. This method is described in a 2015 article by Angus Webb and others, which I am also attaching. Given that PHABSIM has been roundly criticized in the scientific literature, it is distressing the report fails to mention the criticisms. It is also distressing the report fails to mention the many calls in the literature, starting with Castleberry et al. (1996), for adaptive management of environmental flows.	The vast majority of instream flow quantification methods are based on some aspect of biology: Biology methods identify how much water is needed to restore and protect the ecological functions of streams (e.g., flow needs for benthic invertebrate production, fishery life stage needs). Procedures used by California's Instream Flow Program are consistent with the five biological methods most commonly used by other state and provincial fish and wildlife agencies in the western U.S. and Canada (Annear et al., 2009). Standard operating procedures and additional guidance may be found on the Instream Flow Program's website: https://wildlife.ca.gov/conservation/watersheds/instream-flow/sop In summary, riverine processes are dynamic and complex, and thus require flexibility in method selection: The evaluation of flow needs in terms of the five core riverine components (i.e., hydrology, geomorphology, biology, water quality, and connectivity) identifies processes and functions that are essential to preserving riverine ecosystem values (Annear et al., 2004). It is critical to account for these riverine components in any flow regime quantification exercise. The use of multiple methods and models can help address the complex ecological relationships of a riverine ecosystem: When deciding which suite of methods (or models) is appropriate for an intended use, the user must take into consideration limitations and constraints. For more information, visit the Instream Flow Council (IFC) website: https://instreamflowcouncil.org . References: Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other coauthors. 2004. Instream Flows for Riverine Resource Stewardship, Revised Edition. Instream Flow Council, Cheyenne, Wyoming. Annear, T., D. Lobb, C. Coomer, M. Woythal, C. Hendry, C. Estes, and K. Williams. 2009. International Instream Flow Program Initiative, A Status Report of State and Provincial Fish and Wildlife Agency Instream Flow Activities and Strategies for the Future, Final Report for Multi-State Conservation Grant Project WY M-7-T. Instream Flow Council, Cheyenne, WY.
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On another matter, the description of steelhead life history in the report relies on as an authority a report that was ground-breaking when it was published, but that more than 60 years ago, and steelhead biology has advanced considerably since. It is now generally recognized that steelhead life histories are more complex than the report indicates. For up-to-date information, I suggest that you contact Dr. Thomas Williams of the NOAA Fisheries Southwest Fisheries Science Center, who leading a study of steelhead in Big Creek, which enters the Pacific Ocean a few tens of miles south the Big Sur River. This study, and others geographically more distant, have shown that steelhead have extremely complex and varied life histories.	CDFW agrees that steelhead have complex and varied life histories. The site-specific Big Sur River steelhead flow criteria are designed to be representative of steelhead's complex and varied life histories, and the description in the flow regime recommendations report is provided only as a general overview of steelhead biology.

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Draft Instream Flow Regime Recommendations Lack Supporting Data to Enable Meaning Evaluation: The draft Recommendations were developed based on technical studies conducted by the DFW. However, the technical reports do not provide sufficient detail or information to enable the public to fully evaluate the instream flow studies conducted on the Big Sur River. When the DFW Instream Flow Program itself assesses study reports submitted by outside parties, it requires study proponents to submit specified and detailed information to ensure the credibility comparability, coordination and scientific defensibility of the studies. (See Instream Flow Program, Instream Flow Study Results Checklist available at http://dfg.ca.gov/FileHandler.ashx?DocumentID=90817&insline) Information required to be submitted include, but are not limited to, the raw field data generated for the project, habitat suitability criteria data, resultant curves and transferability results, and hydraulic models and calibration results. In the case of the Big Sur River, the technical reports released by the DFW do not provide even the level of detail required by its own Instream Flow Study Results Checklist, precluding an independent evaluation of the credibility and scientific defensibility of the instream flow studies and thus the resulting draft Recommendations. For example, the DFW's posted technical reports fail to provide, among other things, the raw field data, photos of all sampling sites taken under different flow conditions, input data decks, the Hydraulic Calibration Report for Big Sur River RHABSIM Model, the HSC curves and associated raw data used in the RHABSIM analysis, the habitat time series data and duration curves, details and data related to results of the 2D models and comparison of results to the 1D model and documentation on the basis for selecting the analytic tools and assumptions used in developing the flow recommendation process. To ensure complete transparency of the instream flow recommendation process, the DFW should disclose the full details of the instream flow studies conducted on the Big Sur River.	Each of the CDFW Big Sur River technical study reports are stand-alone reports prepared in standard scientific reporting format which include summaries of the methods, quality assurance, performance results, and all other relevant information to enable a credible and transparent technical review of the study results. While raw data are typically not provided as part of any technical report because of the common large amount of data developed through instream flow studies, such data are always available upon request. In the case of the raw field data from the Big Sur River study, CDFW provided El Sur Ranch representatives our raw field data for the hydraulic model in April 2013 as requested. The other "supporting data" referred to in the comments such as calibration results and habitat suitability criteria curves have been available for review since July 2014 in Holmes et al. (2014a) and Holmes et al. (2014b), respectively. Related to the transferability element of the Big Sur study – there was no transferability tests since site-specific HSC curves for juvenile rearing were developed. And as mentioned in your comments, the report Instream Flow Evaluation Steelhead Spawning and Rearing, Big Sur River, Monterey County (Holmes and Cowan 2014) also had a separate hydraulic model calibration report prepared, which was finalized and available for public review in August 2014 (Cowan 2014). Please note CDFW does not *require* study proponents to submit raw field data for every study submitted to us for review. CDFW does *request* that groups providing technical flow study reports to CDFW for review and support for determining flows for protecting fish and wildlife to also be prepared to make available the raw data as well as site photographs to aid in the in-house review - if requested on a case-by-case basis. CDFW's Study Review Checklist for Instream Flow Studies has been revised to clarify that raw data, *all* photos from site surveys at different flows, and other such information are not to be included in final study reports, and instead should be available if requested for review in separate files primarily in an effort to limit the large volume of information contained in technical final reports. Please see for clarification: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=90817 References: Cowan, W. 2014. Hydraulic Calibration Report for Big Sur River RHABSIM Models. California Department of Fish and Wildlife, Water Branch Instream Flow Program. 49pp. Holmes, R.W., D.E. Rankin, M. Gard, and E. Ballard. 2014a. Instream Flow Evaluation: Steelhead Passage and Connectivity of Riverine and Lagoon Habitats Big Sur River, Monterey County. California Department of Fish and Wildlife, Water Branch Instream Flow Program Technical Report 14-3. 84pp. Holmes, R.W., M.A. Allen, and S. Bros-Seeman. 2014b. Habitat Suitability Criteria Juvenile Steelhead in the Big Sur River, Monterey County. California Department of Fish and Wildlife, Water Branch Instream Flow Program Technical Report 14-1. 181 pp. Holmes, R.W., and W. Cowan. 2014. Instream Flow Evaluation: Steelhead Spawning and Rearing, Big Sur River, Monterey County. California Department of Fish and Wildlife, Water Branch Instream Flow Program Technical Report 14-2. 66pp.

