

October 31, 2012

To: Department of the Interior (DOI) Glen Canyon Leadership Team for the High Flow Experimental Protocol (HFE Protocol) and Non-Native Fish Control (NNFC)

From: DOI Glen Canyon Technical Team

Re: Recommendation to Implement a fall 2012 High Flow Experiment at Glen Canyon Dam

## **I. INTRODUCTION**

The DOI Glen Canyon Technical Team (Technical Team or Team) has worked during the past several months to evaluate existing data in determining this recommendation for a high flow experiment (HFE) to be conducted at Glen Canyon Dam in November 2012 and is recommending that the Leadership Team approve a fall 2012 HFE. This controlled high flow release would be the first HFE conducted under the recently completed Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam, Arizona, 2011 through 2020 (HFE Protocol) Environmental Assessment (EA) and Finding of No Significant Impact (FONSI).

The purpose of this memorandum is to transmit this recommendation to the Glen Canyon Dam Leadership Team in accordance with the May 23, 2012, Secretarial Directive on the Implementation of Research to Improve Conditions in the Colorado River in Grand Canyon National Park and Glen Canyon National Recreation Area. The Technical Team includes representatives from the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Indian Affairs (BIA), the United States Geological Survey (USGS) and its Grand Canyon Monitoring and Research Center (GCMRC), and the Bureau of Reclamation (Reclamation). Western Area Power Administration (Western) resource specialists also participated in the process and provided information for this recommendation.

The Technical Team has met on a weekly basis for the past several weeks, and resource and communications specialists have been coordinating in small groups as necessary. The Technical Team has incorporated the latest data from all agency experts in making its final recommendation. In making this recommendation, the Technical Team considered multiple issues, as summarized below, including the tasks addressed in the July 18, 2012, memorandum from Anne J. Castle, the Assistant Secretary for Water and Science. The Team also considered additional technical information included in the Notebook for the 2012 HFE.

We are recommending a HFE at a maximum magnitude of 42,300 cfs for 24 hours, as explained below.

## II. HFE PROTOCOL

As explained in the HFE EA, the HFE Protocol is experimental in nature and is designed to achieve a better understanding of whether, how, and when to incorporate high releases into future dam operations in a manner that effectively conserves natural resources that are intimately connected to the distribution, size, and characteristics of fine-sediment deposits. Fine sediment is sand, silt, and clay; the deposits of the Colorado River in Grand Canyon are primarily composed of sand. The HFE Protocol establishes a decision-making framework consisting of three components: (1) planning and budgeting, (2) modeling, and (3) decision and implementation.<sup>1</sup>

The Protocol anticipates use of predictive models for two purposes. First, predictive models were used to anticipate the magnitude, duration, and frequency of HFEs that might occur on a decadal time scale, based on historic sediment and hydrologic data for the Paria River. These models allow prediction of the maximum potential for sandbar building with the historic sand supply. Second, predictive models are used to make recommendations for specific HFEs using real-time measurements and models of the rate of fine sediment inflow from the Paria River and forecasted hydrologic data to determine whether suitable sediment and hydrology conditions exist for a high-flow experimental release. The two basic inputs for the modeling are the hydrology, based on forecasted monthly inflow volumes from the National Weather Service's Colorado Basin River Forecast Center and Reclamation's 24-month study storage and release projections, and the estimated mass of fine sediment that has been delivered to the Colorado River in Marble Canyon. Virtually all of this fine sediment comes from the Paria River, but other, small tributaries contribute approximately 10% additional sediment supply.

A flow routing model was used to predict the rate at which the HFE release wave moves downstream. A sediment transport/budget model was used to predict the mass of fine sediment that would be transported by an HFE and to estimate if a proposed HFE would transport more, or less, fine sediment than had been delivered to the Colorado River during the fall accounting period. Only HFEs that removed and/or redistributed slightly less fine sediment than had been delivered from the Paria River during the fall accounting period (hereafter termed a "positive sediment mass balance") were considered. Sediment-inflow data are based on real-time measurements of the Paria River measured at the gage near Lees Ferry, a predictive model that allows the measurements of sediment transport to be extrapolated to entire HFE periods. Sediment inflow from lesser tributaries is estimated as a small proportion of the inflow rate from the Paria. Modeling of Colorado River sediment transport is used to predict if the duration and magnitude of an HFE release transports slightly less sand than was delivered to the Colorado River during the immediately preceding accounting period.

Output of the modeling runs provides the initial recommendation for the magnitude and duration of the HFE. Because modeling only considers a simple range of possible HFE peak magnitudes and durations, the HFE Protocol includes a review of the model output, so that other resource

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<sup>1</sup> Although the HFE Protocol model evaluates performance of 13 possible types of HFEs (Table 1), the HFE Protocol decision and implementation phase allows for modifications based on resource conditions and predicted benefits to resources. Thus the HFE Protocol allows for HFEs of from 1 to 96 hours in duration, 31,500 to 45,000 cfs in magnitude, and utilizing the ramp rate limits of 4,000 cfs/hour increasing and 1,500 cfs/hour decreasing as defined in the HFE FONSI and the Operating Criteria for Glen Canyon Dam (62 FR 9447).

considerations can be considered. Thus, the Technical Team also considered the status of resources and consideration of HFE effects on key resources in making the recommendation described here.

Throughout the summer and fall, Reclamation regularly updated its modeling estimates based on ever increasing sediment inputs and worked with scientists at GCMRC to ensure that the HFE design has the greatest potential to produce the greatest likelihood of effective and efficient sandbar building and conservation. GCRMC research scientists provided input concerning how the HFE might best be shaped to meet the twin objectives of providing the greatest resource benefit and developing scientific information that will help better inform future decision making.

### **Sand Budget Model**

Because sand deposits along the Colorado River have the greatest importance to natural resources management, and because sand transport can be reliably predicted, a sand transport/budget model was used to determine the largest and longest HFE that could be conducted that still yielded a positive sand balance in Marble Canyon for the accounting period, given the mass of sand delivered by the Paria River since July 1. Model runs iteratively cycled through the different HFE types until HFE types were identified that did not result in a negative sand balance. Beginning in late August 2012, following several storm events on the Paria River, model results predicted there was sufficient sediment for an HFE.

The sediment modeling component uses the sand transport/budget numerical model developed by the USGS/GCMRC. Model results reliably matched measured conditions in upper Marble Canyon, which is the river segment between Lees Ferry and River Mile (RM) 30. Measurements further downstream indicate that little to no sand accumulated in lower Marble Canyon between RM30 and RM60.

### **Model Inputs**

Model predictions require estimation of the following:

- Antecedent conditions
- Hydrographs including for the potential HFE
- Sand input from the Paria River

#### ***Antecedent Conditions***

The antecedent conditions required for the sand budget model are bed thickness, in meters, and median particle size, in millimeters. The most recent values represented March 2009 bed conditions. These values were updated to July 2012 by running the sand budget model for the period from 2009 to 2012 and using the results of that simulation as the antecedent conditions of the 2012 HFE model simulations.

#### ***Hydrology Input***

Hydrology inputs were provided as hourly releases from Glen Canyon Dam in cubic feet per second (cfs). For simulations run prior to the modeled period of July-November 2012 (i.e.

March, May, and June model runs), Glen Canyon Dam releases were provided from Reclamation's 24-Month Study hydrology and projected releases and updated as each study was published. The releases from the 24-Month Study were provided as monthly volumes in acre-feet and converted to hourly releases by Western Area Power Administration (Western). During the modeled period, a combination of historic hourly releases and forecasted releases were used as the hydrology inputs. Hourly Glen Canyon Dam releases were routed using the one-dimensional unsteady flow model developed by the USGS/GCMRC to determine hourly hydrographs at the downstream end of various modeled reaches.

### *Sand Input*

Sand inputs to the sand budget model were provided as hourly loads in kilograms per second (kg/sec). For model simulations run prior to the modeled period of July-November 2012, sand inputs were provided from historical monthly inputs. Three scenarios of historic monthly sand input were simulated: low (10%), median (50%), and high (90%). During the modeled period, a combination of observed sand loads and the three historic scenarios were used as the sand inputs. This was continued until observed sand input was sufficient to support a HFE with zero future sand input. Once this point was reached, only observed sand loads were used as inputs to the sand budget model.

Sand inputs were measured and estimated by GCMRC. Data were made available in real-time to Reclamation through a Graphical User Interface (GUI) web-based application developed by USGS/GCMRC (informally referred to as "Sandbox"). This application allowed for download of the estimated sand input from the Paria River for the specified time period. The upper and lower bound estimates of Paria River sand inflows were used in modeling estimates. Estimates of sand inflow were regularly adjusted by GCMRC as field samples were processed in the USGS/GCMRC laboratory.

Paria River sand inputs were increased to account for inputs from other tributaries in Upper Marble Canyon. Inputs from these tributaries are monitored and measured but estimates are not available in real-time. The historic average of these inputs is equal to approximately 10% of the Paria River loads, and is always a very small proportion of the amount delivered by the Paria River. Thus, Paria River sand inputs were increased by 10% to account for these contributions from the lesser tributaries as was done for the HFE EA.

On October 17, 2012, GCMRC and Reclamation discussed GCMRC's recommendation to rely on the lower bound of the sand estimate for the Paria River in sand budget model runs. In the final run of the sand budget model, the lower bound of the Paria River sand estimate was used with adjustments for tributary inputs. Such an approach is prudent, because there is an equal probability that the actual amount of sand delivered from the Paria River could be any value between the upper and lower bound. Thus, by using the lower bound, modeling projections used in the design of the HFE are based on an estimated amount of sand about which the USGS/GCMRC has a very high degree of confidence. Estimates of sand input from the Paria River through October 31, 2012, for the lower and upper bounds were 538,000, and 689,000 metric tons, respectively.

The sand mass balance for Upper Marble Canyon where virtually all of the available sand is presently stored was estimated by GCMRC and provided to Reclamation. The latest estimates available were for October 1, 2012. The estimates for the lower and upper bounds were, respectively, 468,000, and 685,000 metric tons.

### *HFE Types*

Appendix E of the HFE EA listed 13 possible HFE types ranging from a peak magnitude of 31,500 to 45,000 cfs and ranging in peak duration from 1 to 96 hours (Table 1). The modeling for this HFE initially used a peak magnitude of 37,000 cfs rather than 45,000 cfs due to expected maintenance at Glen Canyon Dam and other limitations due to power regulation and reserves.

Beginning in September model runs began using 42,300 cfs as the peak magnitude for HFE types. This change was made to the modeling because Reclamation and Western coordinated to maximize the possible release rate by slightly shifting scheduled maintenance and moving power reserves to increase the Glen Canyon release capacity and thus the peak magnitude of a potential HFE. To assist with creating additional generation at Glen Canyon Dam, Western offered to decrease their normal 83 MW of regulation/reserve requirement to 40 MW which increased the maximum possible peak magnitude.

Table 1. The 13 HFE types tested in model runs as defined in the HFE Protocol.

<b>HFE No.</b>	<b>Peak Magnitude (cfs)</b>	<b>Peak Duration (hrs)</b>
1	42,300	96
2	42,300	72
3	42,300	60
4	42,300	48
5	42,300	36
6	42,300	24
7	42,300	12
8	42,300	1
9	40,425	1
10	38,550	1
11	36,675	1
12	34,800	1
13	32,925	1

To that point all HFEs tested assumed a ramp-up rate of 1,500 cfs/hr from baseflow to powerplant capacity, a rate of half a bypass tube (~1,875 cfs) every three hours up to peak magnitude, and a ramp-down rate of 1,500 cfs/hr to baseflow. These ramp rates are in accordance with the 1995 Environmental Impact Statement on Operations of Glen Canyon Dam and its associated 1996 Record of Decision, and are the same ramp rates as were used in the 2004 and 2008 HFEs. The HFE EA also assumed these limits for ramp rates. The HFE EA referenced the 1996 ROD ramp rate limits as limits for the HFE; these limits (4,000 cfs ramp-up

and 1,500 cfs ramp-down) are also described in the Operating Criteria for Glen Canyon Dam (62 FR 9447).

### ***HFE Model Results***

The model simulation for the lower bound estimate for Paria River sand input and the HFE hydrograph recommended October 22, 2012 estimated 494,000 metric tons of sand supply in all of Marble Canyon (i.e the Upper and Lower parts) on November 18, 2012 prior to the start of the HFE and an estimated 75,000 metric tons on November 30 following the HFE and at the end of the accounting period.

The model results were compared with the lower bound estimate for sand mass balance in Upper Marble Canyon on October 1. The measured estimate was 468,000 metric tons compared to the modeled value of 466,000 metric tons for a difference of less than 1%.

Sand budget model results through October 5, 2012, determined an HFE with a peak magnitude of 42,300 cfs and a peak duration of 60 to 72 hours. Reclamation consulted with USGS/GCMRC about the modeling results, and USGS/GCMRC recommended a HFE hydrograph with a shorter peak duration and a slower ramp-down rate. USGS/GCMRC recommended that a sustained 24-hr duration initial peak would facilitate scientific comparison with previous HFEs and thereby maximize scientific understanding to sediment transport processes. Based on the best professional judgment of its geomorphology and sediment transport experts, USGS/GCMRC recommended that a slow rate of recession from the peak flow that would last 24 hrs would provide the maximum potential benefit to fine-sediment-dependent resources in Marble Canyon. Additional modeling was done to assess the appropriate, slow ramp-down rate. Several model runs were made with ramp-down rates from peak magnitude to powerplant capacity ranging from 150 to 300 cfs/hr. Ramp-down rates from powerplant capacity to baseflow were 1500 cfs/hr.

USGS/GCMRC and Reclamation did additional analysis of the modeling runs for HFE numbers 6 and 7 with modified ramp-down rates. USGS/GCMRC provided its final recommendation for the shape of the HFE which included a modified ramp-up rate of 1,500 cfs/hr from baseflow to peak magnitude of 42,300 cfs, a peak duration of 24 hours, ramp-down rate of 200 cfs/hr to 31,300 cfs (4,000 above powerplant capacity), ramp-down rate of 1,000 cfs/hr to powerplant capacity, and ramp-down rate of 1,500 cfs/hr from powerplant capacity to baseflow. These recommendations were used in the final run of the sand budget model and are the basis for the final proposed HFE recommendation.

The model simulation for the lower bound estimate for Paria River sand input and the HFE hydrograph recommended in this document estimated 493,000 metric tons of sand supply in all of Marble Canyon on November 18, 2012 prior to the start of the HFE and an estimated 73,000 metric tons on November 30, 2012 following the HFE and at the end of the accounting period.

