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MEMORANDUM

To: Technical Work Group, Glen Canyon Adaptive Management Program

From: Jeffrey Lovich, Chief /s/

Subject: Response to Proposed Non-Native Fish Suppression Flow Changes for January-March 2004

The USGS, Grand Canyon Monitoring and Research Center (GCMRC) received a request from the Technical Work Group (TWG) of the Glen Canyon Dam Adaptive Management Work Group to review a proposal by the Western Area Power Administration (WAPA) to institute changes in Non-Native Fish Suppression Flows (NNFSF) for 2004. During January, February and March of 2003, NNFSF were conducted at Glen Canyon Dam (GCD). Flows of 5,000 cfs occurred for 8 hours during the night. Ramp-up occurred at 5,000 cfs/hour for three hours beginning at (hour ending) 8 AM. GCD ramped to 20,000 cfs and maintained this level for 9 consecutive hours (from hours ending 1100-1900). Then 6 hours of ramp-down occurred at 2,500 cfs/hour.

Proposed modification

The proposal (see ATTACHMENT) is to add two hours of 20,000 cfs so that there will be 11 hours of 20,000 cfs operations each day. Up- and down-ramping would be the same as 2003. These additional two hours of 20,000 cfs are likely to be on the "front end" (hours ending at 0900 and 1000), although a second option was to put one extra 20,000 cfs hour in the morning (hour ending 1000) with a second at night (hour ending 2000). Since additional water would be required to implement this proposal, Western suggests that Sundays fluctuate between 5,000 (1900-0700) and 8,000 cfs (0700-1900). Forgoing the regular NNFSF on Sunday would mostly make up for the additional water used if Western's proposal is implemented.

In addition to this basic modification there has been discussion of a possible "ramp-rate" experiment, which was explained at the TWG meeting. If the TWG wanted to add a sediment research component to the currently scheduled fish experiment, consideration could be given to this. The idea is:

(1) two weeks of 5 k cfs to 20 k cfs daily with ramp rates at 5,000 cfs up and 2,500 cfs down (same as last year);

(2) two weeks of 5 k cfs to 20 k cfs daily with ramp rates at 2,500 cfs up and 1,500 cfs down (ROD ramp rates);

(3) this would occur in January and then again in February;

(4) in March two weeks of ROD ramps rates would be followed by two weeks in which the ramp rates were higher still (e.g. a down-ramp rate of 3,500 cfs).

Response:

Our response addresses two areas: (1) potential impacts on resources of concern and (2) potential impacts on the integrity of scientific information collected by GCMRC or its contractors related to evaluation of the effectiveness of the experimental flows, as originally proposed. Our response is based on the best scientific data and tools that are available, recognizing the uncertainty inherent in a system as complex as the Grand Canyon ecosystem.

Resources of concern: sediment

We anticipate that the effects of WAPA's proposed flow modification on sediment resources would be an export of approximately 3% (with +/- 15% uncertainty) more sand per week than one week of currently scheduled flows. This means that based on uncertainties associated with our measurements, sand export under the proposed flows should be statistically indistinguishable from sand export under the existing flows.

Seven days of the ramping-rate experiment are predicted to export approximately 25% less sand than 7 days of the currently scheduled flows. This difference in export rates should be measurable with our existing techniques.

Resources of concern: non-native fish

The main intended impact of the NNFSF action is to disadvantage non-native fishes—particularly rainbow trout through disruption of spawning activities and reducing survival of young trout after they emerge from spawning gravels. We believe the proposed modification is likely to be as effective at reducing successful trout spawning, survival, and recruitment as the 2003-flow pattern. Studies in 2003 suggested that a primary mechanism for disrupting spawning success was the increase in temperature above lethal limits in dewatered spawning redds. While this would not be as likely to occur on a daily basis in 2004 under the proposed modification as

in 2003 (redds would not be dewatered as long), the low flows on Sundays should produce the same or an increased effect.