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Insufficient Support for Assumption that Flow is a Limiting Factor: By definition, the use of instream flow regime recommendations assumes that flow is a significant or key limiting factor affecting one or more lifestage of steelhead inhabiting the Big Sur River. Indeed, the draft Recommendations state, without citation, at page 6, that "[i]nsufficient instream flow has been identified as a key factor preventing recovery of steelhead population viability in the Big Sur River and that "[i]ncreasing instream flows is expected to provide substantive progress towards recovery of steelhead in the Big Sur River." The draft Recommendations, however, provide no citation to evidence demonstrating that the steelhead population in the Big Sur River is either in decline or that flow is the limiting factor controlling steelhead population size. Other studies, neither cited nor discussed by the draft Recommendations, indicate that passage obstacles limiting the reach of anadromy and recreational impacts on the river may be limiting factors on steelhead population size on the Big Sur River. (See e.g., Duffy & Associates, Inc. 2003; Nelson 2014 Big Sur River Steelhead Habitat Assessment, Big Sur River Management Watershed Plan, Appendix III.) There is no discussion in the draft Recommendations concerning whether flows can be "increased" in a biologically significant manner in the unregulated Big Sur River. There is also no evidence cited supporting the assumption that any achievable incremental increase in flows would have a corresponding impact on steelhead population size.	The Big Sur River was placed on CDFW's Priority Streams List (CDFW 2008) by the agency's Director because it contains one of the last strongholds of quality steelhead habitat on California's south-central coast, and because this resource and its' habitat are at risk from pending water diversion applications requesting a large portion of available flow, among other threats (CDFW 2009). Pursuant to the Public Resource (PRC) §10000-10005, an instream flow study must be initiated by CDFW to determine streamflow requirements, in cubic feet per second (cfs), for each river on the priority streams list. Completion of this study, as well as transmittal of its' proposed streamflow requirements to the State Water Resources Control Board (SWRCB) are mandated by the PRC §10000-10005 for their consideration as set forth in Section 1257.5 of the Water Code. Furthermore, water quantity (i.e., instream flow) is listed as a limiting factor which does affect habitat quality for steelhead trout in the Big Sur River (RCD of Monterey County, 2014). Also, California's south-central coast steelhead populations have declined significantly and as a result are listed as threatened (NMFS, 2011). The Big Sur River is also an important source stream for the South-Central Coast Distinct Population Segment (DPS) of south-central coast steelhead trout (NMFS, 2013). NMFS (2013) states that ground water extractions and surface water diversions are primary factors limiting steelhead viability in the Big Sur River (see pages 11-8 to 11-13). In response to the last two sentences - the Big Sur River habitat is at risk from pending water diversion applications requesting a large portion of available flow (CDFW 2009). The purpose of the CDFW stream flow recommendations is to identify stream flows to protect the steelhead resource and the habitats that steelhead depend upon in the Big Sur River. This information is to be considered by SWRCB (as outlined above) in making decisions on water diversion applications. CDFW is not requesting flows be "increased" over those provided by the natural unregulated flow regime. Furthermore, there is a plenitude of "evidence" (e.g., > 6,500 steelhead observed) in the current study that juvenile steelhead habitat selection changes with flow level and associated habitat availability (Holmes et al. 2014a; Holmes et al. 2014b). As such, when water flows are present in the lower Big Sur River at flow levels suitable and preferred by rearing juvenile steelhead (see Holmes et al. 2014a; Holmes et al. 2014b) - more steelhead are present in those habitats. References: CDFW (California Department of Fish and Wildlife). 2008. Priority Streams List for Instream Flow Assessment Prepared by the Department of Fish and Game Pursuant to Public Resources Code (PRC) Section 10004. August 12, 2008. Accessed online at: http://www.dfg.ca.gov/water/instream_flow.html CDFW (California Department of Fish and Wildlife). 2009. Study Plan: Habitat and Instream Flow Relationships for Steelhead in the Big Sur River, Monterey County. Holmes, R.W., M.A. Allen, and S. Bros-Seeman. 2014a. Habitat Suitability Criteria Juvenile Steelhead in the Big Sur River, Monterey County. California Department of Fish and Wildlife, Water Branch Instream Flow Program Technical Report 14-1. 181 pp. Holmes, R.W., M.A. Allen, and S. Bros-Seeman. 2014b. Seasonal microhabitat selectivity by juvenile steelhead in a central California coastal river. *California Fish and Game, Special Fisheries Issue,* 100(4):590-615. Accessed at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=99270