### **HFE Recommendation**

GRMRC and Reclamation recommend that the HFE:

- Ramp up from base releases at 1,500 cfs/hr until reaching powerplant capacity (~27,300 cfs)
- Open bypass tubes at 12:00 pm on Monday, November 19 (all times Mountain Standard Time)
- Ramp up from powerplant capacity to full bypass (~42,300 cfs) in 10 hrs.
- Stay at peak release for 24 hrs;
- Ramp down from peak to ~31,300 cfs at 200 cfs/ hr
- Ramp down from ~31,300 cfs to powerplant capacity at 1,000 cfs/hrs
- Ramp down from powerplant capacity to base releases at 1,500 cfs/hr

These rules result in the following release schedule at Glen Canyon Dam

- Begin ramp-up from 9,000 cfs at 11:00 pm on November 18 (Sunday);
- Reach powerplant capacity at 11:00 am on November 19 (Monday);
- Open bypass tubes at 12:00 pm November 19;
- Reach full bypass at 9:00 pm on November 19;
- First step down from bypass at 9:00 pm on November 20 (Tuesday);
- Reach ~31,300 cfs at 4:00 am on November 23 (Friday)
- Reach powerplant capacity at 7:00 am on November 23
- Complete HFE (back to 9,000 cfs) at 8:00 pm on November 23

This recommendation ensures that monitoring to increase scientific knowledge is a priority and places a priority on USGS/GCMRC's field collection of samples at RM61 and RM87. Automated pump samplers will collect at least 2 samples during hydrograph rise. Based on the assumed travel time of the HFE release wave, and to ensure the safety of sampling crews as discussed further below, daylight conditions will be available for sampling at RM61, RM87 and RM166. The proposed HFE also avoids a very rapid rise and does not stress the sampler systems at RM30 and RM225 where there will not be any personnel.

### **III. ASSESSMENT OF RESOURCES**

Since only a few months have elapsed since completion of the HFE Protocol EA, the assessment of resources is mostly unchanged from the analysis in the HFE Protocol EA and the HFE Protocol FONSI. However, there is some new information, and in making this decision, Reclamation completed an assessment of key resources that may be impacted or affected by the HFE that incorporates the most recent information. Reclamation evaluated these resources relative to the proposed timing, duration, and magnitude to the potential fall 2012 HFE as described above using the best available science. The following key resources were considered:

- ❖ Sediment Resources
  - In-channel sediment storage
  - Sandbar campable area
  - High-elevation sand deposits
- ❖ Cultural Resources

- Archaeological site condition and stability
- Access to archaeological sites by tribes
  
- ❖ Biological Resources
  - Aquatic food base
  - Lees Ferry trout population
  - Lees Ferry fishery recreation experience quality
  - Endangered humpback chub and other fish abundance
  - Riparian vegetation
  - Endangered Kanab ambersnail
  
- ❖ Hydropower and water delivery
  - Water quality
  - Water delivery
  - Dam maintenance
  - Hydropower production and marketable capacity

In our resource assessment, we did not find any information that would indicate a HFE would have adverse effects to a resource that would lead to a decision to not conduct a fall 2012 HFE. Several issues warranted further consideration as described in this section.

**Sediment Resources:** See discussion in Section II.

**Cultural Resources:** The HFE Protocol Memorandum of Agreement (MOA) for National Historic Preservation Act compliance has a stipulation (Stipulation 1) for a meeting with the parties within 120 days of execution to discuss any actions needed to protect against direct effects of an HFE. The HFE MOA was executed on May 21, 2012. Reclamation held a meeting on August 1, 2012 in accordance with stipulations in HFE Protocol MOA, and sent a letter to all the parties of the MOA following up on this meeting on September 7, 2012. Parties either attended or called into the August 1, 2012 meeting. The agenda for the HFE MOA included informing everyone that the potential exists for an HFE in fall 2012. The parties also discussed proposed mitigation for historic properties, including traditional cultural properties, which could be affected by multiple HFES. Input for any possible monitoring for effects was also requested. The September 7, 2012 letter also served to notify the MOA parties that an HFE release was anticipated during the fall 2012 release window.

The Pueblo of Zuni and the Hualapai Tribe requested government-to-government tribal consultation meetings. We met with the Pueblo of Zuni on August 17, 2012. Representatives from Reclamation, FWS, and the Arizona Game and Fish Department (AGFD) met with Zuni tribal elders and cultural program representatives. The Zuni expressed concern that whirling disease could be spread downstream by a HFE; that issue is addressed further detail below. A second meeting is planned with the Pueblo of Zuni for November 5, 2012.

The Pueblo of Zuni, in a letter dated September 20, 2012, also noted that although newly deposited sand on archeological sites in Marble and Grand Canyons resulting from HFES is believed to function as a preservation agent by retarding and decelerating rates of erosion,



covering archaeological sites with sediment may actually negatively impact those characteristics (e.g., visible surface artifact distribution and features) that make archaeological sites significant. Also, the creation of more sand bars and campable beach areas from HFEs may facilitate greater access by the general public to specific areas of cultural importance to Zuni thereby inadvertently creating adverse effects to Zuni Traditional Cultural Properties. The Pueblo of Zuni requested information on how Reclamation will coordinate monitoring for these effects and how Zuni monitoring information, as well as other monitoring data, will be employed to evaluate the success or failure of individual or multiple HFE events. We are in the process of working with the Zuni and the other parties to the HFE Protocol MOA to coordinate monitoring that will assess these effects, and plan to meet with the Pueblo Zuni on November 5, 2012.

Reclamation met with the Hualapai Tribal Council on September 10, 2012. The Hualapai tribal council members received a presentation on the Glen Canyon Dam Long Term Experimental and Management Plan Environmental Impact Statement and an update on the potential to conduct a fall 2012 HFE at Glen Canyon Dam. The Hualapai tribal council members indicated they had concerns about potential effects to their commercial river running enterprises. Reclamation agreed to follow up on this issue. Representatives from Reclamation met with representatives from the Grand Canyon Resort Corporation (GCRC) at docks located on the Colorado River near Quartermaster Canyon in western Grand Canyon. Reclamation engineers assessed the site and applied their professional judgment and experience as Reclamation engineers. Reclamation recommended that GCRC should undertake a thorough structural, geotechnical, and hydraulic engineering review, and consider rebuilding the boat dock structures to standards that would allow certification by a licensed civil engineer based on its professional judgment that the docks as designed and built are currently at risk of failure under any Glen Canyon Dam operation, including normal operations. Reclamation is preparing a letter to send to the Hualapai Tribe documenting the site assessment which completes the commitment to evaluate this potential impact of HFEs as defined in the FONSI.

**Biological Resources:** The primary way in which HFEs affect aquatic biological resources is via the effect on the aquatic food base. HFEs scour the river bed, primarily in Glen Canyon, removing algae and aquatic plants and animals. Food base in Glen Canyon recovered from the 2008 HFE in 4 months, and nonnative New Zealand mud snails were significantly reduced, a beneficial effect. Multiple HFEs could lead in a shift to more flood-tolerant species, a potential benefit to higher trophic levels (fish). There are fewer data to evaluate fall-season HFEs, but food base is expected to take longer to recover over the winter period. Spring HFEs in 1996 and 2008 led to increases in rainbow trout in Glen Canyon, and 2011 high steady releases also led to very large recruitment levels of rainbow trout in Glen Canyon. Increases in rainbow trout are a potential adverse affect to humpback chub because nonnative rainbow trout prey on and compete with native humpback chub.

Effects to endangered humpback chub from a fall 2012 HFE are predicted to be minimal. Although rainbow trout are at high numbers in Glen Canyon and have been moving into Marble Canyon, no increase has yet occurred at the Little Colorado River confluence area (RM61; the area of highest abundance of humpback chub) in response to increases in rainbow trout upstream since the March 2008 HFE. Although potential effects of fall HFEs on trout in Glen Canyon are poorly understood, a fall 2012 HFE could result in a decrease in rainbow trout upstream of the

Little Colorado River that would be beneficial to humpback chub. The 2004 fall HFE resulted in displacement or mortality of very young trout in Lees Ferry, and the condition of trout in Glen Canyon overall declined slightly following the 2004 fall HFE. Monitoring now in place should provide for increased capability to detect downstream displacement of rainbow trout, as well as recruitment and condition of rainbow trout in Glen Canyon following a fall 2012 HFE.

The adult humpback chub population size at the Little Colorado River is now estimated by GCMRC to be between 9,000 -12,000 fish, greater than at any point since population estimates were first initiated in the late 1980s. Other native fish populations have responded similarly in recent years and are considered robust. New monitoring of humpback chub in place at the Little Colorado River will improve efforts to detect HFE effects to juvenile survivorship in the mainstem Colorado River. HFEs may have adverse effects to humpback chub due to displacement of young humpback chub downstream and beneficial effects to rainbow trout, but also may improve habitats for humpback chub through the creation of more diverse near shore habitats, i.e. backwaters.

A small reproducing population of endangered razorback sucker occurs downstream in Lake Mead, and a single adult was recently caught at Spencer Canyon (RM242) in the riverine part of Lake Mead that is within western Grand Canyon. Thus, this population uses the riverine parts of the reservoir in western Grand Canyon. Changes in flows are unlikely to have any significant effect to razorback suckers in the Colorado River inflow area since effects of those releases are attenuated by the time the water reaches what is likely to be occupied habitat, and razorback sucker are very rare in the action area. The HFE flows may have some effect to spawning and recruitment if conducted during the spring; however, a fall HFE will not have this effect.

As described in the 2011 Final Biological Opinion on Operation of Glen Canyon Dam including High Flow Experiments and Non-Native Fish Control (2011 BO), endangered Kanab ambersnail would be adversely affected by HFEs. HFEs will scour snail habitat at Vasey's Paradise, and thus will likely result in the loss of some habitat and snails; and Reclamation will monitor how this affects the population status. FWS found in its 2011 biological opinion that this loss of snails and snail habitat would not jeopardize the continued existence of the Kanab ambersnail.

As noted above, the Pueblo of Zuni has informed Reclamation that the Tribe is concerned that an HFE could result in the spread of whirling disease downstream. Whirling disease was recently detected by the AGFD in Glen Canyon.

The AGFD has informed us that they have not monitored for the disease in Marble and Grand Canyons because the parasite causing the disease is water-borne, and therefore, in the opinion of AGFD, the entire river, from Glen Canyon Dam to Lake Mead is considered to be infected. For this reason, AGFD advises that the best course of action to eliminate the risk of spreading the disease is to not remove and transport out of the canyon fish from any location in this reach.

GCMRC completed an assessment of the potential for a HFE to spread whirling disease downstream and concluded that the proposed HFE presents a minor risk of spreading whirling disease, particularly since there are several mechanisms that allow the disease to spread downstream even in the absence of high flow releases. GCMRC explained that the implications

of the presence of whirling disease in Glen Canyon for proposed management actions in the Colorado River vary by action. Live removal and relocation of trout from the Colorado River represents, by far, the greatest risk of spreading the disease. Relocation of trout from an infected population without any risk of fish escapement or spread of myxospores is virtually impossible. There is a low risk of spreading whirling disease as a consequence of conducting experimental high flow releases such as the HFE. The disease is already present downstream from Glen Canyon Dam, and infected fish are already moving into Marble and Grand Canyons. It is likely that HFEs will result in a decrease in the prevalence and severity of the disease through reductions in the abundance of the intermediate host *Tubifex tubifex* and its preferred habitat of fine sediment and organic matter.

In addition, in response to the new information about whirling disease, Reclamation had discussions with FWS staff about possible modifications to the action proposed in the 2011 BO. Reclamation had proposed undertaking two non-native fish mechanical removal trips in 2012 to test live removal of native fish from the Colorado River at the reach between the Paria River and Badger Creek Rapids (PBR). Following the detection of whirling disease in rainbow trout in Glen Canyon by AGFD in October 2011 (the previous detection of the disease had been in 2007), Reclamation determined that those trips should be cancelled and requested FWS concurrence with that proposal in an October 3, 2012 memorandum. It should be noted that although whirling disease can have a devastating effect on rainbow and cutthroat trout, it poses no threat to native fish species, including the humpback chub. Further, while there is some evidence that HFEs may displace juvenile trout downstream, this does not pose an additional risk to the rainbow trout population because the entire population has been exposed to the disease. The FWS concurred with Reclamation's proposal and concluded that live removal of trout was not possible due to the documentation of whirling disease. FWS also noted that the potential effects of a spring HFE on native and non-native fish and the aquatic food base had been documented and affirmed that ongoing monitoring is sufficient to assess the effects of the fall HFE on these resources and to identify significant issues if they result.

Although whirling disease was detected below Glen Canyon Dam in October 2011, that detection was not new; it confirmed an initial detection of the disease in Glen Canyon in 2007. Therefore, as of 2007, the disease was considered to be endemic in Glen and Grand Canyons, and its re-detection in 2011. The identification of whirling disease in Glen Canyon was an issue raised by AGFD both during the structured decision-making process and subsequently during preparation of the NNFC EA. The 2011 re-detection therefore does not have bearing on the HFE Protocol or its impacts because the system had previously been considered whirling disease positive, with or without HFE releases. Similarly, the whirling disease information does not have bearing on the proposed action or its impacts because HFE releases would not be conducted differently or postponed now that whirling disease has been detected. Finally, as explained above, HFE releases are likely to be beneficial relative to whirling disease because they could reduce the prevalence of whirling disease. In sum, Reclamation has thoroughly analyzed all of the information about whirling disease and concluded it does not change the recommendation to proceed with the 2012 fall HFE.

Also, as noted below, an initial proposal to conduct flows before and after the proposed HFE at 5,000 to 8,000 cfs daily fluctuation was changed to 7,000 to 9,000 cfs in part due to concerns

about the effects to the aquatic food base of a flow of 5,000 cfs. Although GCMRC indicated that the difference in these two operations would have little affect on the aquatic food base downstream of Glen Canyon Dam, the 7,000 to 9,000 cfs flow is now being recommended because the trout fishing interests in Glen Canyon recommend this flow to avoid potential effects to the aquatic food base and Lees Ferry rainbow trout fishery.

**Hydropower and Water Delivery:** For the proposed HFE, Reclamation and Western have coordinated to ensure that the maximum possible release from the dam can be achieved. While there are a number of unknown factors that might impact the maximum release rate that can be made during the HFE, Reclamation anticipates that a release of approximately ~42,300 cfs is possible. Each month the generating units are tested to determine their specific capacity. These capacities change based on the changing elevation of the reservoir. Units capacities based on the most recent testing are provided in Table 2.

Table 2. Hydropower and flow release capacities of units at Glen Canyon Dam as of October 2012.

Unit	Generation at 100% gate (MW)	Flow at 100% gate (cfs)*
Unit 1	143	3,850
Unit 2	137	3,690
Unit 3	140	3,770
Unit 4	140	3,770
Unit 5	143	(estimated) 3,850
Unit 6	125	3,365
Unit 7	141	3,800
Unit 8	143	3,850
<b>Total</b>	<b>1,112</b>	<b>29,945</b>
Regulation Reserved (reduction)	-40	-1075
Total (powerplant)	1,072	28,870
Bypass Tubes		(4 @ 3,750 each) +15,000
<b>Total (powerplant and bypass)</b>	<b>1,072</b>	<b>43,870</b>
*All flow numbers rounded to nearest 5 cfs.		

Table 2 represents a best case estimate of what might be possible during the HFE. Given the variability in efficiency, Reclamation used the lower estimate of 42,300 for modeling purposes and as a target for a potential HFE due to increased certainty of achieving this release.