The other aspect of projects being conducted during these experimental flows is to understand impacts and possible mechanisms accounting for reduced survival of trout fry. Another part of this project was to determine the distribution (relative to flows, i.e., elevation) of spawning redds as well as timing of spawning activity. Preliminary data from 2003 suggest that a delay in spawning period occurred relative to previous years and that flows induced spawning at elevations which subsequently became dewatered. Another aspect of the change in flow relates to the stranding of Adult Rainbow Trout. If the flows do not go above 8000 cfs on Sunday, it is likely that there will be some stranding leading to adult mortality.

Potential impacts on the integrity of scientific information collected by GCMRC or its contractors

Despite the potentially limited impact of the proposed flows on sediment transport and non-native fish suppression efforts, the foregoing trout studies are mostly mechanistic in nature, i.e., trying to understand what is actually causing the reductions rather than just measuring whether recruitment of trout is reduced. It is unlikely that these mechanistic studies, if continued, would produce results directly comparable to 2003 nor would they result in reliable cause and effect relationships based on fluctuating flows. This is due to the possible subtle, but not well understood, kinds of influence the proposed changes could have on spawning and survival. This mechanistic understanding is not the key information resulting from these experiments—rather the key information is whether there is an ultimate change (reduction) in trout recruitment due to these flows. This information will be obtained from the core monitoring activities of the program conducted at Lees Ferry and downstream for GCMRC by the AZGFD. However, again the change in flows **may** compromise our ability to draw conclusions about the flows and their effectiveness at reducing recruitment of trout, as well as detecting unintended consequences of these flows. This possibility is related to the original experimental design of the experimental flows program and active adaptive management experimentation in general.

GCMRC's recommendations regarding experimental design called for a blocked design wherein flow and other experiments be repeated unchanged for two years to detect biological effects. This design is to reduce the likelihood that a change in a biological response observed in the year of a treatment was due to some completely different cause than the treatment. This would be a spurious correlation with the treatment and could lead to unwise inference and subsequent management decisions. Our inability to understand complex ecosystems and biological response makes the two-year block a prudent design. The proposed modification, although not a dramatic departure, could compromise this preferred study design. The TWG needs to be aware of this compromise and decide if the risks are acceptable.

Attachment: Proposal from WAPA

Hour Ending	Currently Scheduled	CRSP-MC Proposal #1; morning hours only	CRSP-MC Proposal #2: split hours	Sunday flows for both proposals	Ramp Rate Experiment
1	5000	5000	7500	5000	5000
2	5000	5000	5000	5000	5000
3	5000	5000	5000	5000	5000
4	5000	5000	5000	5000	5000
5	5000	5000	5000	5000	5000
6	5000	5000	5000	5000	7500
7	5000	10000	5000	5000	10000
8	5000	15000	10000	8000	12500
9	10000	20000	15000	8000	15000
10	15000	20000	20000	8000	17500
11	20000	20000	20000	8000	20000
12	20000	20000	20000	8000	20000
13	20000	20000	20000	8000	20000
14	20000	20000	20000	8000	20000
15	20000	20000	20000	8000	20000
16	20000	20000	20000	8000	18500
17	20000	20000	20000	8000	17000
18	20000	20000	20000	8000	15500
19	20000	20000	20000	8000	14000
20	17500	17500	20000	8000	12500
21	15000	15000	17500	5000	11000
22	12500	12500	15000	5000	9500
23	10000	10000	12500	5000	8000
24	7500	7500	10000	5000	6500
Acre ft / day	25,400	27,878	27,878	13,133	24,780
Acre ft / wk	177,797	180,398	180,398		161,813
Acre ft / mo					
JAN	787,385	805,226	805,226		721,594
FEB	736,586	734,727	734,727		660,387
MAR	787,385	805,226	805,226		721,594

	2004		
Month	JAN	FEB	MAR
Sundays	4	5	4
Weekdays	27	24	27
	Sundays	Weekdays	
JAN	4	27	
FEB	5	24	
MAR	4	27	