In the Matter of Proposed Instream Flow Appropriation Hearing
Division 4; San Miguel River

Written Testimony of Jeff Baessler, Deputy Section Chief
Stream and Lake Protection Section
Colorado Water Conservation Board

August 26, 2011

Overview

My name is Jeff Baessler. I am a hydrologist with 28 years of experience, 22 of which are with the Colorado Water Conservation Board's Stream and Lake Protection Section. I am currently Deputy Section Chief for the Stream and Lake Protection Section and one of my primary responsibilities is to evaluate new instream flow and natural lake level appropriation (ISF) recommendations that are submitted to the Board. In this role, I supervise three other Water Resource Specialists (Owen Williams, Rob Viehl, and Brian Epstein) to assess proposed ISF recommendations to ensure that pertinent ISF rules, policies and statutes are followed. In addition, staff and I ensure that standard scientific principles and methods are utilized regarding proposed recommendations and perform detailed water availability analyses.

At its January 25, 2011 meeting, staff provided the Board with a recommendation summary report that outlined staff investigations and analyses for the recommended San Miguel River ISF water right from Calamity Draw to the confluence with the Dolores River. The information presented in this report allowed the Board to take formal action and form its intent to appropriate ISF rights at the January 25, 2011 meeting. This information will further allow the Board to take final action on the appropriation and accurately make the statutory determinations that 1) there is a natural environment that can be preserved to a reasonable degree with the Board's water right if granted; 2) the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made; and 3) that such natural environment can exist without material injury to water rights.

History

Following is a brief history of the San Miguel River recommendation:

- 2005: Recommendation first discussed at February Instream Flow Workshop.
- 2008: Staff receives a formal joint recommendation from the Bureau of Land Management (BLM) and Colorado Parks and Wildlife (CPW).
- March 2008, November 2008, March 2009, November 2009, March 2010 and November 2010: Official Board and public notices sent out in accordance with ISF Rules.
- March 2008 – Present: Ongoing discussions with stakeholders.

Staff met with stakeholders in the field to discuss the recommendation and has also had numerous public meetings in Norwood, Naturita, Telluride and Denver over the past several years. These meetings included stakeholders that supported the recommendation as well as those that opposed the recommendation.

In accordance with the ISF Rules, the Board could have declared its intent to appropriate this recommended ISF in January 2009. However, as a result of the intense interest in this recommendation, staff and the recommending entities delayed asking the Board to appropriate until January 2010 to allow stakeholder discourse to continue in the hope that concerns could be addressed and resolved. The primary concern expressed by those opposed to the recommendation was the potential impact that an ISF water right could have with respect to future water development and future changes of water rights in the basin.

In January 2010, Staff believed that it had sufficient information for the Board to take action on the recommendation and form its intent to appropriate. However, the SWCD and San Miguel and Montrose Counties sent letters to the Board requesting that the recommendation be further delayed to January 2011 to allow additional time for stakeholders to identify and quantify their future needs. In addition, other stakeholders sent letters stating that the ISF recommendation was unnecessary and that the science supporting the recommendations is flawed. As a result, these stakeholders asked the Board to reject the proposed San Miguel River ISF recommendation. Other stakeholders fully supported the recommendation and were disappointed over the delays that had already occurred. They contended that the Board had already provided a one-year delay beyond the standard process for appropriating ISF rights and therefore proposed that the Board form its intent to appropriate at the January 2010 Board meeting.

At its January 2010 meeting, the Board provided an additional year delay for those opposed to the recommendation to identify and quantify future needs. This additional delay resulted in the filing of numerous absolute and conditional water rights that are now senior to the Board's January 2011 ISF appropriation. From a review of the filings, Staff has estimated that since 2008, when the recommendation was first proposed, stakeholders have appropriated the following amounts of senior water:

	Absolute Rights	Conditional Rights
Cfs	144	655
Acre-feet	356	89,881

On March 31, 2011, the Montrose County Board of County Commissioners, Farmers Water Development Company, Southwestern Water Conservation District (SWCD), Norwood Water Commission, and Lone Cone Ditch and Reservoir Company (hereinafter collectively referred to as "Opponents") submitted Notices to Contest the Board's ISF appropriation. These contesting parties continue to express concerns regarding potential impacts to future and existing water rights, and fear that their 2010 water court filings will face serious challenges from objectors. In addition, the parties have challenged the scientific methodologies utilized by the recommending entities to quantify the flows that will preserve the natural environment. Finally, the parties have questioned the water availability analyses performed by Staff.

