United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

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In Reply Refer To
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Memorandum

To: Mr. Brent Rhees, Director, Upper Colorado Region, U. S. Bureau of Reclamation
Ms. Heather Patno, Chair, Flaming Gorge Technical Working Group, Bureau of Reclamation

From: Field Supervisor, Utah Field Office, U.S. Fish and Wildlife Service

Subject: 2016 Green River Spring and Base Flows to Assist in Recovery of the Endangered Fishes

This letter describes our recommendations for 2016 spring and base flows in Reach 2 (with consideration of effects in Reach 3) of the Green River for discussion by the Flaming Gorge Technical Working Group (FGTWG) in development of recommendations for Flaming Gorge Dam operations. Our intent is to work with other FGTWG members to ensure consistency with the 2005 biological opinion (BO; U.S. Fish and Wildlife Service 2005) and 2006 record of decision (ROD; U.S. Department of Interior 2006), which call for flows and water temperatures to protect and assist in recovery of endangered fishes (Muth et al. 2000).

The following recommendations are subject to forecasted and real-time May – July hydrologic conditions in the upper Green River drainage, with recognition that trade-offs of spring and base flows should be considered and used to adjust operations as deemed appropriate.

Spring Research Flows

We support the Upper Colorado River Endangered Fish Recovery Program's (Recovery Program) 2016 Spring Flow Request, as explained in their April 22, 2016 letter. We believe the primary objective, to time Flaming Gorge releases and resultant floodplain connection with the Green River during presence of razorback sucker larvae, is consistent

with the intent of the Flow and Temperature Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam (Flow Recommendations; Muth et al. 2000), the 2005 BO, and the 2006 ROD. Specifically, the objectives and criteria presented in their letter are consistent with the common goals of the Flow Recommendations, BO and ROD: to use the best available science to guide Flaming Gorge operations and recovery actions in an adaptive management framework. Timing Flaming Gorge releases concurrently with larvae presence is proving to be a major step forward in re-establishing a stable population of razorback sucker in the Green River basin.

The *Study Plan to Examine the Effects of Using Larval Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam* (LTSP) details the range of experimental conditions the Recovery Program recommends assessing, with recognition that more than one set of flow conditions identified in their LTSP study matrix could be accomplished in a single year. Because the LTSP describes a systematic analysis for evaluating the success of operating Flaming Gorge concurrently with razorback sucker recovery, we feel it is very important to follow their flow recommendations whenever possible.

Based on recent information provided by Reclamation to the FGTWG by conference call, we understand that inflow into Flaming Gorge is in the average below median hydrologic category and the Yampa River drainage is categorized as average above median. We understand that Bureau of Reclamation (Reclamation) intends to increase releases up to bypass levels (up to a total dam release of 8,600 cfs) between seven to ten days, which is subject to modification due to actual hydrology. Based on that information, it appears that 'average below median' LTSP study objectives will be achieved in 2016. We applaud the coordination between Reclamation and the Recovery Program for what appears to be another successful year of spring studies.

Justification for the LTSP under the Flaming Gorge BO and ROD

The LTSP is an important document that will assist in consistent evaluation of the benefits of Flaming Gorge operations to razorback sucker. The LTSP and updated flow release is supported by the most recent scientific research into endangered fish ecology and floodplain management (Bestgen et al. 2011). As the Recovery Program described in the LTSP, the Bestgen et al. (2011) report synthesized long term data, evaluated the ability to operate Flaming Gorge Dam for the purpose of entraining wild razorback larvae into floodplain habitats, and created a set of conclusions and recommendations to guide future management. The Flow Recommendations support utilizing up-to-date research and monitoring, such as the Bestgen et al. (2011) report:

> "the collection of additional data on endangered fishes and their habitats should focus on the evaluation and possible modification of our recommendations by following an adaptive-management process" (Muth et al. 2000, p. 5-39);

as well as biological information to guide the onset of spring peak flow:

"Examples of real-time and other year-specific information to be considered in determining annual patterns of releases . . .