Western Area Power Administration completed an analysis of the potential financial costs to Western as a result of running a fall HFE in 2012. This analysis produced a range of impacts

based on the range of possible HFEs from a duration of 1 to 96 hours and a magnitude of from 31,500 to 45,000 cfs. The range of costs is from \$199,000 to \$2,596,000. This does not include additional capacity and energy costs to power customers who must replace this foregone resource, but only accounts for the lost revenue to Western resulting from this experiment. Western estimates that the HFE described in this document will have a financial impact on firm power customers of about \$1,388,000 (this figure will be updated upon receipt of the final memorandum from the Technical Team to Leadership Team) due to additional power purchases to replace generation losses before, during and after the HFE.

The release volume required in November for the proposed HFE is approximately 724,000 acre feet. The October 24-Month Study projected 600,000 acre feet release volume in November, therefore it is necessary to reallocate approximately 124,000 acre feet from months later in the water year. Approximately 79,000 acre feet of water would be bypassed. Western and Reclamation will coordinate on the scheduled reallocation of monthly release volumes with the goal of protecting minimum Modified Low Fluctuating Flow (MLFF) monthly thresholds as described in the EA as well as maximizing the economic value of hydropower. Based on monthly release volumes in the October 24-Month Study, there is sufficient volume currently scheduled in later months to reallocate to November and maintain minimum MLFF monthly thresholds. Hourly releases for the days prior to and after the proposed HFE are anticipated to fluctuate between 7,000 to 9,000 cfs.

Releases from Glen Canyon Dam in November may fluctuate beyond the scheduled releases due to system regulation and/or reserve requirements. Throughout the entire month of November, Glen Canyon Dam will maintain 40MW of system regulation. These instantaneous release adjustments stabilize the electrical generation and transmission system and 40MW translates to a range of approximately 1,100 cfs above or below the hourly scheduled release rate. For the days prior to and after the proposed HFE, Glen Canyon Dam will also maintain 43MW of reserves. To provide system reliability, all participating electricity generators within the balancing area maintain a specified level of generation capacity (i.e. reserves) that can be called upon when an unscheduled outage occurs. If reserves are called upon at Glen Canyon Dam, releases may increase by up to an additional approximately 1,100cfs. Maintaining regulation and reserves is necessary for NERC-WECC compliance and safe operation of the hydropower facility.

An initial proposal from Western and Reclamation was to conduct hourly releases from 5,000 to 8,000 cfs hourly fluctuation during the days prior to and after the proposed HFE. Representatives from the Technical Work Group (TWG) of the Glen Canyon Dam Adaptive Management Program (GCDAMP) requested that flows not drop below 7,000 cfs to avoid impacts to the aquatic food base safety risks to recreational boating as low flows make white-water boating and rafting more treacherous. Western and Reclamation considered this request and altered the proposal to 7,000 to 9,000 cfs daily fluctuation. This change should help avoid these resource impacts as a one-time decision for these unique circumstances and for the particular purposes of conducting a HFE in November 2012.

Reclamation thoroughly evaluated the effect of conducting a fall 2012 HFE on the annual release volume from Lake Powell in compliance with the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (2007 Interim

Guidelines). Reclamation currently projects the annual release volume for water year 2013 will be 8.23 million acre feet. Depending on hydrology, the annual release volume in 2013 may be greater than 8.23 million acre feet. An HFE in November will not affect the annual release volume from Lake Powell nor the Operational Tier in accordance with the 2007 Interim Guidelines. In the HFE FONSI, Reclamation also committed to consulting with the Basin States prior to conducting an HFE as to the issue of compliance with the 2007 Interim Guidelines. On October 15, 2012, in accordance with the HFE FONSI, representatives from Reclamation met with representatives from the Basin States to review information relevant to the 2007 Interim Guidelines in consideration of a decision to conduct a fall 2012 HFE. As a courtesy, Reclamation also presented additional information about the HFE (e.g., modeling information, whirling disease updates) to the Basin States. Reclamation had a follow-up conference call with the Basin States on October 30, 2012.

The Pueblo of Zuni, in a letter dated September 20, 2012 indicated that successive iterations of HFEs under the HFE Protocol could have cumulative negative impacts on power generation and a resultant effect on raising the cost of purchasing power for individual rate payers, and that this is especially of concern to economically disadvantaged minority communities such as the Pueblo of Zuni. The Pueblo of Zuni requested that Reclamation provide a detailed description on how the economic effects of successive HFEs on power rate payers will be monitored. Reclamation is working with Western to carefully assess this issue and provide for post-HFE monitoring that will analyze, to the extent possible, effects to ratepayers from HFEs conducted under the HFE Protocol.

#### **IV. SAFETY CONSIDERATIONS**

As identified in the environmental assessment and FONSI, potential effects on public health and safety could occur in conjunction with an HFE, primarily impacting recreational anglers and boaters. All daily fluctuations, minimum flows and maximum flows associated with the proposed HFE are within the range experienced by recreational users in the past, and Reclamation and NPS have been working together to ensure that safety measures are implemented, including restricting access to the river immediately below the dam during the HFE. NPS Boating Safety Rules will continue to apply to all boaters.

Reclamation and NPS Incident Commanders have been identified and have been coordinating to ensure that safety and security issues have been addressed. The Glen Canyon Dam High Flow Release Event Action Plan is complete and has been approved by all law enforcement and security agencies involved and resources have been identified and secured for the event. Reclamation will implement the Unified Command System and its Incident Action Plan will address the overall security and safety of the event as well as anticipated participation by VIPs.

The primary concessionaire on the Glen Canyon reach, Colorado River Discovery (CRD), cannot operate its pontoon fleet during HFEs in excess of 40,000 cfs. NPS has notified CRD that the HFE will occur and has updated the company on a weekly basis as new information is received. If the Leadership Team takes action on the recommendation to conduct a fall 2012 HFE, CRD will move boats and associated infrastructure out of the river at the Lees Ferry launch ramp using a hydraulic system to other locations to avoid damage, and will make alternate arrangements for their customers during the HFE. The costs to the park concessioner were evaluated in the HFE

EA. Revenue losses for a five day HFE in November were estimated at \$8,100 in lost concession revenue, \$600 in lost NPS amenities revenues, and \$1,620 in lost NPS concession franchise fee. Direct expenses associated with the removal of the concession assets from the river per HFE were estimated at \$9,961 in payroll and fuel costs.

Each of the three park service units affected, Glen Canyon National Recreation Area (GCNRA), Grand Canyon National Park (GCNP) and Lake Mead National Recreation Area have worked together collaboratively to develop and share Incident Action Plans (IAPs). These IAPs are specific to each park unit understanding that each unit will be affected uniquely and for different periods of time. The IAPs focus on and maximize continuity of efforts and resources, particularly in those areas where responsibilities are shared, specifically Lees Ferry and Pearce Ferry. Each IAP clearly designates the responsible parties and projects staffing needs and actions that need to occur prior to and during a HFE. The IAPs also include a communication plan, a medical plan and resource capabilities for search and rescue responses. As agreed upon in the IAPs the three park units will maintain frequent communication and information sharing leading up and during the HFE.

GCNP has identified and communicated with the 59 permitted Colorado River trip permit holders that have the potential to be impacted by the HFE while rafting the Colorado River within GRCA and Lake Mead Recreation Area. A plan has been developed to provide alternative trip dates should the permitted river trip decide not to launch during the projected HFE. All permit holders have been directed to access up-to-date information provided by both the Bureau of Reclamation and the USGS/GCMRC websites. Additionally, all backcountry hikers who access the Colorado River as part of their backcountry hike will be alerted to potential campsite inundation areas.

GCNRA has identified and will communicate with the holders of commercial use authorizations for commercial services (primarily fishing guides) on the Colorado River within GCNRA to provide information on the time and duration of the HFE. During the 2008 HFE, relatively few recreational boaters traveled upstream from Lees Ferry. Information about the pending HFE and safety considerations will be provided to recreational users at Lees Ferry in coordination with the Technical Team Communications group. Information will be provided via public media, the GCNRA web site and on-site NPS staff.

A fact sheet explaining potential impacts to park visitors will be developed and distributed to potentially affected visitors. Notifications will be provided at Lees Ferry and Phantom Ranch and the fact sheet will be available at these locations, as well as the park's Backcountry Information Center and primary visitor center.

In addition, safety considerations regarding sampling efforts by GCMRC have been incorporated into planning to ensure that safety of field staff is an overarching priority. There is an unavoidable lag between the time that water is released from the dam and the time that water arrives downstream. USGS crews will be stationed at Lees Ferry (RM0), just upstream from the Little Colorado River confluence (RM61), upstream from Bright Angel Creek (RM87), and upstream from National Canyon (RM166). The crews will have been deployed to those locations in the days before the high flow release and will be supported by motorized rafts, and boats and

cableways. They will be making critical measurements of discharge, suspended sediment transport, and organic drift. At sites downstream from the Paria River (RM1), work can only be safely conducted during daylight hours. This is especially the case on the first day of the HFE when the water surface typically is covered with woody debris that potentially can clog props of outboard engines or snag equipment suspended from cableways. Likewise, large logs that float just below the water surface, can pose a threat to the safety of sampling staff. To address these issues, all field measurements by USGS personnel will be done during daylight hours in order to maximize the safety of field personnel.

Also, as noted above, an initial proposal to conduct flows before and after the proposed HFE at 5,000 to 8,000 cfs daily fluctuation was changed to 7,000 to 9,000 cfs in part due to concerns about the effects of a flow of 5,000 cfs on navigation of white-water boaters in Marble and Grand Canyons, because white-water boating representatives of the TWG indicated that a low flow of 5,000 cfs can present hazardous conditions for navigation at certain rapids. The 7,000 to 9,000 cfs flow is now being recommended in part to alleviate these concerns about white-water boating safety.

## **V. COMMUNICATIONS PLAN**

The first HFE conducted pursuant to the High Flow Protocol presents an excellent opportunity to increase scientific understanding for the general public and to explain to the public the purpose of the HFE Protocol and expected beneficial impacts. The communications/public affairs aspect of the 2012 HFE event fall under three primary categories:

1. Communication Product Development
2. Invitations/Event Coordination
3. Media Coordination

Work associated with all three categories is being led by Reclamation's Upper Colorado Region Public Affairs Office in primary coordination with National Park Service and U.S. Geological Survey public affairs contacts and DOI. Draft documents are also being shared as appropriate. To date, several draft communication products have been developed including: a video podcast featuring Assistant Secretary Anne Castle; draft media advisory; draft news release; and draft questions and answers (Q&As) for availability to the public via a web page to be established for the 2012 HFE. If a decision to proceed with the HFE has been made, once announced, many of these items will be made live and social media channels including Facebook and Twitter will be used to alert the media and public to the event and these information items. Attendance of the HFE event by agency heads has not yet been determined; in order to be broadly prepared for attendance by DOI officials and bureau heads, the team is anticipating that draft talking points will be prepared for Secretary Salazar, Deputy Secretary Hayes, Assistant Secretary for Water and Science Anne Castle, Assistant Secretary for Indian Affairs Kevin Washburn, Reclamation Commissioner Mike Connor, NPS Director Jon Jarvis, FWS Director Dan Ashe, and USGS Director Marcia McNutt. Reclamation is working on additional public communication products including b-roll footage of the 2008 HFE for media use. NPS, FWS, USGS and BIA public affairs contacts are coordinating the development of the draft speaking points for their agency heads.



In addition to the public communication products, an electronic “save the date” guest invitation was finalized and issued on October 22, 2012 to approximately 210 recipients which include staff and representatives from Reclamation, NPS, USGS/GCMRC, FWS, AMWG, TWG, City of Page/Coconino County, congressional members from the seven Colorado River Basin States, and Indian Tribes. This invitation was issued on October 22 to provide a two week time frame for RSVPs which must be in by November 5 to support necessary on-site logistical arrangements. A follow up invitation will be issued upon a final decision to proceed with the release, in which a slight variation to the start time of the event will be highlighted. Tribal AMWG representatives have been invited via the electronic save the date; the plan is send invitation via U.S. mail to tribal leaders, but Reclamation has not yet received the requested information from the AMWG tribal representatives regarding which tribal leaders should receive invitations.

Following the HFE event, NPS is offering two-hour boat trip on Lake Powell from Wahweap Marina to Antelope Canyon and back for up to 150 guests. The boat trip will focus on resource management efforts, ongoing monitoring for aquatic invasive species including Zebra and Quagga mussels, tribal interaction at Antelope Point marina, and recreational infrastructure updates. USGS/GCMRC is planning to lead an interpretive trip to examine the controlled flood in the Colorado River in the vicinity of Lees Ferry and Badger Creek Rapids to explain the underlying science of river processes and how those processes are monitored.

The Team is also exploring an opportunity to include participation by students from four local schools, including a tribal school. In 2008, 8<sup>th</sup> grade and high school students from three local schools attended and participated in the HFE bypass event. BASIS school in Flagstaff has enquired whether there will be a similar opportunity for a November HFE. Interior’s bureaus have a long history of engaging youth in meaningful environmental and scientific education to help educate the next generation of biologists, land managers, engineers and conservationists. The Team believes that participation by local schools should be encouraged and is exploring how best to facilitate it.

Ongoing coordination is also occurring with the facility manager and security manager at Glen Canyon Dam to ensure all necessary preparations are made for event components including media and guest security clearance and escort process; speaker platform and podium, A/V equipment, etc.

If the Leadership Team takes action on the recommendation to conduct a fall 2012 HFE, a media advisory will be issued to a large regional media list as well as key national media outlets via e-mail. A list identifying target media outlets has been developed to guide follow-up “pitch” calls to encourage media attendance. These calls will be conducted by Reclamation’s Upper Colorado Region Public Affairs Office, NPS public affairs, USGS public affairs, and DOI Office of Communications. All media planning to attend the event must RSVP no later than November 14 to allow sufficient time to receive all media names and identification information for advance security clearance. Any special event coverage requests must also be made by this date. Once the final draft news release has been cleared by the participating agencies, it will be provided to the Secretary’s office for finalization with the anticipated issue date of November 19.

## **VI. POST HFE-REPORTING AND FEEDBACK**

Reclamation committed in the HFE EA and FONSI to provide reports on effects of HFEs conducted in a given year. If the Leadership Team takes action on the recommendation to conduct a fall 2012 HFE, the Technical Team will coordinate to report initial findings at the 2012 GCDAMP Annual Reporting Meeting on January 22-23, 2013 in Phoenix.

The Technical Team will schedule additional meetings as necessary and will also report ongoing findings at meetings of the GCDAMP TWG and Adaptive Management Work Group. Reclamation also has a commitment to provide an annual monitoring report to the FWS Arizona Ecological Services Office (AESO) in compliance with the 2011 Biological Opinion; this report will also include a summary of effects of HFEs conducted in that year. Also, under the HFE Protocol MOA, Reclamation will conduct a reporting meeting with the parties to that agreement, describing the effects of the HFE. Reclamation will use the monitoring information and feedback from AESO and the MOA signatories to inform monitoring for future HFEs, and to design and implement any measures necessary to prevent or control adverse effects of future HFEs.

In addition, GCMRC developed a science plan for the HFE Protocol that describes a program of monitoring and research activities that support ongoing information needs associated with implementation of the HFE Protocol. The approach described in this science plan relies on water quality, sediment, aquatic biology, and other resource monitoring and research projects funded in the GCDAMP Fiscal Year (FY) 2013-14 Budget and Work Plan (BWP). While no new studies were proposed, some existing FY2013 monitoring and research efforts, such as Projects A, B, F, and I in the BWP have been modified to provide information that is directly relevant to the evaluation of a high flow experiment in 2012. These ongoing projects will inform the effect of future HFEs on the aquatic biology and the fishery of Glen, Marble, and Grand Canyons. These projects from the BWP are further discussed below.