<u>The San Miguel River ISF appropriation is for the minimum amount of water necessary to preserve the natural environment.</u>

In their prehearing statements, Opponents make multiple assertions regarding the existence of a natural environment and question the assumptions and validity of the quantification methodologies used to recommend the minimum flows necessary to preserve the natural

environment to a reasonable degree. Opponents have specifically stated that the recommending entities quantified optimum habitat conditions in order to maximize the natural environment in the subject reach rather than identifying the minimum amount necessary to preserve the natural environment to a reasonable degree while correlating human and environmental needs.

The BLM and CPW, as the recommending agencies, have coordinated to provide sufficient biological evidence demonstrating the existence of a natural environment on the San Miguel River and to quantify the minimum amount of water necessary to preserve the natural environment to a reasonable degree. Further, Staff and the Board rely upon the biological expertise of the CPW as the basis for the Board's statutory determinations. As a result, Staff defers to CPW and BLM's rebuttal statement regarding the scientific bases for the existence of a natural environment and the biological flow recommendation. However, based upon my programmatic expertise with regard to policy and legal questions regarding what constitutes the "minimum amount necessary to preserve the natural environment to a reasonable degree," I assert that Opponents' contention that the recommended flow amounts exceed the minimum necessary for reasonable preservation of the natural environment is in error.

Over the history of the ISF Program, the CWCB has relied upon standard quantification methodologies (R2CROSS & PHABSIM) as utilized by CPW biologists to scientifically quantify minimum flows. Both methodologies result in flow recommendations that would protect **100 percent** of existing adult fish habitat (or the **optimum adult habitat**) when a fishery is used to indicate the presence of a natural environment. These quantification methodologies allow CPW to equate optimized habitat with a specific flow, which is the minimum flow needed to maintain the existing habitat, and thus the indicator fish. CPW and Staff are attempting to preserve the natural environment conditions that exist at the time of the Board's appropriation.

CPW's and Staff's association of the goal of achieving optimum fishery habitat with the minimum flow necessary for reasonable preservation can result in confusion (see Montrose County's prehearing statement, 9i on page 2; SWCD prehearing statement , page 3). Some think that optimum habitat must mean optimum flows, which would be at odds with the minimum flow required for reasonable preservation. However, when CPW and Staff refer to the optimum habitat, they are talking about the biological definition of optimum, which means "the most favorable condition for the growth and reproduction of an organism" under existing average flow conditions. Optimum habitat does not mean optimum flows, which would include channel maintenance flows. While numerous biologists agree that such flows are necessary for any given fishery, the appropriation of such optimum flows is not being recommended here.

Another way to demonstrate the need for optimum fish habitat is by considering the potential consequences to the natural environment if one were to choose less than optimum habitat conditions for a given species. The logical construct set forth below illustrates this idea and how CPW biologists use modeling to arrive at the correct minimum flow.

- Modeling enables biologists to correlate the flow in a river to the physical habitat available to a given fish species.
- The objective of a CWCB ISF water right is preservation of the natural environment using the minimum amount of water.
- The existing fishery (indicator species) represents the broader natural environment that may include other biota, including the associated riparian areas.

- Preservation (*maintenance*) of that fishery requires protection of its existing habitat.
- Diminution of that habitat could produce harmful changes in the distribution, quantity or health of the fishery, whereas maintaining the most favorable existing habitat conditions (optimum habitat) will ensure that the fishery is "preserved" (to keep safe from injury, harm, and destruction; to protect; to maintain). To choose anything less than the optimum habitat is to risk diminution, which is not consistent with "reasonable preservation" of the natural environment.
- Consequently, the ISF is quantified to be the **minimum** flow to **preserve** that **existing optimum habitat**.
- CPW's recommendation is the modeled flow to achieve that objective.

Finally, the Board's statutory requirement to correlate the activities of mankind with some reasonable preservation of the natural environment is a separate endeavor from the quantification of the minimum flow necessary. As demonstrated above, reasonable preservation only can be achieved when the goal is 100 % protection of existing habitat. Science defines the minimum, whereas policy establishes the manner and degree of correlation and defines "reasonable." In other words, to effectively correlate the needs of mankind with reasonable preservation, the Board may provide additional time for stakeholders to reasonably develop water rights that would be senior in priority to the proposed ISF water right. In addition, the Board's enabling statute itself provides for correlation by requiring the Board to recognize practices in existence at the time the Board appropriates an ISF water right. Correlation also takes the form of the Board looking at average or median hydrographs to assure that even with the appropriation of an ISF water right, adequate water remains available that Colorado's citizens can develop and use as the need arises.