	NMFS (National Marine Fisheries Service). 2011. Endangered and Threatened Species; 5-Year Reviews for 4 Distinct Population Segments of Steelhead in California. Federal Register 76(235):76386. NMFS (National Marine Fisheries Service). 2013. South-Central California Coast Steelhead Recovery Plan. West Coast Region, California Coastal Area Office, Long Beach, California. RCD of Monterey County, Central Coast Salmon Enhancement, Stillwater Sciences and California State University of Monterey Bay. 2014. Big Sur River Watershed Management Plan. Prepared for the California Department of Fish and Wildlife, under a grant for the Fisheries Restoration Grant Program (P1140400). 132 pp. Accessed online at: http://www.rcdmonterey.org/pdf/BSRWMP-1-8-15_no_appendices.pdf
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Incomplete Discussion of Habitat Conditions and Steelhead on the Big Sur River: The draft Recommendations contain a section titled "South-Central Steelhead" (pages 7-9) that provides information on California's south-central coast steelhead population on the Big Sur River in particular. This section, however, fails to provide information from numerous independent investigations concerning habitat and the steelhead population on the Big Sur River. These studies have concluded that the Big Sur River, from the gorge to the lagoon, is highly functional for steelhead production, supports food growth rates with a large percentage of age-1 smolts, and is not food supply limited. 2 (See Titus et al. 2010 ["Recent study of juvenile steelhead use in the lower Big Sur River shows the entire area, from the lagoon to the gorge remains highly functional for steelhead production"]; Central Coast Salmon Enhancement 2014; Collin, 1998; McLaughlin 2009; Hanson 2005; Hanson 2007; Hanson 2011.) The draft Recommendations should provide a summary of known information regarding habitat quality and the steelhead population in the Big Sur River in order to place any flow regime recommendations in context. Review of the recent Bioassessment of the Big Sur River using Benthic Macroinvertebrates (Central Coast Salmon Enhancement, 2014), conducted as part of the Big Sur River Watershed Management Plan Process, revealed that the Big Sur River below the forge was in "fair" to "very good" ecological condition based on the So Cal B-IBI (Southern California Benthic Index of Biological Integrity) scoring of five monitoring sites. All sampled sites had abundant macroinvertebrate densities and assemblages that could be considered productive for Mediterranean stream types in coastal California.	CDFW investigated habitat conditions, characteristics, and associated steelhead habitat use by season extensively on the Big Sur River as discussed in Allen and Riley (2012) and Holmes et al. (2014a, 2014b). We surveyed well over 200,000 square feet of riverine habitats from the lagoon upstream into Pfeifer State Park on three separate time periods (spring, summer, and fall) and recorded over 6,400 steelhead habitat-use observations in the process. Juvenile steelhead habitat selection changed with fish size, season, and most notably - by discharge (i.e., flow level) and associated habitat availability. Big Sur River steelhead trout were observed selecting faster velocity habitats for feeding as the rearing fish grew during the spring and summer seasons. All things considered, water depth and water velocity were of primary importance in habitat selection for all size groups of rearing feeding steelhead in the Big Sur River. Habitat availability data were also collected in each mesohabitat unit sampled immediately upon conclusion of fish observation and data collection procedures using a random point sampling design. Minimum and maximum water depth habitat availability were comparable during the spring, summer, and fall sample events. Maximum water velocity, on the other hand, showed a general decrease from spring through summer and fall. Similarly, average water depth and average water velocity were less in fall when compared to the spring and summer sample events. Due to the lengthiness of the habitat assessment and steelhead results, we could only provide a summary of these data in the Draft Recommendations Report. However, below is a brief discussion of those habitat conditions, characteristics, and steelhead habitat use. Please see Holmes et al. (2014a, 2014b) for further details. Spring Habitat Use: Steelhead <6 cm were found in all habitat types, with most occurring in pool and run mesohabitat types in spring. Over 75 percent of the <6 cm fish observations in spring were of fish 2-3 cm in length. Juvenile <6 cm steelhead were observed in locations with water depths ranging from 0.05 ft to 3.8 ft. The average water depth for all observations was 0.79 ft. Juvenile <6 cm steelhead were observed in locations with average water column velocities ranging from 0.00 ft/s to 3.61 ft/s. The average and median water velocity for all observations was 0.49 ft/s and 0.32 ft/s, respectively. Summer Habitat Use: Steelhead 6-9 cm and 10-15 cm were found in all habitat types, with most 6-9 cm occurring in run mesohabitat type in summer. Steelhead 10-15 cm were fairly evenly distributed among run, low gradient riffle, and pool habitat. Juvenile steelhead 6-9 cm were observed in locations with water depths ranging from 0.30 ft to 4.75 ft. Juvenile steelhead 10-15 cm were observed in locations with water depths ranging from 0.60 ft to 4.75 ft. The average water depths where juvenile steelhead 6-9 cm and 10-15 cm were observed were 1.35 ft and 1.6 ft, respectively. Juvenile steelhead 6-9 cm were observed in locations with average water velocities ranging from 0.00 ft/s to 4.31 ft/s. Juvenile steelhead 10-15 cm were observed in locations with average water velocities ranging from 0.06 ft/s to 5.24 ft/s. The average water velocities where juvenile steelhead 6-9 cm and 10-15 cm were observed were 1.43 ft/s and 1.47 ft/s, respectively.

Fall Habitat Use: Steelhead 6-9 cm and 10-15 cm were found in all habitat types, with most occurring in pool and run mesohabitat types in the fall. Juvenile steelhead 6-9 cm were observed in locations with water depths ranging from 0.45 ft to 4.30 ft. Juvenile steelhead 10-15 cm were observed in locations with water depths ranging from 0.55 ft to 4.90 ft. The average water depths where juvenile steelhead 6-9 cm and 10-15 cm were observed were 1.7 ft and 1.8 ft, respectively. Juvenile steelhead 6-9 cm were observed in locations with average water velocities ranging from 0.03 ft/s to 2.74 ft/s. Juvenile steelhead 10-15 cm were observed in locations with average water velocities ranging from 0.0 ft/s to 5.36 ft/s. The average water velocities where juvenile steelhead 6-9 cm and 10-15 cm were observed were 1.15 ft/s and 1.27 ft/s, respectively.

Related to the comment about reviewing recent Bioassessment data: The Central Coast Ambient Monitoring Program (CCAMP), a component of the Central Coast Regional Water Quality Control Board (CCRWQCB), is the regionally-based water quality monitoring and evaluation program for Central Coast watersheds including the Big Sur River (http://www.ccamp.org/). A review of the Big Sur River bioassessment data using the California Stream Condition Index (CSCI) – a statewide biological scoring tool for assessing the health of freshwater streams, indicates the lower Big Sur River to be "poor" condition and having much less taxa richness than upstream near the Gorge. These data do not suggest highly functional steelhead food production by benthic invertebrates in the lower river.

References:

Allen, M. A., and S. Riley. 2012. Fisheries and Habitat Assessment of the Big Sur River Lagoon, California. Report of Normandeau and Associates, Inc. Arcata, California.

Holmes, R.W., M.A. Allen, and S. Bros-Seeman. 2014a. Habitat Suitability Criteria Juvenile Steelhead in the Big Sur River, Monterey County. California Department of Fish and Wildlife, Water Branch Instream Flow Program Technical Report 14-1. 181 pp.

Holmes, R.W., M.A. Allen, and S. Bros-Seeman. 2014b. Seasonal microhabitat selectivity by juvenile steelhead in a central California coastal river. *California Fish and Game, Special Fisheries Issue*, 100(4):590-615. Accessed at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=99270

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Unsubstantiated Use of the Wetted-Perimeter Method to Establish a Low-Flow Threshold: On pages 21-23, the draft Recommendations discuss the use of the wetted perimeter method to establish a "low-flow threshold" of 22 cfs for the lower reach of the Big Sur River. While site-specific, the wetted perimeter is generally used as a "standard setting" method that is dependent on river structure, with plots of wetted perimeter vs. discharge serving as proxy for habitat. Unlike other common metrics (e.g., median monthly flows, flow exceedance analyses and even the DFW flows derived by habitat duration and time series analyses), the wetted perimeter method does not take into account the actual hydrologic regime of a river. The wetted perimeter method assumes that the flow represented by the first breakpoint in the wetted perimeter vs. discharge curve for each channel cross-section measurement transect will protect food producing riffle habitats at a level sufficient to maintain the existing fish population at some acceptable level of sustained population abundance. (Annear et al. 2004).

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A floor value or low- flow threshold is a necessary component of an overall prescription to conserve and protect fisheries, and should not simply be considered during low flow events (Linnansaari et al. 2013). The wetted perimeter method (WPM) is an established and valid method for use in establishing such a floor or low-flow threshold value (Annear et al. 2004). The term wetted perimeter refers to the perimeter of a cross sectional area of a streambed from wetted edge to wetted edge. The WPM is applied to assess riffle productivity for BMI's and establish low flow ecological thresholds (Annear et al. 2004). This method is used in conjunction with other methods and methodologies when more detailed information is needed such as fish rearing, spawning and/or passage flows under different seasonal and hydrological flow regimes. CDFW IF-004 outlines the empirical version of the WPM which typically requires sampling a range of up to ten ambient flows during roughly the 20%-80% exceedance range. However, we used the hydraulic modeling approach (Annear et al. 2004) to conduct the WPM in the Big Sur River as outlined in the Draft Recommendations Report (and below). In addition, we used site-specific measurements to calibrate and validate the WPM for use in identifying the low-flow threshold by examination of predicted versus observed wetted perimeter for three widely spaced flows as recommended by Annear et al. (2004).