Project H (Understanding the Factors Limiting the Growth of Rainbow Trout in Glen and Marble Canyons) will involve monitoring and tagging trout in Glen Canyon prior to the HFE, as well as monitoring trout redds during winter, and will be conducting additional monitoring in spring 2013. This study will help assess the effects of the HFE on the adult and juvenile trout population in Glen Canyon. Project F (The Monitoring of Native and Non-native Fishes in the Mainstem Colorado River and the lower Little Colorado River) activities will also provide monitoring of the fishery system-wide and will provide an assessment after the HFE (if conducted) in April 2013, which will help assess any system-wide effects of a HFE on the Colorado River fishery. This project also has been monitoring rainbow trout abundance in Marble Canyon, and will serve to help assess how HFEs affect the downstream dispersal of trout from Glen Canyon. Project E (The Humpback Chub Early Life History in and Around the Little Colorado River and Mainstem) monitors the status of juvenile humpback chub (<150 mm total length) in the mainstem at the Little Colorado River quarterly, and monitoring in September 2012 and January 2013 will provide pre- and post-monitoring for a Fall 2012 HFE, providing information on HFE effects to juvenile humpback chub survivorship. Project D (The Humpback Chub Aggregation Studies and Metapopulation Dynamics) conducts annual monitoring of all 9 humpback chub aggregations in Marble and Grand Canyon every September and this monitoring will provide important information on the effect of HFEs on all of the humpback chub aggregations. Also, GCMRC will conduct aquatic food base monitoring before, during, and

following HFEs at Lees Ferry and Diamond Creek to assess the effect of HFEs on this important resource. This suite of projects will provide the monitoring needed to inform future decision-making about the effects of an HFE on key resources such as humpback chub, rainbow trout, and the aquatic food base.

As described in the HFE Protocol EA, the HFE planned for fall 2012 is not being implemented as an isolated event, but as a component of a longer-term effort to restore and maintain sandbars with multiple high flows over a period of several years. The monitoring data that are needed to assess the outcome of this multi-year experiment include annual sandbar monitoring at selected long-term monitoring sites, periodic monitoring of changes in sand storage in the river channel, and measurements of sandbar size at more than 1,000 sites based on aerial photographs that are collected every 4 years. These activities are described in detail in the BWP. It is also important, however, to evaluate the sandbar building response of each high flow to ensure that sandbar building objectives are being achieved incrementally. This evaluation will be based on sites that are monitored by remotely deployed digital cameras and repeat topographic surveys of sites that will occur in spring and fall 2013.

GCMRC scientists have installed digital cameras that capture 5 images every day at 33 sandbar monitoring sites throughout Marble and Grand Canyon between Lees Ferry and Diamond Creek. The images acquired by these cameras will be used to evaluate both the magnitude and spatial distribution of sandbar building caused by the HFE. They will also be used to assess the rate of post-HFE sandbar erosion. GCMRC scientists tested the effectiveness of this monitoring method based on images collected at 22 sites for the 2008 HFE. The assessment of sandbar gains and losses based on a categorical ranking of changes from the images agreed with the changes detected by detailed topographic surveys at 86% of the sites. Because the remote cameras are monitoring the same sites that are monitored by the annual surveys and the same sites that were monitored during previous HFEs, it will be possible to evaluate sandbar-building effectiveness of the planned 2012 HFE relative to the previous events. NPS will also be providing post-HFE monitoring of sandbars using photography.

The images collected by remote camera will also allow scientists to determine whether the slow down-ramp rate of the 2012 event results in sandbar building at the same set of sites as previous events or a different set of sites. This will allow scientists to assess whether the slow down-ramp rate resulted in deposition at more sites. It is also possible that the different hydrograph shape will result in sandbars with different morphology than observed following previous high flows. This will be evaluated based on repeat topographic surveys of 8 sandbars in Upper Marble Canyon in April-May 2013. All of the long-term sandbar monitoring sites will be surveyed in fall 2013. This assessment of the size and distribution of HFE deposits approximately 11 months following each HFE will provide the most informative assessment of sandbar-building effectiveness. These measurements will indicate the degree to which deposits created by a fall HFE provide enhanced sandbars for use in the following summer recreation season and whether the HFE program is resulting in cumulative increases in sandbar size.

## **VII. CONSULTATION**

Consultation was conducted with the affiliated Tribes, as described above. Reclamation also engaged the Adaptive Management Work Group at its August 29-30, 2012 meeting. On October

15, 2012, Reclamation staff met with the Colorado River Basin states, as described in more detail above. Reclamation had a follow-up conference call with the Basin States on October 30, 2012. Reclamation has been working closely with other partners, including Western and the AGFD, as needed. Reclamation and GCMRC also made a presentation to the TWG on October 24, 2012, and had a follow up conference call with the TWG on October 29, 2012. Reclamation, GCMRC, and AGFD are planning to meet with the Marble Canyon business owners on November 8, 2012.

## **VIII. CONCLUSION**

Preparing to conduct a high flow experiment required coordination of a tremendous number of details and effective communication amongst agency technical staff. The Technical Team members relied heavily on multiple people in each of the agencies in making this recommendation. The Technical Team has thoroughly evaluated the issues discussed above, and has taken into consideration the information and analysis included in the HFE EA and FONSI. The Technical Team's recommendation to proceed with implementation of a fall 2012 HFE is based on the careful research developed over the last 15 years, the specific information developed relevant to implementation of the HFE proposed for November 2012, and the inclusion of monitoring of the HFE to ensure continued learning and adaptation.

The success of this important initiative is in large part due to the commitment of our larger DOI team in ensuring that the first HFE under the HFE Protocol is a success, and that future HFEs conducted under the HFE Protocol are streamlined as a result.

The Technical Team also recognizes that implementation of the experiment during the Thanksgiving holiday week requires some of our dedicated staff to spend their Thanksgiving holiday working, and recommends that the Leadership Team specifically recognize their contributions to this effort.

## **Key Dates for Consultation and Coordination on a 2012 fall High Flow Experiment (HFE) at Glen Canyon Dam**

July 11, 2012 – First meeting of the Glen Canyon Leadership Team, Flagstaff, Arizona

August 1, 2012 – HFE Protocol Memorandum of Agreement Meeting, Flagstaff, Arizona

August 17, 2012 – Bureau of Reclamation (Reclamation), U.S. Fish and Wildlife Service (FWS), and Arizona Game and Fish Department (AGFD) consultation with Pueblo of Zuni, Zuni, New Mexico

August 28, 2012 – Glen Canyon Leadership Team, Flagstaff, Arizona

August 29-30, 2012 – Glen Canyon Dam Adaptive Management Program (GCDAMP) Adaptive Management Work Group Meeting (AMWG), Flagstaff, Arizona

September 10, 2012 – Reclamation consultation with Hualapai Tribal Council, Peach Springs, AZ

September 19, 2012 – First Glen Canyon Technical Team Weekly HFE conference call

September 26, 2012 – Glen Canyon Technical Team Weekly HFE conference call

October 3, 2012 – Glen Canyon Technical Team Weekly HFE conference call

October 3, 2012 – Reclamation and Hualapai Tribe site visit to boat docks western Grand Canyon, AZ

October 10, 2012 – Glen Canyon Technical Team Weekly HFE conference call

October 15, 2012 – Reclamation consultation with Colorado River Basin States, Las Vegas, Nevada

October 17, 2012 – Glen Canyon Technical Team Weekly HFE conference call

October 24, 2012 – Glen Canyon Technical Team Weekly HFE conference call

October 24-25, 2012 – GCDAMP Technical Work Group Meeting, Phoenix, Arizona

October 29, 2012 – Follow up conference call with TWG to resolve issues raised at Oct. 24-25 meeting

October 30, 2012 – Reclamation second consultation with Basin States, webinar and conference call

October 31, 2012 – Glen Canyon Technical Team Weekly HFE conference call

November 1, 2012 – Glen Canyon Leadership Team webinar and conference call

November 5, 2012 – Reclamation consultation meeting with the Governor and Tribal Council of the Pueblo of Zuni, Zuni, New Mexico

November 8, 2012- Reclamation, AGFD, and Grand Canyon Monitoring and Research Center meeting with Marble Canyon business owners (planned)



# United States Department of the Interior

## BUREAU OF RECLAMATION

Upper Colorado Regional Office  
125 South State Street, Room 6107  
Salt Lake City, Utah 84138-1102

IN REPLY REFER TO:

October 31, 2012

VIA ELECTRONIC MAIL ONLY

### MEMORANDUM

To: Larry Walkoviak  
Regional Director

From: Glen Knowles /s/  
Adaptive Management Group Chief

Subject: Whirling Disease concerns raised in September 20, 2012 Pueblo of Zuni letter

#### **Introduction**

This memorandum provides a recommendation for addressing concerns from the Pueblo of Zuni (Zuni) letter dated September 20, 2012 (Attachment 1). The Zuni raise several issues in the letter, but the recommendation discussed here addresses the relationship between whirling disease, a trout parasite, and a potential high-flow experiment (HFE) release from Glen Canyon Dam in the fall of 2012. This memorandum also addresses the cancellation of two nonnative fish control trips in the Paria River to Badger Creek reach (PBR) that were cancelled in part due to the increased prevalence of whirling disease in Glen Canyon.

The recent environmental assessment (EA) and finding of no significant impact (FONSI) under the National Environmental Policy Act (NEPA) allow for HFE releases from Glen Canyon Dam under certain conditions. A November 2012 HFE release is under consideration due to sediment levels. Consistent with the HFE process explained in the NEPA documents, Reclamation informed the Zuni that such a release is being considered, and the Zuni responded with the September 20 letter. The issue addressed here is the Zuni's concern that "implementation of the HFE release may directly contribute to the spread of whirling disease downstream toward the Little Colorado River's confluence where it apparently has not yet been detected and may not be present." (Zuni Letter, p. 1). The Zuni letter also alleges that the information regarding whirling disease was not sufficiently addressed in the HFE NEPA process (Zuni Letter, p. 1).

As explained below, the recommendation is to continue planning efforts for a potential HFE in November 2012 because the Zuni concerns regarding spread of whirling disease by HFE flows are unfounded. Similarly, the Zuni allegation that whirling disease was not adequately addressed in the NEPA process fails. We also recommend continuation of planning efforts for a potential HFE in November 2012 because cancellation of the two PBR nonnative fish removal trips because this change similarly was also adequately addressed in the NEPA process.

## Analysis

The analysis is a summary of information compiled from the following sources:

- Letter from Pueblo of Zuni dated September 20, 2012, Subject: Fall 2012 High Flow Experiment Release from Glen Canyon Dam (Zuni Letter, Attachment 1)
- Letter from Arizona Department of Game and Fish (AZDGF) to Reclamation dated July 12, 2012 (AZDGF Letter, Attachment 2)
- Memorandum from Reclamation to Fish and Wildlife Service (FWS) dated October 3, 2012, Subject: Change in nonnative fish control downstream from Glen Canyon Dam (Reclamation Memo, Attachment 3)
- Memorandum from FWS to Reclamation dated October 10, 2012, Subject: Change in proposed action for non-native fish control downstream from Glen Canyon Dam and notification of biological monitoring components for November, 2012, high flow experiment (FWS Memo, Attachment 4)
- Memo from Grand Canyon Monitoring and Research Center (GCMRC) to Reclamation dated October 22, 2012, Subject: Whirling disease in Glen Canyon, Arizona and implications for resource management in the Colorado River (GCMRC Memo, Attachment 5)
- Letter from Pueblo of Zuni dated March 14, 2011, Subject: Pueblo of Zuni's Comments on the Public Draft Environmental Assessment Non-native Fish Control downstream from Glen Canyon Dam (Attachment 6)

The summary below describes the characteristics of whirling disease and then analyzes how HFE releases would affect those characteristics. The summary also describes the cancellation of the two PBR trips and analyzes how the HFE would affect those cancellations. The analysis is the best available scientific information as collected by Reclamation scientists and by colleagues from GCMRC, FWS, and AZDGF.

Whirling disease is a parasite that affects salmonid species, including the rainbow and brown trout that are found below Glen Canyon Dam (GCMRC Memo, p. 2). It does not affect other fish in the area, such as the humpback chub (Reclamation Memo, p. 2). Whirling disease was most recently detected in samples taken during October of 2011; sample analysis was completed in May of 2011, and AZDGF informed Reclamation of the results in a July 12, 2012 letter (AZDGF Letter).

Several characteristics of the whirling disease parasite are important to the understanding the effect of HFE releases on whirling disease. First, whirling disease is a water-borne parasite that spreads easily (GCMRC Memo, pp. 3-4; AZDGF Letter, p. 2; Reclamation Memo, p. 3). Accordingly, whirling disease is assumed to spread from upstream river reaches to downstream river reaches. (GCMRC Memo, pp. 3-4; BA, p. 3). Applied here, the AZDGF considers the entire river from Glen Canyon Dam to Lake Mead infected with whirling disease (BA, p. 3).

This first characteristic is also pertinent to the Zuni letter's request for additional downstream monitoring. Additional downstream monitoring would not provide additional information regarding whirling disease since detection would not distinguish between disease spread from normal dam releases and disease spread from HFE releases. Nevertheless, extensive robust



monitoring of the Colorado River fishery is ongoing annually in all seasons in Glen, Marble and Grand Canyons. These routine monitoring trips, conducted numerous times throughout the year, assess fish species distribution, abundance, and composition throughout the river corridor, will also detect any trout that show physical signs of whirling disease (i.e. deformities of the spine). Thus if the disease spreads and affects the trout population, it is likely that ongoing monitoring will detect this. AZDGF will continue comprehensive annual monitoring of trout for whirling disease in Glen Canyon.

The second characteristic concerns how whirling disease spreads. The spread of whirling disease often occurs in the parasite's lifecycle when it resides in intermediate host species that live on fine sediment particles in the river (Reclamation Memo, p. 3; GCMR). Because HFE releases are designed to transport these fine sediment particles onto sandbars, the available habitat for these intermediate host species is reduced (GCMRC Memo, p. 3). Although HFEs could facilitate the spread of whirling disease to downstream reaches of the Colorado River by temporarily increasing *Myxobolus cerebralis* myxospore and triactinomyxon (life stages of the organism that causes the disease) abundance in the water column, an increase in infection risk due to these HFEs seems unlikely. HFEs of the magnitude proposed result in short travel times through Grand Canyon (e.g., 2.4 d to travel 235 miles at 45,000 ft<sup>3</sup>/s) and flow rates of this magnitude have been shown to result in lower *M. cerebralis* infection prevalence in both *T. tubifex* and rainbow trout, and reduced disease severity in rainbow trout (GCMRC Memo, p. 3). Research further indicates that high flows may even be an effective means of controlling and reducing whirling disease for this reason (GCMRC Memo, p. 3).