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Written Testimony of Owen R. Williams, Hydrologist
Stream and Lake Protection Section
Colorado Water Conservation Board

26 August 2011

Background

My name is Owen R. Williams. I am a hydrologist in the employ of the State of Colorado's Department of Natural Resources, Colorado Water Conservation Board (CWCB), Stream and Lake Protection Section (SLPS). The State classifies me as a level II Physical Science Researcher/Scientist and I have been in the State's employ since November 2006. I have been engaged in my profession as a hydrologist for almost 40 years working in the service of the USDA National Forest Service, the USDI National Park Service, a suite of Federal, State, Corporate/non-profit, and private clients as a consultant, and now the State of Colorado.

As you are aware, the S&LP Section is charged with securing and protecting natural lake level and instream flow water rights in the name of the State of Colorado to preserve the natural environment to a reasonable degree. My role in the S&LPS is to provide technical assistance in the program's new appropriations emphasis area and, when feasible, to assist other staff in support of the overall program. In practice, my primary responsibility is to determine the availability of water for original appropriations as instream flow (ISF) and as changes (increases) to existing instream flow or natural lake level water rights. The determination that water is available and sufficient for appropriation by the CWCB for ISF or natural lake level purposes is a requirement of statute and rule.

Executive Summary

CWCB Staff has concluded that **water is available** for appropriation for instream flow purposes in the reach of the San Miguel River from its confluence with Calamity Draw downstream to its confluence with the Dolores River in the amounts recommended by Colorado Division of Wildlife (now Colorado Parks and Wildlife, CPW) and United States Department of the Interior, Bureau of Land Management (BLM). Using information developed by CPW, CWCB Staff has also concluded **there is a natural environment** that can be preserved to a reasonable degree with the Board's water right, if granted. Finally, CWCB staff has also concluded this environment can exist **without material injury to water rights**, both decreed and undecreed. In developing the foundations for the previous statements, Staff is convinced **this appropriation correlates the activities of mankind with some reasonable preservation of the natural environment**. A reasonable level of environmental protection is achieved with this appropriation without dedicating all of the discharge of the San Miguel River to this natural ISF purpose.

To arrive at those conclusions above that relate to the biology of the lower San Miguel River, CWCB Staff relied upon the field work and studies submitted by recommenders CPW and BLM. With regard to the hydrological aspects of the above conclusions, Staff used the standard CWCB water availability analysis. Opposer's prehearing statements criticized both of these components of the analysis; in my opinion, the rebuttal statements by Staff and by recommenders satisfactorily addressed any issues raised, although some differences

in professional opinion should be expected to remain. Rebuttal statements from the opposers were limited in number and are discussed below.

Collection Of Basin Data

The procedural and legal processes for establishing an ISF or natural lake level water right has been described by others and will not be revisited here except to describe the manner by which I become involved. As the Board no doubt recalls, the creation of an ISF water right begins with a specific written recommendation. The recommendation is typically made by CPW (formerly CDOW), Federal agencies (typically USDI Bureau of Land Management), and environmental organizations (typically Trout Unlimited) and generally includes some discussion of water availability. This discussion is generally cursory and usually serves as a point of departure for additional in-depth data collection and analysis by Staff. Analysis begins by compiling data on water rights that may affect or be affected by the creation of the recommended ISF water right.

The collection and review of water rights information is facilitated by a component of the Colorado Decision Support System (CDSS), called StateView. As used by SLPS, StateView is a data retrieval device that organizes data for preliminary analysis. The StateView tool interacts with HydroBase, the database central to the function of CDSS and its ancillary programs, tools, and routines, to retrieve, order, and analyze information through user queries. After the water rights data are gathered, the analyst can use StateView to arrange water rights data and water structure data so as to facilitate analysis and interpretation; possibly even further analysis. When completed, the results of the StateView data retrieval and analyses are used by the analyst to remove from further consideration the water rights/structures identified as abandoned, historically used but no longer active, inactive with no records, etc. The resultant reduced data set can be further manipulated to emphasize particular attributes such as structure types including ditch, well, spring, dam, etc. For each water right/structure entry, the nature of the right and use is provided as are the rate and volume amounts of the right, the amount of each that is absolute, conditional, alternate point/exchanges, etc. Also provided are the owner, source, types of use, those that are out of basin, as well as the legal and administrative information that controls the administration of the right. With this information sorted and summed, a pretty complete description of water use in a basin can be developed. An example of the information that can be developed with StateView and the CDSS can be seen in Table 1 that displays the summarized data for the San Miguel River basin tributary to the lower terminus of the reach recommended for ISF.