In fact, a primary strength of the WPM, is that it can be used for identifying a low-flow season cut-off flow for "constraining permits or other requests for water withdrawal during summer and fall" (Annear et al. 2004). Our

In the underlying technical reports, it was methodologically unclear how the wetted perimeter relationships were actually determined (i.e. were methods followed in accordance with CDFW IF-004 Wetted Perimeter Method protocol paper) and whether the transects used for doing so were also used in the RHABSIM analysis. Without access to the complete data used to calculate (and verify) the wetted perimeter curves and the chosen breakpoints, it is not possible to fully evaluate the 22 cfs low-flow threshold developed by the DFW. Regardless, a comparison of exceedance flow probabilities for the Big Sur River (see e.g., draft Recommendations, Table 3) demonstrates that flows of 22 cfs occur infrequently on the Big Sur River in the late summer through early fall months and less than 5% of the time in September and October. The infrequency of flows above 22cfs in many months call into question the use of wetted perimeter as an accurate proxy for habitat to derive an instream flow threshold, in particular on a river that has been shown to support high growth rates for juvenile steelhead. When results of the DFW IFIM study are weighted for actual historic hydrologic conditions, such as in the summer months of critically dry water years, the resulting flows for juvenile rearing habitat were 6 to 10 cfs (See CDFW 2014, Table 10.) for the lower river which is substantially less than the 22 cfs minimum being recommended. Further, there is no evidence indicating that food production is a limiting factor at flows below 22 cfs, which regularly occur on the Big Sur River during the summer and fall of many hydrologic years. The statement on page 23 that "flow alteration that may result in managed flows below the 22 cfs ecological threshold would not promote the continued viability of the Big Sur River steelhead population" is not supported by site-specific evidence from the Big Sur River regarding habitat, food production and juvenile steelhead growth. Finally, the DFW draft Recommendations provide no guidance on how the low-flow 22 cfs threshold could be achieved given no surface water storage on the river and naturally occurring late season flows that frequently are 10 cfs or less. Despite flows in many years that are seasonally less than the recommended 22 cfs minimum, the Big Sur River has been characterized by DFW fishery biologists as highly functional and has sustained a coastal steelhead population. The utility of recommending a minimum flow threshold that cannot be achieved in many years is not a meaningful management scenario.	approach was rigorous, employing nine transects, each selected using a stratified random process from three randomly identified riffles in the Lower Molera Reach, which were used to evaluate the discharge versus wetted perimeter relationships. These fixed, cross-channel transects, which were established at each riffle with 0.5 inch rebar (i.e., headpin and tailpin) and surveyed to bankfull discharge level, were assessed in both the RHABSIM and WPM analyses. Three sets of field data, which included water surface elevations, dry bed elevations, water depths, average water velocities, substrate composition, and stream width, were collected at a maximum of 1 ft intervals across each transect from headpin to tailpin at each of three distinct flows (i.e., low, medium, and high). These raw field data were forwarded to representatives for the El Sur Ranch by CDFW as part of the hydraulic model data requested in April 2013. As outlined in the Draft Recommendation Report, the commercially available software program NHC Hydraulic Calculator (Hydro Calc; Molls 2000) was used to estimate wetted perimeter over a range of flows, typically from 1 to 250 cfs. Water depth measurements and stream width (i.e., wetted width) were used to calculate flow area (A) and wetted perimeter (P). Water surface elevation level and the distance between transects within each riffle were used to estimate the slope of the water surface. Manning's equation is described as: $Q = 1.486/n\ AR^{2/3}S^{1/2}$ or $n = 1.486/Q\ AR^{2/3}S^{1/2}$ A minimum of 50% wetted perimeter was used as the lower threshold (Annear et al. 2004) for identifying the breakpoint (i.e., first point of maximum curvature) for the WPM analyses. Maximum curvature was assessed on each transect by computing the slope inflection at each point (e.g., flow) on the wetted perimeter versus discharge curve and subtracting the slope of the flow from the slope of the preceding flow. The flow with the maximum positive slope inflection, above the 50% minimum wetted perimeter, was identified as the breakpoint (Annear et al. 2004). The breakpoint is the lower ecosystem threshold flow, which below this level is indicative of rapidly declining aquatic invertebrate food production and general stream ecological health. A low-flow threshold helps prevent the reduction of natural base flow levels of a stream or river hydrograph by water withdrawal or other water management activities. The establishment of a seasonally appropriate low-flow threshold helps protect fishery productivity during critically low-flow time periods by supporting stream channel forms and riparian communities that directly affect aquatic life (Annear et al. 2004). September and October are typically the driest months for Central Coast California streams where flows may naturally drop below hydrological thresholds in certain water month categories. In fact it is possible in the dry summer and fall months, especially in below normal water month types, that natural flows may recede below the stream's threshold cutoff in some California streams. This is not a justification for artificially reducing flows to those levels on a permanent basis. A low-flow threshold does not equate to a request or recommendation for more water than nature can provide. A low-flow threshold is a cut-off flow that is generally synonymous with implementing a "forbearance period", from which flow should remain instream rather than being diverted. Table 3 does indicate the 22 cfs low flow threshold is available between 10 and 20% of the time in September and October, based upon mean daily data values from October 1, 1949 through September 30, 2012 from USGS 11143000. We performed the analyses again, this time including the period of record up to September 15, 2016 and found that the 22 cfs low-flow threshold is available approximately 16% and 20% of the time in September and October, respectively. Since these flows do not occur every year, it is imperative that the Big Sur flow regime continue to maintain these summer flow regimes during the years when natural flows provide such flows. The statement that flow alteration that may result in managed flows below the 22 cfs ecological threshold would not promote the continued viability of the Big Sur River steelhead population is fully supported by direct site-specific evidence produced by the appropriately conducted, calibrated, and validated WPM analyses.

Additionally, it is also important to point out that it takes considerably higher flow volumes to "maximize" food production in riffles on the Big Sur River (i.e., ~69 cfs) as identified using the CDFW site-specific data (Holmes and Cowan, 2014). The 22 cfs low-flow threshold, therefore, represents only a critical "cut-off" flow, where below which flow levels are in the "danger zone" to fisheries (DOF 2013) and at flows which water withdrawal permits be constrained (Annear et al. 2004) .

Further indication of the 22 cfs low-flow threshold being critical "cut-off" comes from the seasonal site-specific snorkeling observations of Big Sur River steelhead which provide further insight into a compelling range of flow-linked biological and habitat gradient thresholds when observing fish microhabitat selectivity in response to flow level-linked habitat availability (Holmes et al. 2014a). For example, results of 2-Way and 3-Way ANOVA for testing effects of flow level-linked water depth and water velocity selection, mesohabitat, and sample period for juvenile steelhead in Big Sur River indicated significant effects ($p < 0.001$) between those variables and habitat availability at flow levels near the low-flow threshold (e.g., 23-26 cfs) and the more higher summer flows observed up to 62 cfs (See Table 5 in Holmes et al. 2014a). Even more indication of the critical "cut off" is found in the results of the steelhead passage assessment which indicate a similar gradient of flow level effects – but instead on steelhead passage and habitat connectivity flows. For example, two of the four (i.e., 50%) critical riffles at the lagoon and lower river interface were observed to be dry at the low-flow threshold of 23 cfs which results in a significant amount of reduced steelhead passage and rearing habitat opportunities as well as significantly limits the riffle food-producing habitats in the Big Sur River lagoon/lower river critical riffle complex (Holmes et al. 2014b).