The third characteristic is that older and larger trout are less susceptible to contracting the disease, and the Colorado River in Grand Canyon is dominated by older trout and young, small trout are rare (GCMRC Memo, p. 3). Susceptibility to whirling disease in trout varies by life stage and size with young and small fish most vulnerable because the parasite targets cartilage as the infection develops. Resistance to whirling disease increases in developing fish as cartilage is replaced with bone. Fish are most susceptible to infection when they are young and small, thus the large rainbow trout that are common in Grand Canyon naturally have low susceptibility to whirling disease. Although HFEs could facilitate the spread of whirling disease to downstream reaches of the Colorado River by temporarily increasing abundance of *M. cerebralis* in the water column, HFEs are unlikely to contribute to the spread of the disease downstream in this way because there are relatively very few juvenile trout in Grand Canyon, and the adult trout more common in this area are much less susceptible (GCMRC Memo, p. 3).

With regard to PBR nonnative fish removal trips: In the Non-native Fish Control EA, Reclamation had proposed two nonnative fish mechanical removal trips in the PBR reach in 2012. As Reclamation explained in the Nonnative Fish Control EA, the two PBR reach removal trips were to be experimental to assess the potential for removal in this upstream reach to effectively limit downstream dispersal of rainbow trout from Lees Ferry and to assess the potential to move live trout to other waters. The two trips were anticipated to have limited conservation benefit to native fish including humpback chub because the efficacy of removal in the PBR reach is unknown (Reclamation Memo, Attachment 3). The AGFD has now indicated to us that forgoing live removal of fish from Glen, Marble, and Grand Canyons to other waters is the only sure means of eliminating the risk of spreading the disease (AZDGF Letter, Attachment 2). Further, information from the two PBR trips on the abundance and size distribution of trout in

the PBR reach, and on movement of rainbow trout out of the Glen Canyon downstream is now available from additional fish sampling that is now occurring that was not planned at the time of the EA, and it is unlikely that additional data from proposed preliminary PBR trips would add substantially to our understanding of the rainbow trout population in this reach of the Colorado River (Reclamation Memo, Attachment 3). Thus, most of learning that would now occur from these trips is obviated by the increased prevalence of whirling disease that eliminates the ability to test live removal (and any removal) of trout. Based on the foregoing considerations, we reached the preliminary conclusion that these potential trips should be cancelled. Reclamation sent a letter to the U.S. Fish and Wildlife Service (FWS) indicating that we do not believe that the action identified in the EA has been modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion (Reclamation Memo, Attachment 3). The FWS concurred with this finding (FWS Memo, Attachment 4).

### **Relationship of the Zuni Letter to the NEPA process**

The Zuni letter also alleges that whirling disease was insufficiently addressed in the NEPA process (Zuni Letter, p. 1). Although the Zuni did comment on the issue of whirling disease as an issue for nonnative fish control in comments during development of the EA, they did not raise the issue of potential whirling disease spread from a HFE (Zuni Letter, p. 2). Whirling disease was addressed in early stages of the NEPA process when structured decision making was under consideration (SDM Report, p. 17, <http://www.usbr.gov/uc/envdocs/ea/gc/nffc/Appdx-A.pdf>; AZDGF Letter, p. 1). But because Reclamation was notified of the whirling disease results after the FONSI was issued (AZDGF Letter, dated July 12, received July 17), it is most appropriate to consider whether the whirling disease information warrants supplemental NEPA analysis.

Similarly, the PBR nonnative removal trips were proposed for cancellation in our letter to FWS dated October 3, 2012, and the FWS concurred that this cancellation and change in the proposed action would not require reinitiation of Endangered Species Act section 7 consultation was sent on October 10, 2012, after the FONSI were issued.

Under NEPA regulations at 40 C.F.R. § 1502.9(c)(1)(ii), agencies should prepare supplemental NEPA documents if “[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.” Applied here, the whirling disease results and PBR cancellation could potentially be new information because this information was raised after the NEPA process was completed. But this information must be more than simply “new.” It must also be “relevant to the environmental concerns and bearing on the proposed action or its impacts” to meet the regulatory definition of new information under NEPA.

As discussed above, the whirling disease information does not meet the additional parameters of the regulatory definition. Whirling disease has been detected below Glen Canyon Dam, and it does not have bearing on the HFE Protocol or its impacts because it is now in the system, with or without HFE releases. Similarly, the whirling disease information does not have bearing on the proposed action or its impacts because HFE releases would not be conducted differently or postponed now that whirling disease has been detected. HFE releases are likely to be beneficial relative to whirling disease because they could reduce the prevalence of whirling disease (GCMRC Memo, p. 3). With regard to the two PBR nonnative fish removal trips being

cancelled, these two trips were experimental and the FWS found that not conducting the 2012 PBR trips did not significantly affect our knowledge of rainbow trout in Grand Canyon, and would not affect FWS findings in the December 23, 2011, biological opinion, and thus did not require reinitiation of formal consultation as defined in 50 CFR §402.16 (FWS Memo, Attachment 4). Thus, similarly, with regard to NEPA, the cancellation of the two experimental PBR nonnative fish removal trips in 2012 is not relevant to the environmental concerns and bearing on the proposed action or its impacts because cancellation of the PBR nonnative fish removal trips would not affect the manner in which a HFE release would occur.

### **Conclusion**

Based on the information and analysis above, the recommendation is to proceed with planning efforts for a November HFE release because the Zuni concerns related to whirling disease would not affect the manner in which a HFE release would occur, nor does the whirling disease information warrant supplemental NEPA analysis. Likewise, cancellation of the PBR nonnative fish removal trips would not affect the manner in which a HFE release would occur, nor does the cancellation warrant supplemental analysis.



Arlen Quetawki, SR.  
Governor

Steve K. Boone  
Lt. Governor

Arden Kucate  
Head Councilman

Vacant  
Councilman

## PUEBLO OF ZUNI

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Loren L. Leekela, SR  
Councilman

Gerald Hooee, SR.  
Councilman

Mark Martinez  
Councilman

Birdena Sanchez  
Councilwoman

20 September 2012

Mr. Larry Walkoviak, Regional Director  
Upper Colorado Regional Office  
Bureau of Reclamation  
125 South State Street, Room 6107  
Salt Lake City, Utah 84138-1147

RE: Fall 2012 High Flow Experiment Release from Glen Canyon Dam

Dear Mr. Walkoviak,

Thank you for your letter, dated 07 September 2012, informing the Pueblo of Zuni of the Bureau of Reclamation's intention to implement a high flow experimental release from Glen Canyon Dam in the fall of 2012. This information is consistent with what Zuni Councilman Gerald Hooee and our alternate AMWG representative heard from the Department of the Interior during the Adaptive Management Work Group (AMWG) meeting on 29 August 2012. Also during the AMWG meeting, information was presented about the detection of whirling disease among Rainbow trout within the Lees Ferry reach of the Colorado River ecosystem. The information on whirling disease was similar to what Zuni heard from your representative and representatives from the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department on 17 August 2012 during a consultation meeting here at Zuni. Based on the information provided at both meetings about the presence of whirling disease among the Lee's Ferry rainbow trout population coupled with other Zuni concerns that were submitted to the Bureau of Reclamation but insufficiently addressed during the High Flow Experimental Protocol EA process, I am pleased to provide you with the following Zuni concerns in anticipation of a fall high flow experimental release (HFE).

The Pueblo of Zuni expressed concern that the implementation of the HFE release may directly contribute to the spread of whirling disease downstream toward the Little Colorado River's confluence where it apparently has not yet been detected and may not be present. Current information suggests that whirling disease has only been detected in the Lees Ferry reach; however, the degree to which the Lees Ferry rainbow trout population is infected is unknown. The Pueblo of Zuni believes it would be prudent to conduct monitoring of rainbow trout in various locations from the Paria to the confluence of the Little Colorado River to determine the presence or absence of whirling disease prior to implementing a fall HFE. This monitoring will establish a baseline of information regarding the distribution of whirling disease throughout this system and whether subsequent detection of whirling disease below the Paria may be attributable to an HFE event.

As you are aware, the news of the presence of whirling disease within the Lees Ferry reach was interpreted by the Zuni religious leaders as an answer to Zuni prayers by providing a natural means for reducing the trout population in Glen Canyon; thereby reducing the perceived need to implement lethal mechanical removal which is so objectionable to Zuni. All life, native and non-native, is precious to Zuni. While the presence of whirling disease in the Lees Ferry rainbow trout population is a potential means for controlling expanding trout numbers and the resultant immigration of trout downstream, it is not acceptable for the Bureau of Reclamation to knowingly

spread the disease to other unaffected parts of the river and impact other life forms. Until more credible information is gathered regarding how pervasive this disease is among the Lees Ferry rainbow trout population, the Pueblo of Zuni believes that the Bureau of Reclamation should be more concerned with confining whirling disease to the Lees Ferry reach rather than implementing experimental/management actions that might contribute to the downstream spread of this lethal disease.

The Pueblo of Zuni, through successive iterations of the HFE Protocol Environmental Assessment, raised the concern regarding the cumulative negative impact(s) of high flow events on power generation and its resultant effect on raising the cost of purchasing power for individual rate payers. This is a specific concern for economically disadvantaged minority communities such as Zuni that could needlessly experience greater cumulative negative financial harm from a repeated federal agency action that is intended to create beaches for the recreational enjoyment of a more affluent American and international public. The Pueblo of Zuni believes that this issue received insufficient attention and analysis in both the hydropower and environmental justice sections of the final environmental assessment. The Pueblo of Zuni requests that prior to the implementation of the anticipated fall HFE, the Bureau of Reclamation provide a detailed description on how the economic effects of successive HFEs on power rate payers will be monitored and through what method(s) will a threshold of unacceptable power rate increase for economically disadvantaged minority power rate payers be defined.

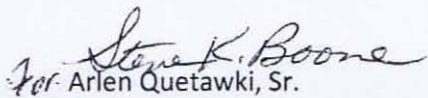
The Pueblo of Zuni also notes that there continues to be an assumption advanced by the Department of the Interior that an HFE event may have a beneficial effect to archaeological sites through transporting suspended sediment in the Colorado River up onto beaches where the sediment is reworked and deposited on archaeological sites through aeolian transport. Newly deposited sand on the archeological sites is believed to function as a preservation agent by retarding and decelerating rates of erosion. Past research demonstrates, however, that a very small subset of archaeological sites located along the Colorado River may benefit from any HFE event. How long that deposited sand stays on an archaeological site and whether or not it has a significant role in site preservation remain unanswered questions. Unfortunately, the Bureau of Reclamation appears to have not considered that implementing an HFE and its resultant effect of covering archaeological sites with sediment may negatively impact those characteristics (e.g., visible surface artifact distribution and features) that make archaeological sites significant (eligible under Criterion (a)) through the conveyance of associative values to the Zuni people. That is to say, by obscuring surface artifacts and surface features, like shrines, Zuni cultural advisors are constrained from freely interacting with these cultural and historical memory triggers that play an important and vital role in the Zunis' ability to meaningfully relate to and interpret these places during river monitoring trips. Additionally, the creation of more sand bars and campable beach areas that result from one or more subsequent HFE may facilitate greater access by the general public to specific areas of cultural importance to Zuni thereby inadvertently creating adverse effects to Zuni Traditional Cultural Properties. Previously, the Pueblo of Zuni expressed concern about the negative effects of uncontrolled public access to Zuni sacred places and traditional cultural properties within Grand Canyon to the National Park Service and the Bureau of Reclamation; a concern that is reiterated and underscored here.

At this point in time, prior to the HFE event occurring, the Pueblo of Zuni is uncertain how the Bureau of Reclamation plans to comply with stipulations II(c) and III of the Memorandum of Agreement Glen Canyon Dam High Flow Experimental Protocol. Please provide the Pueblo of Zuni with specific information on how the Bureau of Reclamation envisions when and how tribal monitoring will occur after this HFE event and specifically how Zuni monitoring information, as well as other monitoring data, will be employed by the Bureau of Reclamation to evaluate the success or failure of any one or multiple HFE events.

Finally, in accordance with Stipulation IV, **Site-Specific Impact Avoidance or Mitigation**, of the MOA, the Pueblo of Zuni requests that the Regional Director of the Bureau of Reclamation meet face-to-face with the Zuni Governor and Tribal Council to address and resolve the Zuni issues presented in this letter prior to conducting the fall HFE.

Should you have any questions or require additional information concerning the information presented in this letter please contact Kurt Dongoske, Tribal Historic Preservation Officer, at 505.782.4814. Thank you for your consideration of the Zuni issues and consulting with the Pueblo of Zuni.

Sincerely,

  
Arlen Quetawki, Sr.  
Governor

Xc: Honorable Ann Castle, Assistant Secretary for Water and Science  
GCDAMP AMWG representatives  
GCDAMP TWG representatives  
Dr. Jack Schmidt, Chief, GCMRC

ORIGINAL

KM071710-03



THE STATE OF ARIZONA  
GAME AND FISH DEPARTMENT

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DEPUTY DIRECTORS  
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BOB BROSCHEID



July 12, 2012

Ms Beverley Heffernan  
Environmental Resources Division Chief  
US Bureau of Reclamation  
Upper Colorado Region  
125 South State Street,  
Salt Lake City, Utah 84138

RECEIVED BOR SLC  
OFFICIAL FILE COPY  
JUL 17 12

ENV. 6.00  
GF

DATE	INITIALS	TIME
7/24/12	BET	7:00
		7:31

Dear Ms. Heffernan,

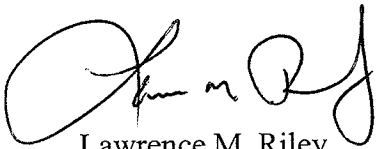
As you are aware on May 16<sup>th</sup> 2012, we received news that several of the rainbow trout samples from our October 2011 Lees Ferry survey tested positive for the presence of whirling disease. The Washington Animal Disease Diagnostic Lab at Washington State University confirmed that 4 of 18 pools of fish were infected with the disease. We have been testing for whirling disease annually since 1999 and this represents the second detection in Lees Ferry. The first detection occurred in 2007, but follow up surveys that year and annual surveys through 2010 failed to detect the presence of the disease. Prior to the 2011 samples, some biologists surmised that the 2007 detection represented an exposure that had failed to become established in the population. Compared to 2007, the 2011 samples showed that a higher proportion of samples tested positive and the disease was detected throughout the entire Lees Ferry reach. In light of the 2011 samples, it appears that the parasite is expanding from static low-incidence population levels or is the result of a new recent exposure. We suspect that the former is a much higher probability than the latter.

To our knowledge Lees Ferry is the only whirling disease positive water in Arizona. Transporting the disease to uninfected waters is risky and preventative measures must be taken to minimize or eliminate the chance of spreading the disease. As you will remember, the Department expressed these concerns during the SDM process in 2010 and subsequently during scoping and analysis for the nonnative control environmental assessment. We have been unable to identify waters in Arizona where risk is completely eliminated not only for whirling disease, but also for the other invasive species found in Lees Ferry; New Zealand mudsnails and *Didymosphenia geminata*. At this time, eliminating risk would seem to involve not moving fish to other waters. We understand the sensitivities of the tribes as it relates to live removal and would recommend working with them to further explore the possibility of relocating trout to tribal waters, keeping in mind the risks involved. Should those options not exist alternative

options, as discussed in the nonnative control environmental assessment also need to be carefully examined.