Gage Data And Human Influences In The San Miguel River Analysis

The irrigated acreage for each of the irrigation rights in the basins above the San Miguel at Uravan gage and above the lower terminus were developed from CDSS by looking at the Diversion Records and Structure Summaries for each water right/structure with an irrigation use. Acreages mentioned in court decisions, official records, or state GIS (geographical information system) measurements were collected from CDSS along with the crops irrigated. The CDSS diversion records included daily amounts of irrigation for each water right, for each day of the year, over the period of irrigation record.

Other data required for analysis was developed more or less concurrently. The gage discharge records for, in this case, the USGS gage station *San Miguel River at Uravan* were acquired and inserted into the Excel workbook established for this analysis. This data included the daily values file (the daily mean values for the period of record [POR]), the statistics file (exceedance values for each day of the POR) and station information

(location, elevation, basin area, etc). In most instances including this one, the basin area tributary to a gage station is shown in the station information record. The basin above the lower terminus, however, must be traced and the area determined. The ArcGIS application, ISFDSS, facilitates this process and was used here to delineate the San Miguel River above the lower terminus watershed and to compute its area. Among other things, basin maps were printed from the resulting map image.

The drainage basin area data was added to the hydrology, and water rights and uses data already placed into the described Excel workbook. With these data in place, the San Miguel River at Uravan gage baseline hydrograph could be developed. In developing the baseline hydrograph, the effects of upstream withdrawals or additions upon the hydrograph were removed by adding back into the existing gage record the daily withdrawal data. The portion of the withdrawals that was "lost" to plant transpiration (and thus not returned to the river by surface or groundwater return flow) was determined by multiplying the acreage of each crop identified with each of the irrigation use water rights above the gage by the amount of water consumed per acre for each crop. The consumption rate for each crop was determined using monthly irrigation consumption values defined by county, crop, and elevation. The resultant consumptive loss amounts, converted to daily values, were added back to the daily discharge values over the POR. Still required for the creation of an "unimpacted" or "baseline" hydrograph were the effects of "out-of-basin" withdrawals and foreign water inputs (diversions into the basin). There are "out-of-basin" diversions in the San Miguel River basin; the daily amounts, taken from CDSS, were added back to the hydrograph. No "into-basin" diversions were found in the CDSS database. Had there been any, they would have been subtracted from the gage station hydrograph.

Extracting "Meaning" From Gage Data

A period of record (POR) of forty to forty three years (exact number dependent upon the inclusion of years with incomplete data) for the San Miguel River at Uravan gage is very satisfactory for characterizing river discharge. However, these discharge measurements are not a perfect representation of historical discharge. Each of the 366 values in the annual hydrograph is the average of 40 to 43 daily averages of discharges. Each of 366 values is itself an average of discharges measured at a specified time interval, usually fifteen minutes. Using statistical terms, the record is only a "sample" of all the possible measurements that could have been made over the river's existence, even though humans had not been on the scene to make those measurements for most of that time.

Because the record is a sample, individual high flow events inordinately impact measures of the record's "central tendency" such as its average or mean. In other words, statistical descriptions like the annual, monthly, and daily means can be upwardly distorted by the effects of a few or even individual flood events. Averages of flow tend to be increased by these unusual high flow events. This effect can be reduced by converting the daily flow values into logarithms, computing the mean of those logarithmic values, and then converting from logarithms back to "regular" daily values. In the San Miguel River, each of these 366 values is the geometric mean of the 40 or so discharge values for that day. If the 366 daily values are plotted, the resultant hydrograph represents the geometric mean of the daily mean discharges. The effects of the unusually high flow events upon the average of the 40 daily values are dampened so as to produce a description of the flow regime that generally approximates the median or 50% exceedance flow. The information in the high flow values is not lost in the analysis, but the distorting power is reduced or eliminated through the logarithmic transformation. Typically, the geometric mean hydrograph is lower than the commonly used average value hydrograph. The outcome is

generally a more conservative estimate of discharge. For the purpose of determining water availability, especially within the CWCB constraint of using the minimum amount necessary for environmental preservation and correlating with the activities of mankind, the hydrograph of the geometric mean is appropriate. Typical hydrographs, by failing to reduce the distorting effects of extraordinarily large flood events, produce increased estimates of water availability. For these reasons, the baseline hydrograph was computed using the geometric means of gaged discharge values, with diversion effects eliminated.

The logarithmic conversion and reconversion just described is the reason you have heard the CWCB water availability analysis described as Geometric Mean analysis. This is something of a misnomer. The CWCB water availability analysis does make use of the geometric mean statistic, but that is only a small part of the analysis as should become increasingly clear.