In summary, the 22 cfs low-flow threshold is a cut-off flow that was derived using established and validated procedures, and is appropriately within the biologically-based range of flows (i.e., 20-30% of the Mean Annual Flow (MAD)) reported in nationally published literature using biologically-based percent of flow approaches (DFO 2013; Richter et al. 2011). The flow is not available every year although represents a critically important component of the overall flow prescription for the Big Sur River. Nonetheless, natural unimpeded flows during the summer months of June – August in the Big Sur River can average 26 cfs in a normal year and 44 cfs in a wet year (RCD of Monterey County, 2014), and therefore well above the low-flow threshold of 22 cfs. Since water diversion and usage does contribute to reduced stream flows and restricts the volume, suitability, and availability of summer and fall rearing habitat for steelhead trout in the Big Sur River (RCD of Monterey County, 2014), establishing the low-flow threshold is essential to preserving the naturally variable flow regime components, including the natural recession of the hydrograph, and as such protecting Big Sur River steelhead trout.

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Inappropriate and Unnecessary Application of "Rule of Thumb" Metrics When Site-Specific Data is Available: In its discussion of the low-flow threshold on page 23, the draft Recommendations also discuss the use of various "rules-of-thumb" metrics for determining low-flow thresholds such as 30% of mean annual discharge or daily flow alterations of no more than 10% from the natural flow regime. While such metrics are commonplace and useful in calculating and assessing instream flows, they are best suited for use on rivers for which more detailed, site specific information on flow-habitat relationships is not available. (*See* Richter et al. 2011 [acknowledging that a better method for assessing the impacts of hydrologic alteration on ecological function involves the collection of site-specific data to develop ecological response functions to hydrologic alterations].)[4] For example, the Policy for Maintaining Instream Flows In Northern California Coastal Streams North Coast Instream Flow Policy (p.7)[5] establishes that when site-specific criteria that identify more precisely the instream flow needs of a particular location are available, more general and less precise regional criteria should not be relied on. In this case, the DFW has conducted an extensive IFIM study of the Big Sur River that provides more site-specific, detailed, and, presumably, more precise information regarding the instream flow needs of the Big Sur River. Less precise rules-of-thumb metrics, as well as methods such as the wetted-perimeter method which use solely one metric (wetted perimeter vs. discharge) as a surrogate for physical habitat, do not necessarily produce accurate and reliable results regarding the instream flow needs of a particular river. Where, as here, site-specific and more detailed information is available, it should be preferentially used in lieu of less precise metrics.	CDFW's IFIM study on the Big Sur River used multiple methods and models to address the various components of the flow regimes needed for fish and wildlife and the habitats that support them. The wetted perimeter analyses, which used the same site-specific transect data as the RHABSIM analyses, is an effective tool when used with other methods and models to determine a flow regime prescription for assessing ecological function flows for a river such as the Big Sur River (Annear et al. 2004). Of particular interest to CDFW in using the multiple methods is how well the results of the detailed site-specific methods and models from the intensive IFIM study of Big Sur River compare to the much less intensive desk-top methods which use percent of flow (POF) hydrological thresholds derived from the Mean Annual Discharge (MAD) and Mean Monthly Flow (MMF). Flow standards based upon POF have been used increasingly more and more recently in the United States, Europe, and beyond because the approach recognizes the importance of natural flow variability and sets protection standards by using acceptable migrations from natural conditions based upon the POF (Richter et al. 2011). While appropriately selected and conducted site-specific flow methods – such as those employed in the CDFW study generally trump rule of thumb methods - application of a variety of methods, including desktop biological methods, to assess instream flow regime needs is both appropriate and necessary for determining stream flow needs for fish and wildlife (Annear et al. 2004). Desktop biology methods that are based upon percent hydrology, such as the Tennant (1976) Method, are in fact widely used throughout the world (Reiser et al.1989; Jowett 1997) because they are founded on real empirical data indicating that almost any reduction in streamflow can have a negative effect on stream ecosystem health. Tennant (1976) is based on almost two decades of observations on hundreds of coldwater and warmwater streams, which were verified with field studies on 11 streams in Nebraska, Wyoming and Montana. The tests used empirical hydraulic data from cross-sectional transects and assessments of habitat quality to define relationships between flow and aquatic habitat quality. For any given flow Tennant (1976) found that habitat quality was very similar for each of his study streams, and therefore developed stream flow recommendations based on percentages of MAD. Tessman (1980) developed a modification (from which CDFW also uses) which incorporates consideration of natural variations in flow regimes on a monthly basis (i.e., mean monthly flow or MMF) in addition to the MAD. This type of modification is common, and has led to modifications that make the original Tennant Method applicable to regions, such as California, with different hydrological and biological cycles.

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PUBLIC INPUT	CDFW'S CONSIDERATION OF PUBLIC INPUT
Inappropriate Reliance on Approximate Maximum Flow Losses as an Adjustment to Flow Recommendations: Pages 23 to 24 of the draft Recommendations discuss the incorporation of flow losses in the Big Sur River between the upper USGS gage in Pfeiffer State Park and the now-inoperable lower USGS gage in Molera State Park into DFW's flow regime recommendations. Taking nearly three and a half years of gage data (2010-2014), the DFW adjusted its instream flow recommendations by adding a maximum 1-day observed loss of 8 cfs to recommendations for the months of May to October and an approximate maximum loss of 7 cfs to recommendations for the months of November to April. The DFW's analysis suggests that the reach between the two gages is a losing reach. Consultants for the El Sur Ranch evaluated these findings using techniques developed by the USGS (USGS 2002, 2008, and 2012). Concurrent daily flows from the upstream gage were plotted against flows from the downstream gage and a Kendall-Theil Robust Line was fitted through the data using software developed by the USGS (2006). (See attached Figure 1). The line was broken into three segments to match the general patterns of the data. The results suggest that the river reach between the upper and lower gages is a lowing reach under low flow conditions and a gaining reach at flows above 59 cfs. As shown in Figure 1, there is no support for the application of a maximum observed flow loss adjustment of either 7 or 8 cfs for all	Please see attached "Response to April 28, 2016 Duane Morris Comments on the September 16, 2014 Draft Instream Flow Regime Recommendations for the Big Sur River, Monterey County, California" from Kit Custis, Senior Engineering Geologist, to Robert Holmes, Instream Flow Program Supervisor dated September 16, 2016.

flows below 59 cfs. For example, at the DFW-determined low-flow threshold of 22 cfs at the most downstream of the studies reaches, the analysis in Figure 1 demonstrates that the equivalent flow at the upper gage is 35.6 cfs (a 3.6 cfs difference). Any evaluation of, and adjustments for, flow losses should take into account the actual relationship between the gages in the Big Sur River. Finally, the DFW's analysis of potential flow losses between the gages fails to take into account the fact that the river reach below the lower Molera gage is a gaining reach in which groundwater accretes into the Big Sur River.

