



IN REPLY REFER TO:

96-42040  
ADM-1.10

# United States Department of the Interior

## BUREAU OF RECLAMATION

Upper Colorado Regional Office  
125 South State Street, Room 6107  
Salt Lake City, Utah 84138-1147



JUN 23 2009

### MEMORANDUM

To: Secretary

From: Larry Walkoviak  
Acting Secretary's Designee   
Glen Canyon Dam Adaptive Management Work Group

Subject: Recommendation from the Glen Canyon Dam Adaptive Management Federal Advisory Committee

The Glen Canyon Dam Adaptive Management Program Work Group (AMWG) convened on April 29-30, 2009, in Phoenix, Arizona. As the Acting Secretary's Designee, I chaired the meeting, and in accordance with the Group's charter under the Federal Advisory Committee Act, the following recommendation is hereby submitted:

**AMWG recommends to the Secretary of the Interior to approve the Strategic Science Plan revisions dated April 2009, and the Monitoring and Research Plan amendment dated March 24, 2009.**

These documents are used by the Grand Canyon Monitoring Research Center and the Technical Work Group to formulate work plans and science plans for research and monitoring conducted under the Glen Canyon Dam Adaptive Management Program. They can be viewed at the following uniform resource locator: <http://www.usbr.gov/uc/rm/amp/amwg/mtgs/09apr29/index.html>

The motion passed by the following vote: Yes = 19; No = 2; Abstain = 0

The AMWG considered several other motions. Among the motions that did not pass were two by the Grand Canyon Trust and the Grand Canyon River Guides, respectively. The vote on the first motion, which addressed reporting requirements was 5 in favor, 11 against, and 5 abstained. The Grand Canyon Trust has elected to advance a minority report, as identified in the AMWG operating procedures, which contains their position on the motion. The second motion, which proposed a high flow experiment during fiscal year 2010-2011, received a vote of 8 in favor, 10 against, and 3 abstained. The Grand Canyon River Guides also have produced a minority report on their motion. Both motions are attached to this memorandum.

Please call me at 801-524-3600, if you wish to discuss further.

Attachments - 2

cc: Secretary's Surname

Acting Assistant Secretary – Water and Science  
Assistant Secretary – U.S. Fish and Wildlife Service  
Assistant Secretary – National Park Service  
Assistant Secretary – Bureau of Indian Affairs  
Commissioner, Bureau of Reclamation  
Director, U.S. Geological Survey  
Director, U.S. Fish and Wildlife Service  
Director, National Park Service

Chief, Grand Canyon Monitoring and Research Center, 2255 N. Gemini Drive, Flagstaff, AZ  
86001; Attn: Mr. John Hamill

The Mary Orton Company, LLC, 2254 Morning Mesa, Henderson, NV 89052-2627  
Attn: Ms. Mary Orton

AMWG Members and Alternates  
Technical Work Group Members and Alternates  
(via electronic mail)

# GRAND CANYON TRUST



May 20, 2009

Secretary Ken Salazar  
U.S. Department of the Interior  
1849 C Street, N.W.  
Washington, D.C. 20240

**RE: MINORITY REPORT – DOI AND AMWG REQUIREMENTS**

Dear Secretary Salazar:

The Grand Canyon Trust (GCT) is very concerned that you are not being provided with the information on the status of resources, trends, and recommended management actions that you need in order to comply with the Grand Canyon Protection Act (GCPA) and other laws and policies regarding the protection of park resources in Grand Canyon National Park.

Several reports—many of which are required on an annual basis—simply are not being completed. This lack of transparency inhibits the Adaptive Management process, and deprives you, Congress, and the American public of the information we all deserve regarding the health of this great national treasure.

Frustrated by a lack of progress on producing these critical information products, GCT forwarded a motion at the April 29, 2009 Adaptive Management Work Group (AMWG) meeting recommending that you direct the appropriate agencies to meet these reporting requirements. (The motion also recommends that the Department share with AMWG the General Services Administration's annual review of AMWG's effectiveness at meeting the requirements of the GCPA.) We were dismayed that numerous "stakeholders" voted against a motion to follow law and policy. However, we were not surprised at the vote—it highlights the supremacy of politics over science and law in the Adaptive Management Program.

Although GCT's motion failed, two Interior agencies did recognize the importance of satisfying relevant legal requirements and voted YES – the U.S. Fish & Wildlife Service

and National Park Service.<sup>1</sup> The GCT motion language reads:

**There are several duties and reporting requirements related to the Glen Canyon Dam Adaptive Management Program. These duties and reports include:**

1. **Operating Criteria for Glen Canyon Dam;**
2. **Periodic Review of the Operating Criteria;**
3. **Annual Report to Congress;**
4. **Annual Plan of Operations;**
5. **Annual Allocation of Costs report;**
6. **Annual review of resource status;**
7. **Annual review of program status;**
8. **Annual coordination between the AMP and the AOP;**
9. **Annual Comprehensive Review for a FACA committee.**

**The AMWG recommends to the Secretary of the Interior that he direct the relevant agencies in the Department of the Interior to complete items 1-8, with review and input by the AMWG, by the end of calendar year 2009. The AMWG further recommends that item 9, conducted by the General Services Administration, be shared with the AMWG.**

A consistent failure to meet the above legal and regulatory requirements has existed for some time. For example, the requirement to periodically (at least every five years) review the Glen Canyon Dam operating criteria has existed since 1997, but has never been done.