Existing Conditions At The Lower Terminus

The baseline hydrograph for the lower terminus was computed by multiplying the baseline hydrograph at the gage by an area ratio (the fraction or ratio that results from dividing the lower terminus basin area by the gaged basin area). The ratio in this case was 1.0388 which means the basin above the lower terminus is about 4 percent larger than the basin above the gage. Next, the baseline hydrograph at the lower terminus had to reflect existing conditions of daily mean discharge before anything could be determined about water availability. To accomplish this, the baseline lower terminus values were adjusted in the same manner as described above - by adding back or removing existing diversions and additions in the basin above that point. This included all of the impacts that were included in the adjustments of the hydrograph at the gage plus any others that exist in the additional contributing area tributary to the larger lower terminus basin; i.e., the areal increase represented by roughly four percent of the gaged basin area. Once the "existing condition" hydrograph was established, it could be compared to the recommended instream flows.

However, before examining the differences between the "existing condition" lower terminus hydrograph and the recommended ISF amounts, a standard formula was used to compute 95% confidence values above and below the existing condition lower terminus hydrograph. The confidence values, when connected into a line for the lower 95% value more or Less paralleled the plot of geometric mean values; the same resulted from connecting the upper 95% confidence values. The distance between the upper and lower confidence plots described the region within which there is a 95% chance of finding the "true" population value; i.e., the one that would be found if the entire population of discharges in the San Miguel River at the lower terminus had been measured over the river's existence. The distance from the lower band to the upper band shows the variable nature of the 40 or so discharge measurements taken on that specific day of the year (e.g. 26 August.) The narrower the band, the better is the quality of the value predicted for that day of the year.

The next step in the analysis is the comparison of the recommended ISF values to the existing condition geometric mean hydrograph for the San Miguel River at the lower terminus. As a matter of policy, the Board has accepted as a criterion for establishing an affirmative determination of water availability, a demonstration that recommended flows are equal to or less than the existing condition geometric mean hydrograph for the lower terminus of the recommended reach. Generally, recommenders, in light of the CPW's approval of the concept, accept that discharges of this magnitude will serve to preserve fishery values because of the mobility and adaptability of the fish species to be preserved by the target ISF flows.

Criticism Of CWCB Staff's Water Availability Analysis

Prehearing statement criticisms of the CWCB's approach to analysis of water availability were addressed in rebuttals. However, additional comments were made in Montrose County's rebuttal statement of 17 August 2011. Montrose's consultant GEI (GEI) asserts the historical flow regime measured at the San Miguel River at Uravan gage "…prior to 2008 that maintained the fishery through this period serve as a basis for judging the adequacy of the agencies minimum flow recommendations." GEI further asserts the "synthetic hydrology" developed for the lower terminus "… has no biological relevance as the current fish community did not experience synthetic hydrology but survived and thrived on actual historic hydrology." Continuing, GEI discusses their calculation of "historic median flows" and comparison to the recommended minimum flows. GEI noted the recommended flows would have been greater than the median values 30% of the days in the year. This observation was augmented by GEI's reminder that, "[b]y definition, half the time flows were lower than the median." Expanding on this observation GEI asserts the flows previously recommended by GEI "…would have been met over 94% of the days by median flows in this period."

Extrapolation

These comments address more than just water availability because, among other things, an assumption is made that the flows "… through one of the most severe drought periods in Colorado history" "…were sufficient to maintain the current healthy fishery." The work of the CWCB on water availability does not address the requirements of fish relative to particular discharges. All that can be addressed here is CWCB's analysis of water availability. With that said, the portions of GEI's comments related to this topic tend to focus on "synthetic hydrology." I assume the pejorative use of the term "synthetic hydrology" refers to the extrapolation of data from the gage site to the lower terminus rather than to the use of statistical tools like the median that provide measures of "central tendency" useful in understanding the significance of a list of numbers. Of course, if my assumption is wrong and GEI disfavors the use of statistical tools to extract meaning from strings of numbers, then GEI's disagreement with CWCB's analysis goes to issues that will not be satisfied through this testimony. However, in rebuttal, GEI has felt it appropriate to use the median (one of the statistical devices that extract meaning from strings of numbers) to support GEI's rejection of recommenders' ISF proposal. Because I can see no good reason for GEI rejecting statistical tools on the one hand while using them on the other, I must conclude that GEI took exception to the use of extrapolation to characterize flow at the lower terminus. Therefore, from its own experience using statistical tools like the median, GEI should appreciate CWCB's conclusion that more or better information could be wrung from the San Miguel at Uravan gage discharge record by applying additional statistical tools. CWCB's analysis of water availability is intended to bring the best available science to bear upon the problem of characterizing the hydrology of an ungaged point on the San Miguel River. In doing so, CWCB staff turned to the USGS's technical guides for the measurement and analysis of hydrologic data. CWCB staff asserts that its conclusions are reasonable and well supported by the existing science.