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Unconventional Use of Mixed Methodologies to Derive Flow Recommendations: Finally, in Tables 4 through 6, the DFW provide separate flow regime recommendations for the three studied reaches of the Big Sur River (Lower Molera, Molera and Campground Reaches). For the lower Molera Reach, an evaluation of the recommended flow in Table 4 demonstrates that when the IFIM results (CDFW 2014, Table 10) returned values less than the wetted-perimeter derived low-flow threshold of 22 cfs, the DFW adopted the low-flow threshold of 22 cfs plus the flow loss adjustment (7 or 8 cfs depending on month) as the recommended flow. This unconventional use of mixed methods to obtain flow recommendations results in the use of the wetted perimeter method, as opposed to the IFIM, to establish higher instream flow recommendations for many months and in many hydrologic year types. For example, in Table 4, the wetted perimeter method plus flow loss adjustment establishes the DFW's instream flow recommendations for all months except February and March in critically dry years, for most of the summer and fall months in dry and below median years, for September in all hydraulic year types except extremely wet years, and for October and November in all hydrologic year types. As noted above, the wetted perimeter method returns a "one-size-fits all conditions" flow result that does not necessarily provide a good "fit" or "proxy" for actual habitat conditions on the Big Sur River. Big Sur River steelhead have historically experienced, are likely adapted to, natural flows less than 22 cfs during the summer and fall in most hydrologic years. The DFW IFIM technical reports or draft Recommendations provide no evidence that food production or habitat availability limit the steelhead population on the Big Sur River at flows less than 22 cfs.

Moreover, a comparison of the flow recommendations in Table 4 with the exceedance flow probabilities for the Big Sur River demonstrates that the recommended flows rarely occur on the Big Sur River, in particular in the months from June through October in which the low-flow threshold default was used by the DFW. For example, flows of 30

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Use of mixed methodologies is not only appropriate but essential to develop flow prescriptions for fish and wildlife that maintain the variable flow regimes necessary for aquatic community structure and function (Annear et al. 2004; Annear et al. 2009). As outlined earlier, the Wetted Perimeter Method, is one of several tools used to assess the flow regimes needed for protection of fish and wildlife in the Big Sur River. The Wetted Perimeter Method is a site-specific method that is 100% reflective of the Big Sur River habitat vs flow conditions indicating critical low-flow cutoffs. It is also important to point out that the Wetted Perimeter Method flow results are actually a critically important "component" of the IFIM study, not used as a "one size fits all" flow method, and should not be compared to or viewed as in contrast to results of other methods, such as the RHABSIM modeling for steelhead rearing flows or the River 2D modeling of passage flows through riffle habitats. All of these methods, and the other methods used as well, identify important "components" of the flow regimes necessary for protecting Big Sur River steelhead and the habitats that support them.

Science supports the view that natural flow regimes are essential for sustaining fisheries and the ecosystem structure and function which supports them. The CDFW flow regime recommendations are tied in very closely with natural hydrology patterns following CDFW Guidelines (CDFW 2008). Incorporating the monthly and yearly variability of the naturally occurring flow regimes steelhead have historically adapted to into the recommended flow regimes provides biologically-accurate and realistic flows for effective resource management. Furthermore, the low-flow threshold developed using the Wetted Perimeter Method provides a protective cut-off for maintaining adequate flow under naturally occurring low-flow times of the drier water month types (e.g., the zone of high risk described by DFO 2013). Without such a cut-off threshold, currently requested diversions from the Big Sur River could result in the low-flow component of the regime being severely limited, resulting in decreased habitat availability and limited connectivity for movement within and between important rearing habitats in the Big Sur River (Holmes et al. 2014; Holmes et al. 2015). Such non-natural and potentially consistent "flat-lining" and loss of the natural flow recession of the low-flow steelhead rearing months would not protect steelhead as they are adapted to having variable low-flow regimes with wetter and drier summertime flows, not a flat-lined low-flow regime.

There is a consensus amongst experts (see DFO 2013) that cumulative flow alterations that result in instantaneous flows less than 30% of the Mean Annual Discharge (MAD) have a heightened risk of impacts to ecosystems that support fisheries (see "zone of highest risk" in Figure 3 below). The MAD is a relatively robust hydrological indicator, which has a strong correlation to the size of the drainage basin on a regional basis. During low flow events (i.e. drought, historic low flows, etc.), a "cut-off limit", such as the 30% MAD identified below, is recognized as an important component of the overall flow regime prescription to be applied during these critical low flow events.

cfs, September or October at the upstream USGS Pfeiffer State Park gage used as the control point in the DFW flow recommendations, have occurred in less than 5% of all years. In large part, the draft DFW flow recommendations call for flows that nature has not and does not provide on the Big Sur River. This result calls into question not only the usefulness of such flow recommendations for resource managers seeking to manage the Big Sur River for all beneficial uses including protection of steelhead habitat, but also the biological accuracy of the assessment given that the steelhead population on the Big Sur River has historically adapted and thrived under naturally-occurring flows lower than the draft Recommendations.

The low-flow threshold component of the Big Sur River flow prescription is biologically accurate and consistent with the published literature (Richter et al. 2011; DFO, 2013) and provides a useful, very "real", and important component of the flow regime for resource management. For example, any diversions that request to take more than 10% of the instantaneous flows (see Richter et al. 2011; DFO, 2013) when conditions fall below the low-flow threshold on the Big Sur River should avoid direct diversion and consider using off-stream storage or other means to avert impacts to the fishery during this sensitive and "high risk" low-flow time period.

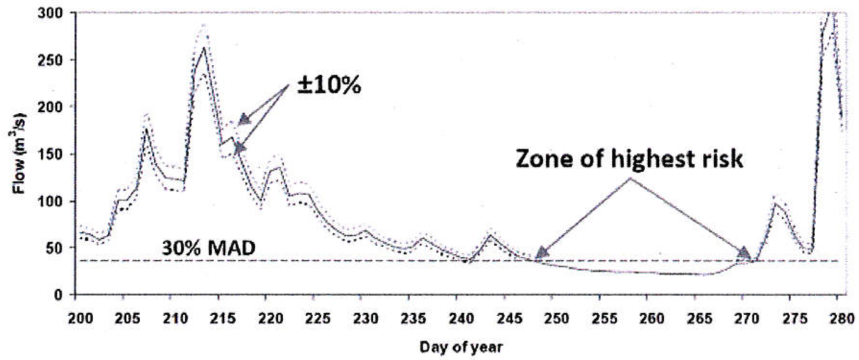

Figure 3: Detailed depiction of zone of highest risk; expressed as instantaneous discharges which are less than 30% Mean Annual Discharge (MAD) for the river/stream being assessed. (Courtesy of D. Caissie, 2012)

The calculated 7-8 cfs adjustment of flow criteria for losses in the lower each has been verified by use of the gage comparisons during the timeframe with both USGS gages in Molera and Pfeiffer State Parks which were recording simultaneous 15 minute increment data. Furthermore, California's extreme drought conditions allowed us all to see firsthand that when the USGS in Pfeiffer was reporting flow rates of 7 cfs in the summer of 2014, the Big Sur River was completely dry in the lower end of the Molera Reach at River Mile 0.4 (see photo below).