- Initial appearance of larval suckers in established reference sites in Reach 2 (e.g., Cliff Creek)" (Muth et al. 2000, p. 5-9, Table 5.3).

Similarly, the 2005 BO recommends adaptive management in implementing the proposed action (operations of Flaming Gorge Dam) (U.S. Fish and Wildlife Service 2005, p. 16) and set forth this process as a conservation measure:

> "The adaptive management process will rely on the Recovery Program for monitoring and research studies to test the outcomes of implementing the proposed action and proposing refinements to dam operations" (U.S. Fish and Wildlife Service 2005, p. 17);

and

> "[Bureau of] Reclamation, Western [Area Power Administration], and the [U.S. Fish and Wildlife] Service will use any new information collected in these studies to determine the need for management actions or modification of operations as determined appropriate" (U.S. Fish and Wildlife Service 2005, p. 17).

Therefore, we believe that the 2005 BO supports the Recovery Program's 2016 Spring Flow Request and implementation of the LTSP and we support the Bureau of Reclamation's (Reclamation) implementation of this request. The Recovery Program determined they need a minimum of six study years to meet the objectives of the LTSP. Unless otherwise specifically stipulated, this letter conveys the Service's interpretation of ESA compliance under the 2005 BO as it relates to Reclamation's future LTSP-related spring operations. We recognize that Reclamation's targeting of a biological trigger (presence of larval razorback sucker) rather than a hydrological one (Yampa River flows) deviates from past operations and may require greater volumes of water in some years. However, we conclude that this experiment is consistent with the intent of the Flow Recommendations and will assist in the recovery of the endangered fish.

We further recognize that timing releases from Flaming Gorge Dam consistent with the Recovery Program's 2016 Spring Flow Request and the LTSP may require the hydrologic tradeoff of not meeting the 2000 Flow and Temperature Recommendations for Reach 2. Nevertheless, we support Reclamation following the Recovery Program's 2016 Spring Flow Request and LTSP, and consider that doing so will meet Reclamation's responsibility to the ROD objectives in 2016.

Base flow operations

Because of projected average year conditions, we believe that Green River base flow augmentation is a very important consideration for 2016. We propose the following approach to base flow operations in 2016, which is heavily influenced by a recent report presented to the Recovery Program that summarizes 33 years of Age-0 Colorado pikeminnow collection information in Green River Reaches 2 and 3 (Bestgen and Hill

2015a; *in review*). Here we excerpt from the author's conclusions and recommendations, which will serve as the primary basis for our 2016 baseflow request:

- *Conclusion - Age-0 Colorado pikeminnow abundance declined in both the middle and lower Green River reaches over time, especially since about 1994.*
- *Conclusion - Middle Green River base flows in the range of 51-85 m^3/sec (1,800-3,000 ft^3/sec) were consistent with higher densities of age-0 Colorado pikeminnow in autumn and with more backwater habitat.*
- *Conclusion - Lower Green River base flows in the range of 62-108 m^3/sec (2,200-3,800 ft^3/sec) were consistent with higher densities of age-0 Colorado pikeminnow in autumn and with higher backwater habitat availability; the existing upper end of flow ranges in wetter classifications may need to be reduced. Flow recommendations for the lower Green River naturally follow from flows in the upstream middle Green River.*
- *Conclusion - Timing of the onset of base flow conditions should be linked with first presence of Colorado pikeminnow larval drift in the lower Yampa River to ensure adequate backwater conditions throughout the reproductive period and longer growing seasons for age-0 Colorado pikeminnow.*
- *Recommendation - Initiate immediately, an experimental program of base flows in the middle and lower Green River that are higher than presently recommended for average and drier hydrologic conditions and begin those flows earlier in summer, with a goal to bolster populations of age-0, juvenile, and eventually adult, Colorado pikeminnow abundance in the Green River.*