Turning to GEI's issues regarding extrapolation, if indeed that is where its issues lie, any concern over the potential for errors to accrue to data that are extrapolated from the gage record at Uravan to the lower terminus

of the recommended ISF reach must first address the errors that arise from not extrapolating. In its analysis, GEI chooses to define the hydrology measured on the smaller gaged basin (that basin tributary to the site of the USGS gage) to be the same as that of the larger ungaged basin (that basin tributary to the site of the lower terminus). To the best of my knowledge, this was done without adjustment to account for the larger drainage area or altered precipitation input. The difference in drainage areas, more than 58 mi^2, may represent a small percentage of the basins, but in my view, it is not trivial. Furthermore, GEI's analysis fails to address the impacts of human activity upon the hydrology of either the gage station basin or the lower terminus basin. As discussed above, the CWCB methodology for determining water availability includes a clear intent to address all or as many as feasible of the factors, both human and natural, that influence the hydrology of the recommended ISF reach and its tributary basin.

GEI's Claim That Flows Less Than the Median Have Maintained the Current Healthy Fishery

Another of GEI's rebuttal arguments asserts GEI's flow recommendation is better than that of the recommenders because GEI's recommended flows "…would have been met over 94% of the days by median flows in this period…" (this period being "…one of the most severe drought periods in Colorado history"). In my view, this statement says little; a flow of near 0 cfs would probably have been met over more than 99% of the days by median flows. Another GEI assertion is misleading and could be seen as contradictory. GEI asserts, "… the current fish community did not experience synthetic hydrology but survived and thrived on actual historic hydrology" and then goes on to opine that GEI's minimum flows (as related to their computed median values and significantly less than the recommended flows) would maintain the current healthy fishery. In other words, GEI's "synthetic hydrology" (their proposed flow values met by the median flow 94% of the time) could replace the actual historical flows and maintain the current healthy fishery. The hydrograph that would result from GEI's proposal is not the historical hydrograph that GEI points out has sustained the fishery but would be one that is just as "synthetic" as any other proposal. The status quo regimes of flow at the San Miguel River at Uravan gage and at the lower terminus constitute regimes of flow the recommenders would be thrilled to see dedicated to the preservation of the fishery in the lower San Miguel River. In my opinion, those regimes of flow, being variable and including the full range of hydrological variability, would certainly sustain the current healthy fishery. However, what is at issue is not the well being of the fishery under the existing flow regime but rather under a "synthetic" regime of a few fixed GEI discharges. From the CWCB water availability analysis and recommenders' studies, the question as to which "synthetic " regime of flow will best serve the fish as a replacement for the status quo appears to have been answered in the ISF recommendation.

Water Volumes "In Excess" Of ISF Amounts

Montrose County's rebuttal included a memo from its second consultant, Deere and Ault Consultants, Inc. (D&A) regarding D&A's review of a Memorandum by Laura Belanger, P.E. (Belanger) that evaluated the hydrologic analyses of Bikis Water Consultants, LLC, as documented in Bikis's November 2009 preliminary report, *Evaluation of Technical Basis for Lower San Miguel River CWCB Instream Flow Recommendations*. D&A noted Belanger's belief that several of the methodologies and draft findings in the Bikis report were "incomplete or inaccurate." D&A's review of Belanger's Memo did not directly address CWCB Staff's analysis; however, it did attempt to "… place Ms Belanger's analysis in the proper context so as to not invite incorrect interpretations and conclusions regarding the annual availability of flow in excess of the recommended

ISF recommendations" [sic]. To the extent that Belanger's Memo supported CWCB's determination of water availability, it is appropriate for CWCB to consider both the Memo and D&A's review comments.