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PUBLIC INPUT	CDFW'S CONSIDERATION OF PUBLIC INPUT
Beginning with the Black and Veatch report in 1979 and the 1983 Big Sur River Protected Waterway Management Plan there has always been a gap in knowledge of the river. Each of those studies told us more than we had known previously and each recommended further study to answer the basic question for Big Sur residents; how much water was available for human use from the Big Sur River? Since the recommendations of this report have been prepared for the State Water Resources Control Board one would think that was its objective. Maybe it's just me but I had assumed that such a report would consider how much water is in the river, how much is currently being used by people and what is a fair and reasonable distribution between man and fish. In other words, are we using too much, is there water available for people, are the fish suffering at the hands of human greed?	The Big Sur River is currently on the Department's Public Resources Code (PRC) §10000-10005 priority streams list (see: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=14106&inline As a result, the Department is mandated to do an instream flow study and identify flow requirements for protecting this resource. The PRC also requires the Department to transmit those flow requirements (i.e., flow recommendations) to the State Water Resources Control Board (SWRCB). The flow recommendations identified by the Department reflect the instream flow requirements for fish and wildlife, and the habitats to support them. The flow recommendations also consider natural water availability, but do not compare availability with current human consumption or demand. The SWRCB, in turn, must consider the flow recommendations from the Department for fish and wildlife and water availability from a demand standpoint when making water management and allocation decisions and balancing among beneficial uses.

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There is no doubt that the study adds a great deal of scientific information about steelhead at all life stages, in all sites of the river. The methods employed, from careful measurements to scuba divers observing fish in the various parts of the river add new information specifically about these fish in this river. That is great but for us lay-persons it doesn't answer the question of how we proceed.	The Department intends to finalize the draft flow recommendations for fish and wildlife on the Big Sur River and forward those recommendations to the SWRCB for their consideration in balancing beneficial uses and water management allocation decisions.

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In the "Statement of Findings" section it is said, "It is imperative that this steelhead population be restored to viable self-sustaining population levels". I assume that since it needs to be restored that currently it is diminished. What is causing the river to be broken such that it needs to be restored? We can't fix it if we don't know what is broken. At the end of this section the report states, "Insufficient instream flow has been identified as a key factor preventing recovery of steelhead population viability." That would seem to say that people are using so much water that they inhibit population viability or that it doesn't rain enough. Which is it? There is a very sparse population of people in Big Sur and the water used is returned for the most part to the watershed through infiltration from septic tanks so I doubt that it is the former. How much water is being used by people? Is it significant enough to change river levels that endanger fish?	The National Marine Fisheries Service (NMFS), per their South Central California Steelhead Recovery Plan (NMFS 2013) page 11-9, identify the threats to the steelhead population in the Big Sur steelhead population segment which includes the Big River (and adjacent watersheds like the San Jose Creek etc.). NMFS states: "The principal sources of threats to individual steelhead populations in the Big Sur Coast BPG are passage barriers created by culverts, road crossings, and periodic landslides; impediments to migration and degradation of spawning and rearing habitats as a result of groundwater extraction (particularly in San Jose Creek and the Big Sur River), and surface water diversions; and non-point pollution, including sedimentation resulting road cuts, including abandoned logging roads." While these threats, generally speaking, apply to each of the waters in the Big Sur Biogeographic Population Group, not all of them are primary limiting factors in every watershed included in the BSBPG. For the Big Sur watershed, per the Monterey County Resource District's 2014 Big Sur Watershed Management Plan (RCD 2014), the primary factors limiting steelhead production in the Big Sur River include: Fish passage (i.e. upstream and/or downstream fish migration blockage), Excess Fine sediment (i.e. making spawning and rearing habitats unsuitable for steelhead use), Spawning habitat availability (i.e. improve the rock substrate structure of specific adult steelhead spawning areas), Rearing habitat availability (i.e. improve in-river and lagoon juvenile rearing habitat), Food availability and size at smolting (i.e. enable more juvenile steelhead to migrate to, and reside in, the lower lagoon, where abundant food exists, so growth can be maximized),

	Instream flows (i.e. improve instream flows so habitat quantity/quality improves along with fish use), Riparian Corridor (i.e. need for improved riparian vegetation (aka canopy cover) to be present in some areas of the Big Sur River channel), and In-channel wood (i.e. need for more large woody debris to be present to increase fishery habitat value and use). When fewer juveniles are produced, generally speaking, fewer adults are produced. The steelhead in the Big Sur River are listed as Threatened by the National Marine Fisheries Service because too few adult steelhead are being produced in the Big Sur River. It is believed that reestablishing surface flow continuity in the lower Big Sur River, all the way to the lagoon, both within and across years, will provide the habitat necessary to substantially improve the number of steelhead that rear here and eventually grow to become adults thence return to spawn in future years. Natural unimpeded flows during summer in the Big Sur River can average 26 cfs in a normal year and 44 cfs in a wet year (RCD of Monterey County, 2014), and therefore well above the low-flow threshold of 22 cfs. Since water diversion and usage does contribute to reduced stream flows and restricts the volume, suitability, and availability of summer and fall rearing habitat for steelhead trout in the Big Sur River (RCD of Monterey County, 2014), establishing the low-flow threshold is essential to preserving the naturally variable flow regime components and protecting Big Sur River steelhead trout. References: NMFS (National Marine Fisheries Service). 2013. South-Central California Coast Steelhead Recovery Plan. West Coast Region, California Coastal Area Office, Long Beach, California RCD of Monterey County, Central Coast Salmon Enhancement, Stillwater Sciences and California State University of Monterey Bay. 2014. Big Sur River Watershed Management Plan. Prepared for the California Department of Fish and Wildlife, under a grant for the Fisheries Restoration Grant Program (P1140400). 132 pp. Accessed online at: http://www.rcdmonterey.org/pdf/BSRWMP-1-8-15_no_appendices.pdf
PUBLIC INPUT	**CDFW'S CONSIDERATION OF PUBLIC INPUT**
In the last sentence of the second paragraph of the section titled "Low-flow Threshold" it is stated "flow alterations that may result in managed flows below the 22 cfs ecological threshold would not promote the continued viability of the Big Sur River steelhead population." Looking at gauged flows from 1950 to 2004 shows that the mean flow for those 54 years for the months of August, September, and October are 17.5, 15.3, and 17.5 respectively. These are unimpaired, unmanaged flows coming out of the wilderness. This is the amount of water that the gods historically have granted the river. Unless the climate changes in Big Sur causing summer rains 22 cfs will not be possible during summer.	A low-flow (i.e., cut-off) threshold flow helps prevent the reduction of natural base flow levels of a stream or river hydrograph by water withdrawal or other water management activities. The establishment of a seasonally appropriate low-flow threshold helps protect fishery productivity during critically low-flow time periods by supporting stream channel forms and riparian communities that directly affect aquatic life (Annear et al. 2004). September and October are typically the driest months for Central Coast California streams where flows may naturally drop below hydrological thresholds in certain water month categories. In fact it is possible in the dry summer and fall months, especially in below normal water month types, that natural flows may recede below the stream's threshold cutoff in some California streams. This is not a justification for artificially reducing flows to those levels on a permanent basis. A low-flow threshold does not equate to a request or recommendation for more water than nature can provide. A low-flow threshold is a cut-off flow that is generally synonymous with implementing a "forbearance period", from which flow should remain instream rather than being diverted. In summary, a low-flow threshold flow is a necessary component of a flow regime prescription for fish and wildlife. And as discussed above, those flows may not always naturally occur in all water month types (i.e., critically dry, dry, below median) especially in the summer months. Such a flow value, although not always naturally available, serves as a critical benchmark for delineating the flow levels which become "high risk" to the fishery resource (DFO, 2013). In order to protect the structure and function of the aquatic ecosystem, the flows below that threshold during that low-flow period must maintain the natural variability of the normal and