The myxospore life stage of whirling disease is highly resilient to environmental conditions and any option for removal of affected trout, live or lethal, must be undertaken with caution. Grinding up the fish to use as fertilizer will not kill the myxospore and studies have shown that in some cases freezing may not kill the spores. We will continue to work with you and the tribes to identify a mutually acceptable strategy for population control and beneficial use for these fish. If you would like to discuss further feel free to contact me 623-236-7302.

Sincerely,

A handwritten signature in black ink, appearing to read "Lawrence M. Riley". The signature is fluid and cursive, with a large initial "L" and "R".

Lawrence M. Riley  
Assistant Director  
Wildlife Management Division  
Arizona Game and Fish Department

LMR:bs





# United States Department of the Interior

## BUREAU OF RECLAMATION

Upper Colorado Regional Office  
125 South State Street, Room 6107  
Salt Lake City, Utah 84138-1102

IN REPLY REFER TO:

OCT 03, 2012

UC-731  
ENV-9.00

VIA ELECTRONIC MAIL ONLY

### MEMORANDUM

To: Field Supervisor, U.S. Fish and Wildlife Service, 2321 West Royal Palm Road,  
Suite 103, Phoenix, AZ 85021  
Attn: Steve Spangle

From: Larry Walkoviak /s/  
Regional Director

Subject: Change in Proposed Action for Non-Native Fish Control Downstream From Glen  
Canyon Dam

Recently we have been in discussions with your staff on the possible modifications to the proposed action in your December 23, 2011, Final Biological Opinion (BO) on the Operation of Glen Canyon Dam including High Flow Experiments and Non-Native Fish Control (consultation number 22410-2011-F-0100). In the Non-native Fish Control Environmental Assessment (EA) completed December 30, 2011, and as described in your December 23, 2011, BO, we had proposed undertaking two non-native fish mechanical removal trips in 2012 to test the removal of non-native fish using boat-mounted electrofishing from the reach of the Colorado River between the Paria River and Badger Creek (PBR). For reasons detailed below we are seeking your input and views on our proposed cancellation of those trips. Our anticipated change in the proposed action was made after thorough discussion and preliminary input from your staff. We are writing to request your response on whether you support our conclusions for the proposed cancellation of these trips, and are seeking your concurrence that this proposed course of action would not constitute a change that would necessitate reinitiation of formal consultation as defined in 50 CFR §402.16.

As you know, the Arizona Game and Fish Department (AGFD) recently detected whirling disease in rainbow trout in Glen Canyon. Previously, despite annual monitoring, whirling disease had only been detected in a single rainbow trout in 2007. AGFD had been prepared to declare the fishery free of the disease if the 2011 samples did not detect it. However, multiple fish sampled in October 2011 from several locations in Glen Canyon between Glen Canyon Dam and Lees Ferry tested positive for the disease. Histological examination of a subsample of fish revealed internal signs of the disease in analyses completed in May 2012. Outward signs of the disease, such as spinal deformities or lesions, or fish mortality, have not been seen in fish in Glen Canyon, indicating that while the disease is more widespread in these samples than in the past, it

does not yet appear to be causing mortality or population-level effects to rainbow trout in Glen Canyon.

Although whirling disease can have a devastating effect to rainbow trout and cutthroat trout populations, it is specific to salmonids, and so poses no threat to native fish species including the endangered humpback chub. However, in contrast to our earlier anticipated approach, the AGFD has now indicated to us that forgoing live removal of fish from Glen, Marble, and Grand Canyons to other waters is the only sure means of eliminating the risk of spreading the disease. While AGFD indicated that it may be possible to undertake live removal to isolated waters within Arizona if owners of such waters understand and accept the risks, we have been unable to identify any potential waters for this purpose. Because we had proposed removing rainbow trout alive to stock in other waters to avoid adverse effects to cultural resources of importance to several Indian Tribes, we are now consulting with these tribes to determine if acceptable mitigation is possible in the event that lethal removal is our only possible course of action.

In the Non-native Fish Control EA, and as described in your BO, we had proposed two non-native fish mechanical removal trips in the PBR reach in 2012 to test our ability to conduct live removal in this upstream reach. As we explained in our EA, the PBR reach removal is experimental, and was proposed to assess the potential for removal in this upstream reach to effectively limit downstream dispersal of rainbow trout from Lees Ferry and to assess our ability to move live trout to other waters. As we have worked to implement this project in cooperation with AGFD and the Grand Canyon Monitoring and Research Center (GCMRC), it became apparent to us and our cooperators that most of the unknowns and areas where the most learning would likely occur, relate to what would happen to the fish once removed from the river and how successful would our efforts be in transporting fish to their final destination alive. Further, we already know with some certainty some aspects of our ability to capture and remove fish alive because the agencies and personnel involved in Glen Canyon and Grand Canyon fisheries research already have considerable experience conducting electrofishing surveys and mark-recapture studies such that mortalities of targeted species, including trout, are minimal. These efforts also include the transport of captured fish by boat to processing stations, another activity that would be required as part of live removal from the PBR reach. Therefore, the primary learning activity from the PBR trips now would be in testing our transport of removed fish to other waters.

Another area that had been identified for potential learning from these two PBR trips is information on the abundance and size distribution of trout in the PBR reach, and on movement of rainbow trout out of the Glen Canyon downstream. While this information was lacking or only available on a limited basis when the PBR removal element of the proposed action was developed, we now have additional updated information on this matter. Last fall, GCMRC began a robust mark-recapture study of rainbow trout in Glen and Grand Canyons to generate information on the abundance and size distribution of trout in the PBR reach. This study includes quarterly electrofishing surveys that incorporate sampling in the PBR reach. In addition to this work, AGFD also conducts an annual system-wide electrofishing survey that includes this same reach of river. Given the level of sampling that is now occurring, it is unlikely that additional data from proposed preliminary PBR trips would add substantially to our

understanding of the rainbow trout population in this reach of the Colorado River. We will be able to share results of this work with the U.S. Fish and Wildlife Service (Service) as reports of this monitoring are completed, and in our annual reports to you in compliance with the 2011 BO.

Based on the foregoing considerations, we have reached the preliminary conclusion that these potential trips should be cancelled. We will continue to consult with tribes and other signatories to the Non-native Fish Control Memorandum of Agreement to attempt to find a suitable means of removing non-native fish. We do not believe that the action identified in the EA has been modified in a manner that causes an effect to listed species or critical habitat that was not considered in the BO for the following reasons:

With regard to removal in the reach at the mouth of the Little Colorado River (LCR), the LCR reach, currently, based on the above-mentioned sampling, rainbow trout numbers are below trigger numbers identified in the BO, juvenile humpback chub numbers are relatively high and stable at the LCR confluence, and the adult population is now 9,000-12,000 fish based on the Age-Structured Mark Recapture Model. Water temperature will also exceed 12 degrees Celsius this year which will continue this trend since 2003. Therefore, based on the guidance in the BO for when this removal should occur, we perceive no immediate need to conduct removal actions from this reach.

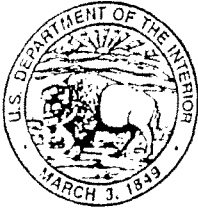
Representatives from the Pueblo of Zuni have also recently informed us that they are concerned that a high flow experiment (HFE) could result in the spread of whirling disease downstream. The AGFD has informed us that they have not monitored for the disease in Marble and Grand Canyons, because the parasite causing the disease is water-borne, and therefore in the opinion of AGFD, the entire river, from Glen Canyon Dam to Lake Mead, is considered to be infected. For this reason, AGFD advises that the best course of action to eliminate the risk of spreading the disease is to not remove and transport out of the canyon fish from any location in this reach. While there is some evidence that HFEs may displace juvenile rainbow trout downstream, this does not present any additional risk to the rainbow trout population because the entire population is already exposed to the disease. Because brown trout are naturally more resistant to the disease, and the disease would not affect any other species in the system including humpback chub, all other fish species will not be affected by the disease, and for this reason, the prevalence of whirling disease in the system is not new information that reveals the effects of the action may affect listed species or critical habitat in a manner or to an extent not previously considered. Whirling disease also requires an intermediate host, an oligochoete worm. These worms require fine sediment to complete their life cycle. Although the HFEs do redistribute fine sediment in Glen, Marble, and Grand Canyons, the available science indicates that HFEs reduce the abundance of oligochoete worms in the system temporarily due to scouring of their habitat and therefore HFEs are expected to reduce the prevalence of the disease. For these reasons, we have concluded that HFEs will not increase the prevalence or distribution of whirling disease in comparison to other flows associated with the operation of Glen Canyon Dam.

We would also like to take this opportunity to provide a synopsis of the near-term biological monitoring that will help us assess a fall 2012 HFE, should one occur; as you know, we are forgoing spring HFEs through 2014 due to the potential effect of increasing the rainbow trout

population in Glen Canyon. GCMRC has a number of research efforts underway that will provide valuable information about the effect of future HFEs on the aquatic biology and the fishery of Glen, Marble, and Grand Canyons. The Understanding the Factors Limiting the Growth of Rainbow Trout in Glen and Marble Canyons project will be monitoring and tagging trout in Glen Canyon prior to the HFE, monitoring trout redds this winter, and conducting additional monitoring in the spring. This study will help us assess the effects of the HFE on the adult and juvenile trout population in Glen Canyon, as well as assess how HFEs affect the downstream dispersal of trout from Glen Canyon. The Monitoring of Native and Non-native Fishes in the Mainstem Colorado River and the lower LCR will also provide monitoring of the fishery system-wide in April 2013, which will help assess any system-wide effects of a HFE on the Colorado River fishery. The Humpback Chub Early Life History in and Around the LCR Mainstem project monitors the status of juvenile humpback chub (<150 mm total length) in the mainstem at the LCR quarterly, and monitoring in September 2012 and January 2013 will provide pre- and post-monitoring for a Fall 2012 HFE, providing information on its effects to juvenile humpback chub survivorship. The Humpback Chub Aggregation Studies and Metapopulation Dynamics project conducts annual monitoring of all 9 humpback chub aggregations in Marble and Grand Canyon every September and this monitoring will provide important information on the effect of HFEs on all of the humpback chub aggregations. Also, GCMRC will conduct aquatic food base monitoring before, during, and following HFEs at Lees Ferry and Diamond Creek to assess the effect of HFEs on this important resource. We believe this suite of projects will provide the monitoring needed to successfully evaluate and help us answer important science questions on the effects of an HFE on key resources such as humpback chub, rainbow trout, and the aquatic food base.

We appreciate the Service's assistance in our efforts to protect and conserve humpback chub and other imperiled species through the Glen Canyon Dam Adaptive Management Program and look forward to continuing our work with you on this matter. We would request your expedited review of this request, given the limited remaining time in this calendar year. For further information please contact Mr. Glen Knowles at 801-524-3781.

cc: UC-413, UC-438, UC-600, UC-720, UC-730



# United States Department of the Interior

U.S. Fish and Wildlife Service

Arizona Ecological Services Office

2321 West Royal Palm Road, Suite 103

Phoenix, Arizona 85021-4951

Telephone: (602) 242-0210 Fax: (602) 242-2513



In reply refer to:  
AESO/SE  
22410-2011-F-0100  
22410-2011-F-0112

October 10, 2012

## Memorandum

To: Regional Director, Upper Colorado Regional Office, Bureau of Reclamation, Salt Lake City, UT (UC-731)

From: Field Supervisor

Subject: Change in Proposed Action for Non-Native Fish Control Downstream From Glen Canyon Dam and Notification of Biological Monitoring Components for November, 2012, High Flow Experiment

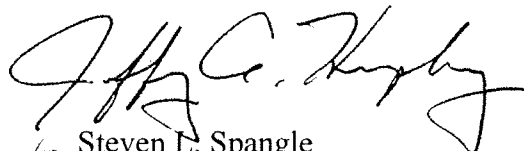
This memorandum responds to your October 3, 2012, memorandum concerning the subject Bureau of Reclamation (Reclamation) programs. These actions were included in the Fish and Wildlife Service's (FWS) final biological opinion (FBO) dated December 23, 2011, for the Non-Native Fish Control (NNFC) and High Flow Experiments (HFE) environmental assessments.

As stated in your memorandum, the documentation of whirling disease at the Lees Ferry rainbow trout fishery in 2012 by Arizona Game and Fish Department (AGFD) has significant consequences for the 2012 test removal trips for rainbow trout removal in the Paria-Badger Rapid (PBR) reach of the Colorado River at and below Lees Ferry. These two trips were intended to evaluate the effectiveness of mechanical removal of rainbow trout in the PBR reach to effectively reduce rainbow trout emigration downstream prior to initiation of larger-scale removal efforts (up to 10 trips could be scheduled in any one year from 2011-2020) in the reach. With the documentation of whirling disease, it is not possible to implement live removal of rainbow trout from the PBR reach with subsequent transport of the fish to stocking sites elsewhere in Arizona. The 2012 test removals would have provided information on implementation of such removal and transport. As you describe in your memorandum, other information that would be gained from continuing with the removals in 2012 is already available from other ongoing research and monitoring in Grand Canyon. Thus, not conducting the 2012 PBR trips does not significantly affect our knowledge of rainbow trout in Grand Canyon, and does not affect our findings in our December 23, 2011, FBO. This change does not require reinitiation of formal consultation as defined in 50 CFR §402.16.

The FWS has considerable interest in the potential effects to native and non-native fish and the aquatic food base from the implementation of a fall HFE. We understand that the conditions to

support a fall HFE have been met, and the Secretary of the Interior has determined that an HFE will occur in November, 2012. The effects of a spring HFE to these resources was documented after the 2008 HFE and significant issues related to rainbow trout population increases were identified. We have reviewed the list of monitoring actions that are ongoing in Grand Canyon that will provide information to assess the effects of the fall HFE on these biological resources and believe it to be sufficient to inform us of significant issues resulting from a fall HFE. We do have one concern; official publication of results from the monitoring after the 2008 spring HFE did not occur until 2010 and 2011. We understand that preparing these reports for official distribution by U.S. Geological Survey/Grand Canyon Monitoring and Resource Center (USGS/GCMRC) is a complex process. However, it is important that the findings from this monitoring be available to us prior to any subsequent fall HFE events taking place. We understand you are working with USGS/GCMRC on this concern.