The Grand Canyon Protection Act (GCPA) also requires that an **annual** report to Congress be delivered by the Secretary of the Interior on the status of Grand Canyon resources and the measures being taken to protect, mitigate, and improve the resources. In March of 2008, GCT filed a similar motion during an AMWG meeting, and Dave Sabo (representing the Bureau of Reclamation) committed to getting a draft report written for the Secretary's consideration. It still has not happened. Important legal requirements were not met last year and continue to not be met this year.

Following is the text that we provided AMWG members that gives a sample of the references for the nine required actions listed in GCT's motion:

There are several duties and reporting requirements related to the Glen Canyon Dam Adaptive Management Program that are not being met, or not being shared with the Adaptive Management Work Group. Without these documents, the AMP cannot provide sound advice

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<sup>1</sup> Voting in favor of the motion were the National Park Service, U.S Fish and Wildlife Service, Grand Canyon River Guides, Grand Canyon Wildlands Council, and Grand Canyon Trust. Voting no were the seven basin states, Utah Associated Municipal Power Systems, Colorado River Energy Distributors Association, Bureau of Indian Affairs, and Federation of Fly Fishers. Abstaining were Bureau of Reclamation, Hopi Tribe, Hualapai Tribe, Paiute Tribe, and Western Area Power Administration.

to the Secretary of the Interior on how best to implement the Grand Canyon Protection Act. These duties and reports include (but may not be limited to):

1. Operating Criteria for Glen Canyon Dam;
2. Periodic Review of the Operating Criteria;
3. Annual Report to Congress;
4. Annual Plan of Operations;
5. Annual Allocation of Costs report;
6. Annual review of resource status;
7. Annual review of program status;
8. Annual coordination between the AMP and the AOP;
9. Annual Comprehensive Review for a FACA committee.

The duties and reporting requirements are described in part as follows:

1. Operating Criteria for Glen Canyon Dam
  - a. The 1997 Operating Criteria for Glen Canyon Dam (62 FR 9447-9448) states, "Pursuant to the Grand Canyon Protection Act of 1992, the Bureau of Reclamation (Reclamation) is required to prepare formal Operating Criteria and an Annual Plan of Operations...." And, "The Operating Criteria specify the requirements for an annual report of operations under the Grand Canyon Protection Act, a periodic review of Operating Criteria, and details regarding operational constraints." And, "These Operating Criteria are separate and apart from the Criteria for Coordinated Long-Range Operation of Colorado River Reservoirs prepared according to the Colorado River Basin Project Act of 1968."
  - b. GCPA Section 1804(c)(1)(A) states, "Adopt criteria and operating plans separate from and in addition to those specified in section 602(b) of the Colorado River Basin Project Act of 1968...."
  - c. GCPA Section 1804(c)(3) states, "In preparing the criteria and operating plans described in section 602(b) of the Colorado River Basin Project Act of 1968 and in this subsection, the Secretary shall consult with the Governors of the Colorado River Basin States and with the general public, including-(A) representatives of academic and scientific communities; (B) environmental organizations; (C) the recreation industry; and (D) contractors for the purpose of Federal power produced at Glen Canyon Dam."
2. Periodic Review of the Operating Criteria
  - a. The 1997 Operating Criteria states, "The Secretary of the Interior shall review these Operating Criteria as the result of actual operating experiences to determine if the Operating Criteria should be modified to better accomplish the purposes of the Grand Canyon Protection Act. Such a review shall be made at least every 5 years in consultation with the appropriate Federal agencies, Governors of the Colorado River Basin States, Indian Tribes, representative of academic and scientific communities, environmental organizations, the recreation industry and contractors for the purchase of Federal power produced at Glen Canyon Dam."
3. Annual Report to Congress
  - a. Section 1804(c)(2) of the GCPA states, "Each year ... the Secretary shall transmit to the Congress and to the Governors of the Colorado River Basin States a report, separate from and in addition to the report specified in section