	wet months when they are available. Failure to maintain such flow variability could result in the low-flow regime being "flat-lined" by future water allocations in the lower Molera Reach which would be detrimental to the fishery. For this reason, CDFW recommends flows remain in-stream below the threshold as much as possible to protect the fishery. References: DFO, 2013. Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. DFO Can. Sci. Advis. Rep. 2013/017.
PUBLIC INPUT	**CDFW'S CONSIDERATION OF PUBLIC INPUT**
The section titled "Flow Losses Evaluation" is incomplete. It is significant that the time period in which the Molera gauge was operating was during years of extreme drought. This is by no means a normal flow. For example consider the Pfeiffer gauge on 2/1/14 at 12 cfs. Unfortunately the Molera gauge is no more and so the best we can do is look at those few rainy periods that caused the river to rise to somewhat "normal" levels in winter. For example, 1/1/13 showed that Molera at 266 cfs and Pfeiffer at 255 cfs, a reversal of summertime flows where Pfeiffer always exceeds Molera. Lacking good data we could speculate that in winter water naturally flows from the alluvial plain that is Molera Park into the river and in summer water from the river spreads out into alluvium.	Please see attached "Response to April 28, 2016 Duane Morris Comments on the September 16, 2014 Draft Instream Flow Regime Recommendations for the Big Sur River, Monterey County, California" from Kit Custis, Senior Engineering Geologist, to Robert Holmes, Instream Flow Program Supervisor dated September 16, 2016.
PUBLIC INPUT	**CDFW'S CONSIDERATION OF PUBLIC INPUT**
Finally, the "Instream Flow Regime Recommendations" section recommends flows that don't occur regularly in an unimpeded Big Sur River. Flows of 30 cfs in lower Molera, in August, when the 50 mean for those months is 16.5 is not going to happen no matter how we might wish it, particularly when the recommendation for the campground reach coming out of the wilderness is 22 cfs.	The flow regime recommendations actually tie in very well with the variable flow regime and natural water availability observed on the Big Sur River in all water month types - with the exception of flows that may drop below the recommended low-flow threshold during the low-flow period. The part of the comment related to such instances of natural flows dropping below the low-flow threshold is addressed above.
PUBLIC INPUT	**CDFW'S CONSIDERATION OF PUBLIC INPUT**
Still the question remains, how much water are we using and is it too much? Is there a reasonable sharing of the resource that is possible? We need some straight talk here.	The objective of the CDFW Big Sur River instream flow study is to identify flows to protect fish and wildlife. CDFW also considers natural water and habitat availability to develop the flow regimes to protect fish and wildlife. CDFW does not examine water use (or demand) as this statutory responsibility lies with the SWRCB.

Roy Thomas
Carmel, CA.

PUBLIC INPUT	**CDFW'S CONSIDERATION OF PUBLIC INPUT**
I believe that there are serious problems with the CDFWS work on the Big Sur River. It is hard for me to believe that a maximum flow of 70 cfs is enough to keep a healthy steelhead population in good	The flow regime recommendations by CDFW for the Big Sur River range from 22 cfs to 90 cfs depending upon steelhead lifestage (e.g., spawning, rearing, passage) and overall ecological need, and water month type (e.g., critically dry, dry, below median, above median, wet, or extremely wet). In addition CDFW

condition over time. I believe that you need much higher flows to keep the gravels clean, provide edge habitat, create scour pools, attract large wood and maintain channel configuration. The failure to include the entirety of the large diverters, thus without a water right, makes your conclusion about the mysterious depletion of flow very questionable.	recommended channel maintenance and flushing flows for developing and/or maintaining the stream's diverse morphological and hydraulic characteristics. These flows, which are generally associated with peak runoff during the winter and spring are required to maintain the quality of the substrate and channel conditions for steelhead lifestages. The 1.5 year recurrence flood (Leopold 1994) was determined using a peaks-over-thresholds method (SWRCB, 2014) which estimates flood magnitudes using a frequency analysis. This flow level (i.e., 1644 cfs) is considerably higher than the flows needed for steelhead spawning, fry, and rearing lifestages, however and as stated in the recommendations document, should be considered in an overall stream management plan for channel maintenance and flushing streamflows in the Big Sur River. References: Leopold, L.B. 1994. A View of the River. Harvard University Press Cambridge. SWRCB (State Water Resources Control Board), 2014. Policy for Maintaining Instream Flows in Northern California Streams. Division of Water Rights. California Environmental Protection Agency. Sacramento, CA. 33 pp. plus appendices.
The study of only 5-8 river miles and ignoring the 15+ miles above the gorge is wrong. Many years steelhead are seen using the upper reaches. I have seen steelhead over 30 inches backing down the river in the spring.	Comment noted. However, CDFW only had resources to investigate flow regime needs in the lower reaches of the Big Sur River below the gorge. This is not unique, as our program typically does not have the luxury of investigating flow needs in whole river systems and always have had to prioritize efforts where most needed within each priority river.
The failure to include the entirety of the large diverters, thus without a water right, makes your conclusion about the mysterious depletion of flow very questionable.	CDFW is mandated to perform instream flow studies pursuant to the Public Resources Code §10000-10005 with the goal to identify instream flow requirements for protection of fish and wildlife in priority rivers and streams. While CDFW did include an analysis of water availability and examine flow gains and losses in the Big Sur River instream flow study, these efforts were done so as to ensure accurate and representative instream flow regime recommendations in the Big Sur River. The flow recommendations do not compare water availability with current human consumption or demand. The State Water Resources Control Board, in turn, must consider the flow recommendations from the Department for fish and wildlife and water availability from a consumption and demand standpoint when making water management and allocation decisions, and balancing with other beneficial uses.