Base Flow Request:

As per Reclamation's *Proposed Flow and Temperature Objectives for 2016* document, Reaches 1 and 2 should have base flow ranges as described in the Flow Recommendations and based on the observed April through July unregulated inflow into Flaming Gorge Reservoir. April through July unregulated inflow into Flaming Gorge Reservoir was categorized as 'average below median' in 2016. Pursuant to the Flow Recommendations, during the August through November base-flow period, the daily flows should be within ± 40 percent of mean base flow. The recommended 'average' Reach 2 baseflow range from the Flow Recommendations is 1,500 – 2,400 cfs. When we apply the summer seasonal variability of + 40 percent, the 'average' category shifts to 2,100 – 3,360 cfs. Consistent with the information presented in Bestgen and Hill (2015a), we request that Reclamation maintain a baseflow of ≥ 2,100 cfs in Reach 2 through at least September 30, 2016. The 30 September end date is consistent with the duration of time needed to maintain conditions for improved growth and survival of age-0 Colorado pikeminnow. We understand that Reclamation may not be able to maintain that target base flow in Reach 2 beyond September 30, 2016 and still balance annual operations.

We interpret the Flow Recommendations as recommending Reclamation incorporate seasonal variability into dam operations to assist in the recovery of endangered fishes and accommodate natural variability, but not allow for manipulation that targets a specific

operational pattern. Our 2016 base flow request, which complies with the ROD and the BO, is consistent with the intent of the flow recommendations, is based on information gathered by the Recovery Program, and responds to current biological conditions in the Green River system including reduced survival of age-0 Colorado pikeminnow.

Our rationale for requesting elevated base flows through September 30 is consistent with our requests in 2008 – 2013 and again in 2015, and is bolstered by the information presented in Bestgen and Hill (2015a).

A secondary benefit of elevating the base flow target in Reach 2 and the associated increased releases from Flaming Gorge Dam (at least through September 30, 2016) is the deleterious effect higher flows have on spawning time and growth of nonnative and predaceous smallmouth bass in Reach 1 and to a lesser extent in the upper portions of Reach 2. To illustrate this point, we provide a graphical comparison of two Reach 1 base flow hydrologies and thermal regimes (years 2005 and 2007) and the resultant effect on smallmouth bass spawning chronology (Figure 1). During a relatively wet and cool year (2005), smallmouth bass spawning occurred nearly 3 weeks later than during a drier, warmer year (2007). The same relationship was observed in related investigations on the Yampa River.

Also, preliminary information from population dynamics modeling of smallmouth bass in the upper Colorado River basin indicates that any disruption of early season spawning nests results in the largest reductions to future sub-adult and adult density (Bestgen and Hill 2015a; *in review*). Furthermore, Bestgen and Hill recommend undertaking any means of early season nest disturbance, including flow releases, to reduce abundance of invasive smallmouth bass. Elevated releases from Flaming Gorge to primarily benefit Colorado pikeminnow will therefore also delay spawning and reduce growth of smallmouth bass.

The Flow Recommendations call for a base flow range of 1,800 – 4,200 cfs in Reach 3 during 'average' hydrologic years. Bestgen and Hill (2015a) recommend a preferred base flow range of 2,200 – 3,800 cfs for this lower Green River reach in all years. In drier than average years, the Green River between the Jensen, Utah and Green River, Utah gauges can become a 'losing' reach, where substantial volumes of flow are subsumed into the alluvium and are unavailable as surface water. Our Reach 2 base flow request of $\geq$ 2,100 cfs may support the lower end of the Flow Recommendation base flow range in Reach 3. It is important to provide preferred flows in this important reach of the Green River, because in recent years, we have learned the critical role lower Green River nursery habitats play in Colorado pikeminnow population viability (Bestgen et al. 2010).