Thank you for your continuing coordination on implementation of the NNFC and HFC programs and their effects to biological resources. If there are other questions, or we may assist in any way, please contact Ms. Lesley Fitzpatrick of my staff at (602) 242-0210 (x236) or me (x244).



for Steven L. Spangle

cc: Regional Director, Southwest Region, Fish and Wildlife Service, Albuquerque, NM  
 (ES; FARC)  
 Project Coordinator, Arizona Fish and Wildlife Conservation Office, Flagstaff, AZ  
 Chief, Natural Resources Division, National Park Service, Grand Canyon, AZ  
 Glen Canyon Natural Recreation Area, Page, AZ  
 Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ (B. Stewart)  
 Director, Environmental Programs, Bureau of Indian Affairs, Phoenix, AZ  
 Havasupai Tribe, Supai, AZ  
 Hopi Tribe, Kykotsmovi, AZ  
 Hualapai Tribe, Peach Springs, AZ  
 Kaibab Band of Paiute Indians, Pipe Springs, AZ  
 Navajo Nation, Window Rock, AZ  
 Pueblo of Zuni, Zuni, NM  
 San Juan Southern Paiute Tribe, Tuba City, AZ  
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## United States Department of the Interior

### U.S. GEOLOGICAL SURVEY

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#### Memorandum

To: Glen Knowles, Bureau of Reclamation, HFE Technical Team Lead

From: Scott VanderKooi, Grand Canyon Monitoring and Research Center, Acting Deputy Chief

CC: Shane Capron, GCDAMP Technical Work Group, Chair

Date: October 22, 2012

Subject: Whirling disease in Glen Canyon, Arizona and implications for resource management in the Colorado River

The confirmation of the presence of whirling disease in Glen Canyon has repercussions for the management of fisheries and other resources in the Colorado River below Glen Canyon Dam. The risk of spreading the disease must be taken into consideration as the recently completed Environmental Assessments (EA) for Nonnative Fish Control and High-Flow Experiments are implemented. Of the actions proposed, live removal and relocation of rainbow trout (*Oncorhynchus mykiss*) represents the greatest risk for spreading whirling disease, as these fish are highly susceptible to infection and can carry large numbers of the parasite. Risks associated with experimental floods further spreading the disease are low as the downstream movement of infected fish is already occurring. Higher flows may actually decrease the prevalence of whirling disease through disruption of the parasite's life cycle by displacing its alternate host and reducing its preferred habitat.

Whirling disease was initially detected in Glen Canyon in 2007 (Makinster and others, 2008) and re-detected in 2011 (B. Stewart, AZGFD, pers. comm.). The 2011 results showed 22 percent of samples (90 fish pooled into batches of five fish each) tested positive for the disease with positive groups collected from both upstream and downstream reaches. The presence of whirling disease has implications for a number of proposed management actions related to Glen Canyon Dam and the Colorado River in Glen, Marble, and Grand Canyons. Two potential actions that have raised concerns due to their perceived potential to spread whirling disease are: 1) live removal and relocation of rainbow trout associated with the Nonnative Fish Control EA (Bureau of Reclamation, 2011a); and 2) experimental floods conducted as part of the High-Flow Experiment EA (Bureau of Reclamation, 2011b). Below, we summarize available literature concerning the risk of spreading whirling disease through these potential management actions.

### ***Background: Whirling disease biology and life cycle***

Whirling disease only infects salmon and trout species, and is caused by *Myxobolus cerebralis*, a myxozoan parasite introduced to North America from Europe in the 1950s (Bartholomew and Reno, 2002). Elwell and others (2009) provide a thorough description of the parasite and summarize the disease and its effects on fish in the United States in a white paper prepared as part of the Whirling Disease Initiative. Myxozoan parasites exhibit complex life histories requiring both an invertebrate and vertebrate host to complete their life cycle (Figure 1). In the case of *M. cerebralis*, the invertebrate host is the oligochaete worm *Tubifex tubifex* and the vertebrate host is a salmonid fish (e.g., salmon, trout and whitefish).

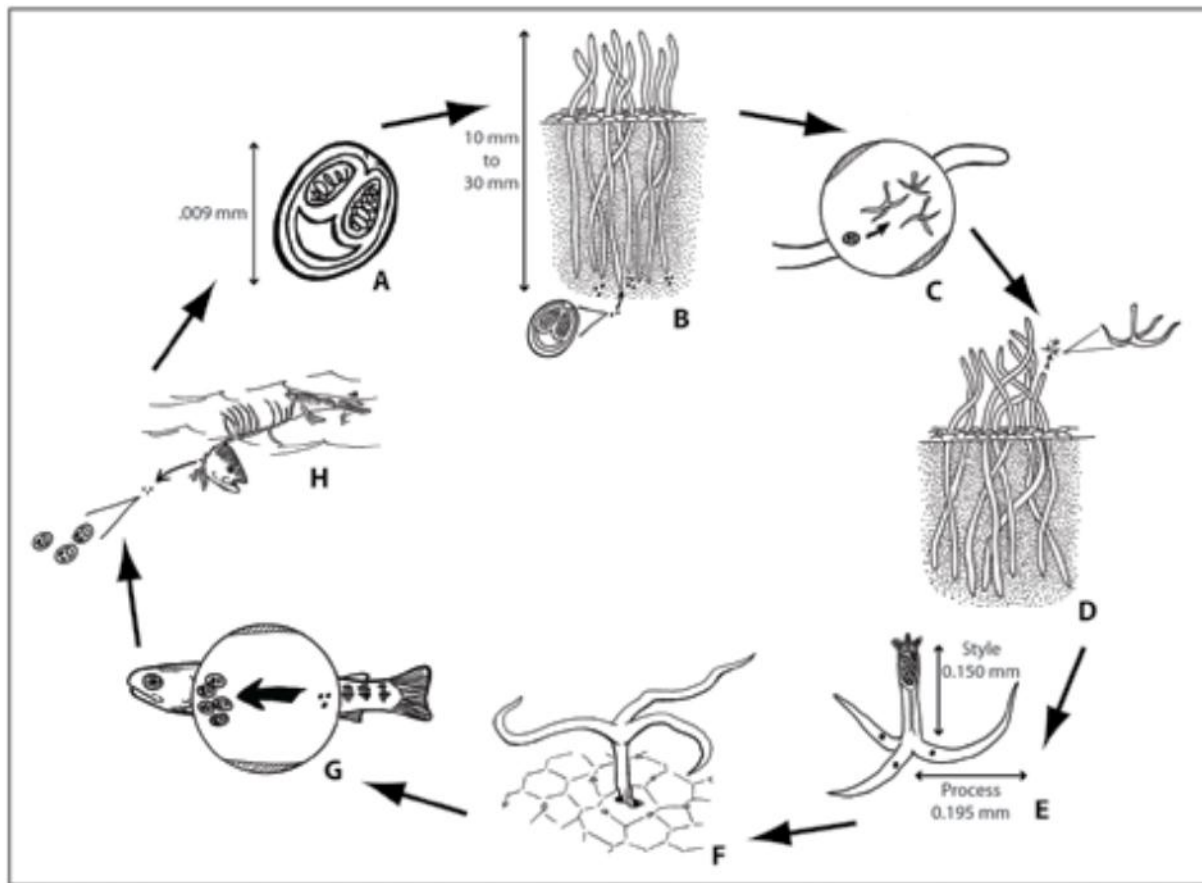


Figure 1. The life cycle of *Myxobolus cerebralis*, the parasite that causes whirling disease. Myxospores (A) are ingested by the oligochaete worm *Tubifex tubifex* (B) which are infected and subsequently produce (C) and release (D) triactinomyxons (E). Triactinomyxons infect a salmonid fish through their skin (F) which then produce myxospores (G) that are released following the death of the fish (H) completing the life cycle (Figure from Elwell and others, 2009).

No other worm or fish species can be infected, but susceptibility to whirling disease does vary by strain of *T. tubifex* as well as species and stock of salmonid. For example, rainbow trout are quite susceptible to the disease although some stocks are resistant, while brown trout (*Salmo trutta*) can carry the parasite and show few clinical signs of infection. Susceptibility in fish also varies



by life stage and size with young and small fish most vulnerable, because the parasite targets cartilage as the infection develops. Resistance to whirling disease increases in developing fish as cartilage is replaced with bone. Infection is also influenced directly and indirectly by a number of environmental factors including water temperature, substrate, and flow. Water temperatures between 10 and 15 °C are most suitable for triactinomyxon (TAM) production (the life-stage of whirling disease produced in *T. tubifex* that subsequently infects fish) and are associated with the highest levels of infection and disease severity. Substrates composed of finer materials like silt and clay are more favorable for *T. tubifex* reproduction and TAM production in those worms. Higher levels of organic material in streams lead to higher worm abundance which, in turn, may be related to an elevated risk of infection in fish. In the short term, flows high enough to scour substrates can disadvantage *T. tubifex* by displacing fine sediment and the worms residing in it. Scouring high flows can also disadvantage *T. tubifex* in the long term by limiting amounts of suitable habitat. Anthropogenic changes in watersheds can also affect whirling disease prevalence. The tailwaters downstream from dams often have conditions favorable to *T. tubifex*, which could increase *M. cerebralis* infection risk in fish.

### ***Risk of spread through relocation of trout***

Live removal and relocation of rainbow trout or brown trout from the Colorado River to other waters poses a substantial risk of unintentionally spreading whirling disease as both species can carry the parasite. An infected fish can release millions of myxospores (Hallet and Bartholomew, 2008), which can then infect *T. tubifex*, thus completing the life cycle of the parasite. There is no effective treatment of whirling disease in fish once a population has become infected (Gilbert and Granath, 2003). Because of this, possessing or transporting fish from whirling disease infected waters is explicitly forbidden by state law (see Arizona's Aquatic Invasive Species Interdiction Act; A.R.S. 17-255.02). Absent human intervention, the natural movement of infected fish appears to be a likely mechanism by which *M. cerebralis* is spread within rivers and watersheds (Zielinski, 2008).

### ***Risk of whirling disease spread through High-Flow Experiments***

Controlled floods, administratively called High-Flow Experiments (HFEs), appear to pose a minor risk of spreading whirling disease, particularly since there are several mechanisms that allow the disease to spread to downstream reaches in the absence of controlled floods. Triactinomyxons are neutrally buoyant (Gilbert and Granath, 2003) and are easily dispersed downstream in rivers and streams. In addition, TAMs have been shown to be viable for as long as 15 days at temperatures ranging from 7 to 15 °C (El-Matbouli and others, 1999). These findings are particularly relevant to the current situation in the Colorado River downstream from Glen Canyon Dam. Triactinomyxons released from infected worms in Glen Canyon clearly have the potential to infect fish throughout the length of Marble and Grand Canyons during normal dam operations given that water transport times are short (e.g., 4.5 d to travel 235 miles at 15,000 ft<sup>3</sup>/s; Graf, 1997) and water temperatures throughout Grand Canyon are usually between 7 and 15 °C (Voichick and Wright, 2007). This is why many agencies consider the length of the Colorado River between Glen Canyon Dam and Lake Mead to be infected by whirling disease.

Higher flows are thought to limit whirling disease (Hallet and Bartholomew 2008). In fact, flushing flows have been identified as a potential management tool for decreasing whirling disease infections (Elwell and others, 2009). Higher flows scour fine sediments and associated organic material from larger substrates and displace *T. tubifex* living there, thus reducing sources of TAMs that can infect fish, as well as limit suitable habitat for worm recolonization. A flushing flow with a peak approximately 6 times higher than base flows on the San Juan River in New Mexico temporarily reduced organic matter and *T. tubifex* densities in downstream deep water habitats, which may have decreased the prevalence and severity of whirling disease there (DuBey and Caldwell, 2004). The last controlled flood on the Colorado River in March 2008 resulted in a temporary decrease in the density of tubificid worms in Glen Canyon (Cross and others, 2011). Thus, future HFEs are likely to result in a decrease of whirling disease prevalence and severity in Glen Canyon.

Controlled floods on the Colorado River could facilitate the spread of whirling disease to downstream reaches by temporarily increasing *M. cerebralis* myxospore and TAM abundance in the water column, but an increase in infection risk due to these floods seems unlikely. Floods of the magnitude proposed result in short travel times through Grand Canyon (e.g., 2.4 d to travel 235 miles at 45,000 ft<sup>3</sup>/s; Graf, 1997) and Hallett and Bartholomew (2008) found higher flow rates resulted in lower *M. cerebralis* infection prevalence in both *T. tubifex* and rainbow trout, and reduced disease severity in rainbow trout. Another factor that makes it unlikely that future HFEs will facilitate the downstream spread of whirling disease, is that most rainbow trout in downstream reaches are relatively large (Yard and others, 2011). Fish are most susceptible to infection when they are young and small, thus the large rainbow trout that are common in Grand Canyon naturally have low susceptibility to whirling disease.

### ***Conclusions***

The implications of the presence of whirling disease in Glen Canyon for proposed management actions in the Colorado River vary by action. Live removal and relocation of trout from the Colorado River represents, by far, the greatest risk of spreading the disease. Relocation of trout from an infected population without any risk of fish escapement or spread of myxospores is virtually impossible. There is a low risk of spreading whirling disease as a consequence of conducting experimental floods. The disease is already present downstream from Glen Canyon Dam, and infected fish are already moving into Marble and Grand Canyons. It is likely that HFEs will result in a decrease in the prevalence and severity of the disease through reductions in the abundance of the intermediate host *T. tubifex* and its preferred habitat of fine sediment and organic matter.

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**Subject:** Pueblo of Zuni's Comments on the Non-Native Fish Control EA and the HFE Protocol EA  
**Date:** Saturday, March 19, 2011 1:02:02 PM  
**Attachments:** [PuebloofZuni\\_HFEProtocolEA\\_Comments.pdf](#)  
[PuebloofZuni\\_NNFCEA\\_Comments.pdf](#)

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Ladies and Gentlemen;

On behalf of the Zuni Governor Quetawki, Lt. Governor Zunie, Zuni Tribal Council Representatives Mr. Boone and Mr. Leekela, and Zuni AMWG Representative Mr. Kucate, I am pleased to provide you with the Pueblo of Zuni's comments on the public drafts of the Non-native fish control EA and the High-flow experimental release protocol EA.

Any questions should be directed to Mr. Kucate or me. Thank you.

Best regards,

Kurt Dongoske, RPA  
TWG representative  
Director/Tribal Historic Preservation Officer  
Zuni Heritage and Historic Preservation Office  
Pueblo of Zuni



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Officially known as the Zuni Tribe of the Zuni Indian Reservation

14 March 2011

Mr. Larry Walkoviak, Regional Director  
Upper Colorado Region  
Bureau of Reclamation  
125 South State Street, Room 6107  
Salt Lake City, Utah 84138-1147

RE: Pueblo of Zuni's Comments on the Public Draft of the Environmental Assessment for Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam, Arizona, 2011 through 2020.

Dear Mr. Walkoviak,

The Pueblo of Zuni has reviewed the public draft of the Environmental Assessment for Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam, Arizona, 2011 through 2020 and is pleased to provide you with the following comments. As I am sure you are aware, the Grand Canyon and Colorado River are extremely significant traditional cultural places on the landscape for the Zuni people. The Zuni people have maintained a long and continuous spiritual, cultural, and historical connection to the Grand Canyon and the Colorado River because it is the place of Zuni emergence, migrations, and continued visitation for enduring cultural and ceremonial purposes.

Due to the extremely important nature of the Grand Canyon and Colorado River to the Zuni people, the Pueblo of Zuni decided to enter into a memorandum of agreement with the Bureau of Reclamation to become a cooperating agency in the development of this environmental assessment. The intention of the Pueblo of Zuni in becoming a cooperating agency was to work with the Bureau of Reclamation and the other cooperating agencies in a spirit of true collaboration and cooperation in addressing many difficult environmental and cultural issues that have the potential for significant cultural ramifications to the Zuni people. Unfortunately, our experience as a cooperating agency in this process did not result in the type of collaborative environment that we envisioned. Rather, we experienced limited or little attention by the action agency to many of the cultural concerns that were raised by the Pueblo of Zuni during this environmental assessment process. Therefore, we are compelled to reiterate here many of the same previously expressed cultural concerns in commenting on this public draft. The following are the comments of the Pueblo of Zuni.