Belanger's Memo included computations of the annual volumes of water passing the San Miguel R. gage at Uravan that would be" in excess" of the proposed ISF recommendation over a 43-year study period. Belanger concluded that flows at the Uravan gage in excess of the recommended ISF amount averaged 167,183 acre-feet per year. Belanger's report included a probability of exceedance analysis using the annual volume of flows in excess of the ISF. This analysis produced an exceedance curve that illustrates the probability of annual flows in excess of the ISF recommendation meeting or exceeding a given volume. D&A states it confirmed Belanger's results but noted " … the annual average of excess flow, 167,183 acre-feet, is influenced by wet years, in that the annual volume of excess flow that is exceeded 50 percent of the time (i.e., the median) is approximately 123,469 acre-feet…" D&A then offered the notion that the median volume of 123,469 acre-feet, about 26 percent less than the average, was a "… better representation of the excess flows that will be equaled or exceeded in about half of the years." D&A's review and analysis to this point appears to support CWCB's water availability analysis that determined there would be water available for the recommended ISF appropriation without dedicating all San Miguel River discharge to natural ISF purposes. Belanger's determination, verified by D&A, that water would remain available for future appropriation also serves to support the CWCB contention that the ISF appropriation would not be injurious to other appropriators. However, D&A's conclusions were far from supportive of the recommended ISF; they argued the 123 thousand acre-feet were not an "excess" at all.

To correct possible misunderstanding of the Belanger Memo and D&A's repetition of Belanger's numerical conclusions, D&A next discussed the practical limitations that would work against attempts to appropriate and develop the flow volumes in excess of the recommended ISF as computed by Belanger. D&A remarked upon the difficulties experienced in trying to use Belanger's annual time step for the kind of analysis D&A was attempting. As a better approach, D&A offered that a daily and/or monthly analysis would be better for examination of the amount of water in excess of the ISF that could be appropriated and put to beneficial use. (D&A's recognition of the importance of the time step and preference for a daily or monthly unit also lends support to the CWCB method which is virtually entirely based on a daily time step.) D&A opined that, "[i]t is the absence of the monthly data that will likely lead to incorrect interpretations of actual availability of water for future water use and appropriation." In explanation, D&A contends the flow rates and volumes of "excess" water (that could best determined using the shorter than annual time step), would only become available during storm or high runoff events which would be too high for appropriators to develop. " … Without large diversion capacities and storage reservoirs" and additional infrastructure, a large portion of the "excess" water would not be susceptible to diversion and use. Before concluding D&A also observed that during dry years, the flows within the San Miguel River are rarely adequate to fully satisfy the CWCB's recommended ISF flow rates. This sentence could be somewhat misleading in that it is qualified by looking at dry years, by saying flows are rarely adequate, and specifying "fully satisfying" the recommended flow rates. In contrast to typical consumptive uses, recommenders and CWCB Staff do not expect to either always be in priority or always get "full" satisfaction of ISF rights. As remarked above, certain aspects of the natural environment are compensatory of difficulties.

The D&A review of Belanger's Memo brings to the fore some important issues that go to the source of the controversy surrounding this recommendation. Specifically, the potential limitations (increased cost) that future

appropriations (and, by implication, some changes to water rights) might endure as a consequence of an ISF appropriation. Though of heated interest and concern to local appropriators, the issue of speculation has been addressed in Colorado water law. Through a ban on speculation and the creation of conditional water rights, lawmakers have created the means whereby municipalities can address their future water development needs. Lawmakers understood the major difficulties for existing water rights that would accompany speculation if it were not prevented. The ISF water right is a water right like any other with the same privileges and duties. If a water right is required to "give way" to future appropriations, changes, etc., uncertainty would attach to existing water rights, their value would be reduced or lost, and there would be little or no financial increment attached to water right seniority.

Summary

CWCB has developed and continues to improve its process for water availability analysis. The process is based upon standard analytical tools, USGS – hydrologic records and statistical methods, CWCB sponsored/developed information management tools (CDSS, ISFDSS) and staff ground truth. The process is intended to be a standard, consistent and reproducible approach to analysis for use on all ISF recommendations. The inclusion into the analysis of water use records and other available information about the real-world uses that could impact or be impacted by the recommended ISF is intended to address CWCB's directive to analyze water availability. The intensity and scope of this analysis may be viewed as overkill by some, but its establishing legislation and subsequent rules leave CWCB with small latitude for change in its required determinations and in its responsibility to the citizenry to serve a balancing role in water resource allocation and use.

This process and the tools employed were, to one degree or another, subjected to direct and indirect attack in the pre-hearing statements preparatory to the hearing on the appropriation of an ISF water right on the lower San Miguel River in Water Division 4. The attacks and criticisms enjoyed by CWCB Staff in this matter have generally been substantive only in small degree. Differences in outcomes among analyses as compared to that of CWCB Staff are small, small enough to be trivial in some cases. The significance of differences is further diminished when considered in the light of the precision, reliability and accuracy of much of the data and assertions that go into measurements of natural resources and environmental processes to say nothing of data used for administrative purposes.