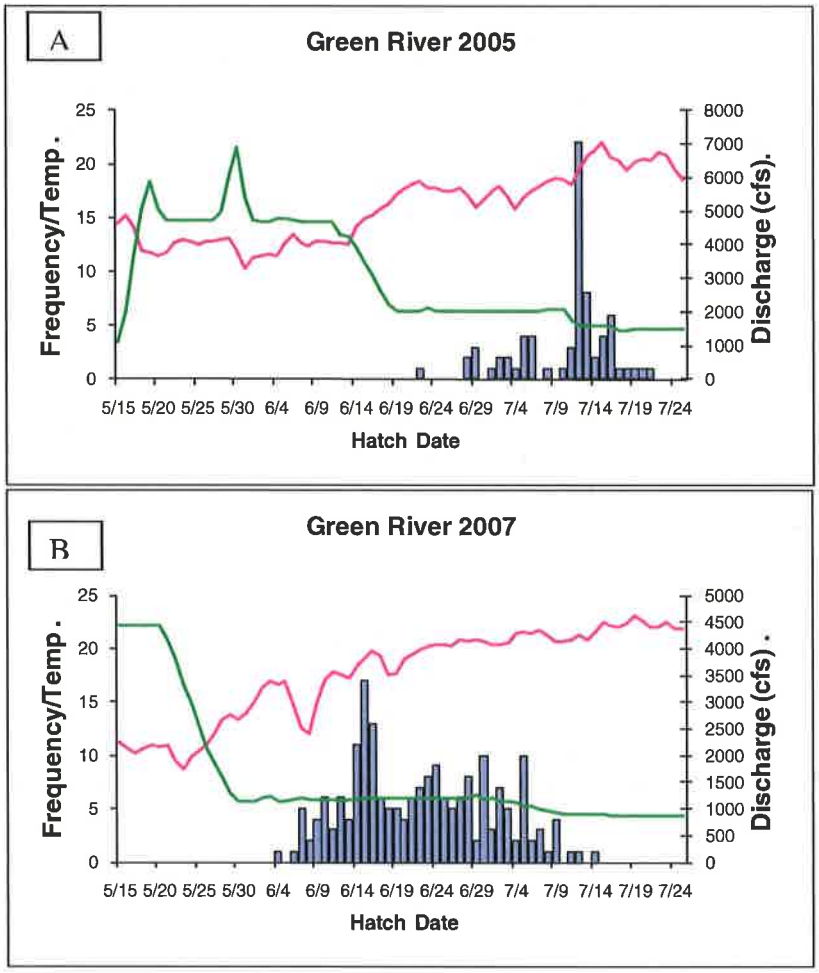

Figure 1. A comparison of flow (green), temperature (purple), and smallmouth bass hatching dates (bars) in Lodore and Whirlpool canyons (Green River - Reach 1 and upper Reach 2). A) 2005 conditions included higher base flows and cooler temps; B) 2007 conditions included lower base flows and warmer temps. Figures excerpted from Recovery Program Project #115 2009 Annual Report (preliminary information)[1]

Conclusions

In summary, we request that Reclamation:

- Time spring bypass flow releases (up to 8,600 cfs) for up to ten days (subject to modification based on actual hydrology) from Flaming Gorge to correspond with the presence of wild produced razorback sucker larvae according to the LTSP in order to improve entrainment success; and

[1] Available online at: http://coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2009/nna/115.pdf

- Enhance summer base flows in Reach 2 of the Green River by maintaining ≥2,100 cfs through September 30, 2016.

We believe that data gathered by the Recovery Program make a strong case for these proposed operations in 2016 and should benefit young life stages of endangered fish. We hope that hydrology conditions in the Upper Green and Yampa River drainages will supply sufficient water to meet these needs. Furthermore, we believe that these operations are consistent with the existing BOs for Flaming Gorge and the Flaming Gorge ROD.

We thank Reclamation for the opportunity to provide this input and look forward to participating in the FGTWG process. If you have any questions or concerns, please contact George Weekley at 801-975-3330 x137.

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