Page ix. Executive Summary - In the first paragraph of the executive summary it is claimed that beneficial environmental results from implementing high flow experiments are improved key wildlife habitats, protect archaeological sites, enhance riparian vegetation, and provide camping opportunities. This statement is not entirely accurate. It is the understanding of the Pueblo of Zuni that improved benefits to key wildlife habitats from past high flow experiments have not been scientifically demonstrated and continue to remain a on-going research hypothesis. Similarly, the role that high flow experiments have in "protecting" archaeological sites is unclear, remains a working research hypothesis, and most certainly is not a system-wide benefit. In fact, research associated with past high flow experiments have demonstrated that a very small set of archaeological sites located along the Colorado River corridor through Grand Canyon will benefit from a high flow experiment and these archaeological sites will only benefit when the sand deposited is in such a location where the prevailing winds can rework the sand by transporting it and re-depositing it on an archaeological site. How long that newly deposited sand stays on an archaeological site and whether or not it has a significant role in preserving that site continue to be unanswered research questions. Thus, it is inaccurate and misleading for the Bureau of Reclamation to characterize the protection of archaeological sites as a system wide benefit from implementing a protocol for high flow experiments.

Additionally, the same beneficial statement in the executive summary concerning archaeological sites from a high flow experiment is contradicted later in the document on page 97 (3.3.2.1 Historic Properties) which states that the proposed action will ". . . with the probability of two HFEs per year and HFEs occurring five or six years out of the next ten years, application of the criteria of adverse effect at 36CFR800.6 would result in an adverse effect determination." Twenty-nine historic properties and/or archaeological sites listed on the National Register of Historic Places or eligible for listing on the National Register are identified in Chapter 3 as receiving an adverse effect from implementing this protocol. It seems disingenuous then of the Bureau of Reclamation to claim that implementation of the protocols for high flow experimental releases from Glen Canyon Dam will have a beneficial effect on archaeological sites.

Page xii. – Impacts to cultural resources from implementing this protocol for high flow experimental releases over a ten year period is presented here as having an adverse effect to historic properties and to sacred sites for Native Americans. This section reinforces the claim made above that the document is contradictory in its assessment of the benefits of implementing this protocol. Additionally, the estimated range of lost revenue from power generation and the cost of replacement power from implementing this protocol is 5.99 to 12.51 million dollars. How this cost will ultimately be passed on to Colorado River Storage Project power customers is not considered or presented. The Pueblo of Zuni believes that it is important to understand how this loss in revenue and power generation will affect the day-to-day lives of power customers; especially those living in economically disadvantaged communities like Zuni because the effects of implementing these protocols may unnecessarily intensify the economic hardships experienced by these people for a ten year period.

Page 1, 1.0 Introduction; 1.1. Background, first paragraph- The benefits of implementing high flow experiment events in protecting archaeological sites is advanced again in this paragraph, but as stated above those benefits are still hypothetical, not well documented scientifically, and should not be

Page 3 – 14 March 2011

Letter to Mr. Walkoviak, Regional Director

RE: Pueblo of Zuni's Comments on the Protocol for High-Flow Experimental Releases Environmental Assessment

included here as a long-term benefit of implementing these protocols. In fact, this statement continues to contradict the analysis of implementing this proposed action on historic properties in Chapter 3.

Page 6, 1.2. Purpose and Need for Action, first paragraph – Here again the document falsely contends implementation of these protocols will benefit the protection of archaeological sites. What is the position of the Bureau of Reclamation on this issue? Will implementation of these protocols benefit archaeological site protection or will they be an adverse effect on historic properties? Please rectify this contradiction that permeates the entire document.

Page 7, 1.2. Purpose and Need for Action, second paragraph – Here the document acknowledges that one of the impacts of implementing this protocol is that repeated high flow experimental events can increase the numbers of rainbow trout in the Lees Ferry reach and may also cause greater downstream dispersal of rainbow trout into reaches of the Colorado River that are occupied by the Humpback Chub. Thus, implementation of this protocol may have effects that are in direct conflict with the efforts of the Bureau of Reclamation to control non-native fish in the Colorado River as defined in a sister environmental assessment. It seems odd that the Bureau of Reclamation would issue environmental assessments for two proposed actions that have environmental impacts that are in direct conflict with each other. Perhaps it would be useful to consider integrating these two environmental assessment into one environmental compliance document because the actions considered in this environmental assessment has a significant impact on the Non-native fish control environmental assessment.

Pages 9-10, 1.4.1.1. Bureau of Indian Affairs, last sentence- This statement that the". . . Bureau of Indian Affairs' Western Regional Office is committed to working hand-in-hand with interested tribes and other participating agencies to ensure that this fragile, unique, and traditionally important landscape is preserved and protected" is contrary to the experiences of the Pueblo of Zuni in dealing with this agency in the Glen Canyon Dam Adaptive Management Program.

Pages 27-28, 2.2.1. Overview of HFE Protocol, last bulleted item on Page 27- There is no mention here about notifying Native American traditional religious practitioners (or their affiliated tribal governments) who may be accessing culturally important places within the Grand Canyon that will be impacted (inundated) by health and safety threats as a result of a rapid response approach. Why was that not considered and addressed here?

Page 29, first full paragraph- Throughout this document the impacts of implementing these protocols over a ten year period are not adequately considering the direct, indirect, and cumulative effects to the reach from Glen Canyon Dam to Lees Ferry. The benefits of preserving sediment in the system downstream of the Paria appear to be the main focus of this assessment with little to no mention of how impacts to the Glen Canyon reach will be tracked and assessed. It appears that the Glen Canyon reach is the one reach that will not benefit from the long-term implementation of this protocol but rather will experience the biggest negative impacts for any high flow experimental event. The document needs to more equitably consider the long-term impacts of implementing this protocol on the Glen Canyon reach.



Page 34, Table 7 – Noticeably absent from Table 7 are historic properties, archaeological sites, traditional cultural properties, and places of importance to Native American Tribes among the list of important resources potentially effected by Beach Habitat Building Flows (BHBF). The Pueblo of Zuni contends that these are important resources that should have been considered by past BHBFs and need to be fully considered prior to implementing these proposed protocols.

Page 62, 3.2.4. Terrestrial Invertebrates and Herptofauna Under Proposed Action – The Pueblo of Zuni is very concerned about any loss of life to frogs, toads, lizards, and/or snakes from a high flow experiment release and the implementation of ten year program of annual multiple high flow experimental releases. The Bureau of Reclamation is aware of the expressed Zuni concerns with the taking of life in the Grand Canyon and the distinct familial relationship that the Zuni people have to all aquatic wildlife; especially those in the Colorado River through Grand Canyon. We are disappointed that the Bureau of Reclamation does not acknowledge this expressed relationship and concern of the Zuni people in this environmental assessment.

Page 63, 3.2.6. Aquatic Foodbase Under Proposed Action – High flow experimental events are expect to export large numbers of New Zealand mudsnails downstream thereby making available to fish more digestible items in the foodbase, but the document does not present what impacts to the downstream ecosystem will result from a increased amount of mudsnails. Please include an analysis of how increased New Zealand mudsails will impact the downstream ecosystem.

Page 65, last paragraph- The document does not provide the reader with an evaluation of how useful the comparison between the Grand Canyon, Colorado River ecosystem and the River Spöl ecosystem in Switzerland is in considering the effects of this high flow experimental protocol. Without this information making an evaluation of the comparability of these two ecosystems leaves the reader wondering if this comparison is similar to comparing apples to oranges and that the results of multiple floods in the River Spöl are not comparable to the Colorado River ecosystem. Please elaborate on the reliability of this comparison as a useful tool.

Page 68, 3.2.7.1. Humpback Chub, first full paragraph – The document could provide more information on the methods employed by the Fish and Wildlife Service in determining that 1,000 to 24,000 young of the year or juvenile Humpback chub would be lost to predation by trout with suspension of mechanical removal during a 13-month period. Not only is this estimated range extremely broad and rather dubious, but it is unclear whether it is extrapolated from existing trout population numbers or Humpback chub population numbers. Because there is no clarity presented in this document on how these numbers were calculated they leave that reader with the impression that this estimated range is very suspect.

Page 68, 3.2.7.1. Humpback Chub, second full paragraph – Isn't the common belief that displacement of young humpback chub from near shore habitats by high water velocity and their inability to effectively swim in the colder water released by Glen Canyon Dam being challenged by recent information obtained from the Near Shore Ecology project? This new information seems to suggest, based on otolith research, that the young of the year humpback chub frequently move between the LCR and the mainstem and perhaps the thermal factor is not as critical as previously considered.

Page 76, 3.2.8.1. Humpback Chub Under Proposed Action – The effect of conducting a high flow experiment in the spring of the year is a substantial increase in rainbow trout and their hypothesized increased impact on the Humpback chub populations through predation and competition. To mitigate this effect on Humpback chub, it appears that the Bureau of Reclamation is proposing to conduct mechanical removal of trout at the confluence of the Little Colorado and Colorado Rivers; a place that is very important to the Zuni people. It is unfortunate that the Bureau of Reclamation has chosen to omit from this environmental assessment a consideration of the serious concerns that the Zuni Tribe has expressed over the past year and a half regarding the “taking of life” (mechanical removal of trout) within the Grand Canyon. Moreover and more troubling, it appears as discourteous to the Zuni people that the Bureau of Reclamation would propose a high flow experimental release in the spring knowing that the consequences (increased rainbow trout numbers) would require the Bureau of Reclamation to implement a management action (mechanical removal of trout at the Little Colorado River confluence) that is objectionable to the Zuni people; especially since consultation over this very issue is on-going. In addition, the effects of repeated high flow experimental releases on Humpback chub populations or their habitat is clearly unknown. The document suggests that there are no positive effects to the Humpback chub populations, but does not acknowledge what negative effects may be occurring.

Page 89, 3.2.8.6. Fish Habitat –It is the understanding of the Pueblo of Zuni that depending on the time of year when the high flow experimental release is implemented it can have a serious negative effect on the aquatic food base in Glen Canyon which is significant to the health and prosperity of the rainbow trout fishery. The negative impacts to the food base and how that correspondingly impacts fish habitat, especially in Glen Canyon, is not well discussed or considered in this document.

Page 96, 3.3.1. Cultural Resources Under No Action - The Grand Canyon is a documented Zuni traditional cultural property considered eligible to the National Register of Historic Places by the Zuni Government. The Bureau of Reclamation was notified of this position through Zuni Tribal Council Resolution M70-2010-C086 on 27 September 2010, yet the document makes no mention of this fact. Additionally, traditional cultural properties of importance to Native American Tribes are not discussed at all in this section that considers cultural resources under no action.

Page 97, 3.3.2.1. Cultural Resources Under the Proposed Action – This section contradicts the earlier statements made that high flow experiment releases benefit archaeological sites. See comments regarding this issue above. This contradiction needs to be resolved.

Also the claims made in the fourth paragraph in this section are completely conjectural because the Bureau of Reclamation has not yet begun meaningful consultation with the Pueblo of Zuni or presumably any of the other participating tribes concerning the effects (direct, indirect, or cumulative) of implementing this protocol on those traditional cultural values that the Zuni people ascribe to the Grand Canyon and the Colorado River. Similarly, the Bureau of Reclamation has unilaterally determined that the effect of implementing this protocol will have an adverse effect on the Grand Canyon and Colorado River as traditional cultural properties, but at the time of writing these comments the Bureau of Reclamation has not initiated any discussions with the Pueblo of Zuni regarding the nature of those

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effects or ways to possibly mitigate effects to this traditional cultural property if they are determined to be adverse. It is also unlikely that the Bureau of Reclamation will have successfully negotiated a Memorandum of Agreement for resolving adverse effects to this traditional cultural property with the Pueblo of Zuni within the timeframe envisioned by the Department of the Interior. As a result, it is the position of the Pueblo of Zuni that the Bureau of Reclamation cannot reach a finding of no significant impacts (FONSI) for this proposed action until the resolution of adverse effects to this Zuni traditional cultural property are successfully negotiated through a Memorandum of Agreement in accordance with 36CFR 800. Please revise this section to reflect these facts.

Page 101, 3.4.2.1 Results of Hydropower Analysis – As stated above the Pueblo of Zuni is concerned about how the loss of power revenue and the resultant increased costs of replacement power purchase as a result of implementing these protocols will impact the individual power rate consumer especially in economically disadvantaged communities like the Pueblo of Zuni. The hydropower analysis does not follow the effect as it is passed on to individual power rate consumers who will inevitably have to bear the burden of the overall economic loss of implementing these protocols. The hydropower analysis should look analyze how the protocols will affect the individual power consumer and how this is absorbed by economically disadvantaged communities.

Page 117, Table 19, Sacred Sites -The impacts to sacred sites described in this table were unilaterally determined by Reclamation and are based presumably on what are anticipated to be physical effects from higher dam releases. This is an almost meaningless evaluation because the Bureau of Reclamation has yet to work with the Pueblo of Zuni, and the other participating tribes, regarding the identification of sacred sites within the area impacted by these proposed protocols. Additionally, these impacts do not reflect the perspective of the Pueblo of Zuni because Zuni has not been consulted on the effects.

Page 121, 3.6 Environmental Justice- The conclusion that disproportionately high and adverse costs to minority or low income groups are not expected from the high flow experiments, give that the principal months of a high-release are during low to moderate power demand and alternate sources of energy are available, as needed is questionable. The need to purchase replacement power from alternate sources of energy is a cost impact to hydropower generation that is passed on to the individual rate payer by their utility provider. The greater the percentage of total power to a utility provider that comes from electricity generated by Glen Canyon Dam or the CRSP power that serves disadvantaged economic communities the greater the financial impact on individual rate payers as a result of implementing these protocols. By averaging out the costs across all utility providers that receive power from Glen Canyon Dam the direct and real financial costs to individual members of economically disadvantaged communities are obviated from the analysis and considered insignificant. A greater in-depth analysis of the impact of implementing these protocols over a ten year period to hydropower generation and it subsequent financial impact to individual rate payers is needed and encouraged.

General Monitoring and Research Plan For High-Flow Experimental Potocol produced by the Grand Canyon Monitoring and Research Center – Conspicuously absent from the monitoring and research plan for the implementation of the high flow experimental protocol is a consideration and inclusion of monitoring and research activities implemented by the participating Native American Tribes to

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determine adverse effects or positive effects to sacred places and traditional cultural properties. The environmental assessment predicts negative impacts to Native American sacred places and traditional cultural properties but offers no method for monitoring and tracking these impacts as are provided for other resources. This disparity in the environmental assessment document and the monitoring and research plan is plainly conspicuous and needs to be remedied.

Thank you for the opportunity to comment on this environmental assessment. Should you have any questions or need additional information regarding any of the comments provided by the Pueblo of Zuni please don't hesitate to contact us to discuss these issues further. Thank you for consulting with the Pueblo of Zuni.

Sincerely,

A handwritten signature in black ink, appearing to read 'Arlen Quetawki', with a horizontal line extending to the right from the end of the signature.

Arlen Quetawki, Governor  
Pueblo of Zuni