In the final analysis, CWCB staff has concluded and, in my opinion, demonstrated to a reasonable level of certainty that **water is available** for this appropriation and that **no water right would be injured**. The issue of greatest moment among opposers, aside from a personal rejection of the very concept of protected instream flows, is the potential for a loss of future opportunities. Neither the CWCB procedure nor Colorado water law are designed to address this concern and neither should be.

San Miguel Basin Water Rights

Structure Type	Total Number	TRANS- BASIN COUNT	DECREED RATE ABS (CFS or A-F)	DECREED RATE COND (CFS)	DECREED RATE APEX ABS (CFS)	DECREED RATE APEX COND (CFS)	DECREED RATE TOTAL (CFS or A-F)	DECREED VOL ABS (ACFT)	DECREED VOL COND (ACFT)	DECREED VOL APEX ABS (ACFT)	DECREED VOL APEX COND (ACFT)	Total Volume (A-F)	Total Total (A-F)	Sum Cols L,M,N & O) DECREED VOL TOTAL (ACFT)	(From Col K) Total Rate Conv to A-F	
HEADGATE (1575 Total Structures)	1575	173	3,597.01	1,155.70	229.90		4,982.61									
Active Ditches (767 Total)	550	46	3,180.79	345.18	215.18	14.62	3,755.77									
(Ditches conv to A-F)			6,309.00	684.65	426.80	29.00	7,449.46	395.33	90.15			485.48		485.48	7,449.46	Ditch - Abs & Cond, APEx Abs & Cond
(Ditches conv to A-F/yr)																
Springs	808		74.37	26.85	1.08		102.30									
(Springs Conv to A-F)			147.51	53.26	2.14		202.91	10.45	16.55			27.00		27.00	202.91	Spring - Abs &Cond, Abs APEx
(Springs Conv to A-F/yr)																
Active Augmentation Plans	41	17														
EXISTING CWCB ISF	24		202.05				202.05									
(CWCB ISF Conv to A-F)			400.76				400.76									
(CWCB ISF Conv to A-F/yr)																
JURISDICTIONAL DAM	19															
NON-JURISDICTIONAL DAM	295															
US Govt (BLM, USFS)	113															
Private, etc	182															
REACH (pond, stock pond, reservoir)	933	590	5.18	267.55	0.00	0.00	272.73									
(Reach Conv to A-F)			10.27	530.68	0.00	0.00	540.95	65,171.20	274,548.45	12.00	2,143.60	341,875.24		341,875.24	540.95	Reach - Rate conv to A-F
US Govt (BLM, USFS)	447															
Private, etc	546															
WELL OR WELL FIELD	265		13.68	13.07	22.08	11.22	60.05									
(Conv to A-F)			27.13	25.93	43.80	22.26	119.11								119.11	Well - Abs & cond, Abs & Cond APEx
US Govt (BLM, USFS)	5															
Private, etc	260															
SUMMATION (w/o exist CWCB ISF)			3,274.02	652.65	238.34	25.84	4,190.85					342,387.72	Total		8,312.43	Tot of Rates - Converted to Volume
															350,700.15	Total of Vols and Rates -conv to vol
Summed Water Uses Incl exist CWCB ISF			3,476.07	652.65	260.06	25.84	4,392.90									
(Conv to A-F)			6,894.66	1,294.52	515.83	51.26	8,713.18								6,894.66	Total of Abs Rates - conv to Volume
RECOMMENDED ISF (averaged)			140.08													
(Conv to A-F)			277.84													
(Summation of proposed daily ISF (A-F))			101,413.23									Will Come From SM R at Uravan			101,413.23	Recomm ISF - A-F/yr
MEAN of DAILY MEAN DISCHARGE (SM R @ Uravan in cfs)			359.72													
Includes Incomplete Data - Conv to A-F/yr			260,422.24												260,422.24	Mean SM R Q - A-F/yr

Table 1. Analyst Summary of Output from StateView for San Miguel River

BEFORE THE COLORADO WATER CONSERVATION BOARD

STATE OF COLORADO

CERTIFICATE OF SERVICE

IN THE MATTER OF STAFF'S RECOMMENDATIONS FOR AN INSTREAM FLOW APPROPRIATION ON THE SAN MIGUEL RIVER, WATER DIVISION 4

I hereby certify that I have duly served the copies of **Written Testimony of Jeff Baessler, Deputy Section Chief and Owen R. Williams, Hydrologist of the Colorado Water Conservation Board** all parties herein by email or depositing copies of the same in the United States mail or via email, postage prepaid, at Denver, Colorado, this 26th day of August 2011, addressed as follows:

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/s/ *Holly Archer*
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