- 602(b) of the Colorado River Basin Project Act of 1968 on the preceding year and the projected year operations undertaken pursuant to this Act.”
- b. Section 3(e) of the Charter states, “Review and provide input on the report identified in Section 1804(c)(2) of the Act to the Secretary, the Congress, and the Governors of the Colorado River Basin States. The report will include discussion of dam operations, the operation of the AMP, status of resources, and measures taken to protect, mitigate, and improve the resources defined in the Act.”
  - c. The 2002 AMWG Operating Procedures state, “The Annual Report (AR) required by the Grand Canyon Protection Act shall be reviewed by the AMWG. The State of the Natural and Cultural Resources in the Colorado River Ecosystem report developed by the Grand Canyon Monitoring and Research Center will be attached to the AR and shall contain information on the condition of the resources impacted by the operation of Glen Canyon Dam. The AR shall be concise, containing critical resource issues and recommendations to the Secretary on future dam operations.”
  - d. The 1997 Operating Criteria states, “Annual Report: As required in the Grand Canyon Protection Act, a report shall be prepared and submitted to Congress annually. This report will describe the operation of Glen Canyon Dam for the preceding water year and the expected operation for the upcoming water year.
  - e. The House Report on the GCPA states, "Section [1804 (c)(2)] requires the Secretary to prepare an annual report to Congress regarding the operation of Glen Canyon Dam during the preceding year and the anticipated operations over the next year with respect to the requirements of this title. The annual report by the Secretary should reflect the results of the ongoing monitoring and studies required under section [1805]. As more information is developed, the Secretary will be able to decide on an annual basis whether dam operations at Glen Canyon should be further adjusted to carry out the purposes of this title more effectively."
  - f. At the March 2008 AMWG meeting, Reclamation made a commitment to produce the Annual Report to Congress for 2003-2007. The minutes state, “After much discussion and the fact that the report is in draft along with Reclamation’s commitment to provide the report [] annually and in a timely manner for the AMWG’s review, Mr. Lash withdrew his motion.”
4. Annual Plan of Operations
- a. The 1997 Operating Criteria states, “Pursuant to the Grand Canyon Protection Act of 1992, the Bureau of Reclamation (Reclamation) is required to prepare ... an Annual Plan of Operations....”
  - b. The 1997 Annual Plan of Operations states, “This plan is prepared in conformance with section 1804(c)(1)(A) of the Grand Canyon Protection Act. Any changes to the plan would require reconsultation in accordance with this Act.”
  - c. GCPA Section 1804(c)(1)(A) states, “Adopt criteria and operating plans separate from and in addition to those specified in section 602(b) of the Colorado River Basin Project Act of 1968....”
  - d. GCPA Section 1804(c)(3) states, “In preparing the criteria and operating plans described in ... this subsection, the Secretary shall consult with the Governors of the Colorado River Basin States and with the general public, including-(A) representatives of academic and scientific communities; (B)

- environmental organizations; (C) the recreation industry; and (D) contractors for the purpose of Federal power produced at Glen Canyon Dam.”
5. Annual Allocation of Costs report to Congress
    - a. Section 1804(e) of the GCPA states, “The Secretary shall determine the effect of all the provisions of this Act and submit a report to the appropriate House and Senate committees by January 31 of each fiscal year, and such report shall contain for that fiscal year a detailed accounting of expenditures incurred pursuant to this Act, offsetting receipts generated by this Act, and any increase or reduction in net offsetting receipts generated by this Act.”
  6. Annual review of resource status
    - a. Section 3(f) of the AMWG Charter states, “Annually review long-term monitoring data to determine the status of resources and whether the AMP Strategic Plan goals and objectives are being met. If necessary, develop recommendations for modifying the GCDEIS ROD, associated operating criteria, and other resource management actions pursuant to the Grand Canyon Protection Act.”
  7. Annual review of program status
    - a. Section 3(h) of the AMWG Charter states, “Monitor and report on all program activities undertaken to comply with applicable laws, permitting requirements, and the Act.”
  8. Annual coordination between the AMP and the AOP
    - a. Section 3(g) of the Charter states that one of the functions of the AMWG is to, “[F]acilitate input and coordination of information from stakeholders to the Secretary to assist in meeting consultation requirements under Section 1804(c)(3) ...”
    - b. The section on the Adaptive Management Work Group in the 1995 EIS (incorporated by reference in the 1996 ROD) states that the AMWG would, “Ensure coordination of operating criteria changes into the Annual Operating Plan for Colorado River Reservoirs and other ongoing activities.”
    - c. The minutes of the 10 September 1997 AMWG meeting includes discussion and a flowchart of the relationship between the AMP and the AOP.
  9. Annual Comprehensive Review for a FACA committee
    - a. Section 7 of the Federal Advisory Committee Act states, “The Administrator shall, immediately after October 6, 1972, institute a comprehensive review of the activities and responsibilities of each advisory committee to determine-- (1) whether such committee is carrying out its purpose; (2) whether, consistent with the provisions of applicable statutes, the responsibilities assigned to it should be revised; (3) whether it should be merged with other advisory committees; or (4) whether it should be abolished. The Administrator may from time to time request such information as he deems necessary to carry out his functions under this subsection. Upon the completion of the Administrator's review he shall make recommendations to the President and to either the agency head or the Congress with respect to action he believes should be taken. Thereafter, the Administrator shall carry out a similar review annually. Agency heads shall cooperate with the Administrator in making the reviews required by this subsection.”

By most standards, the Adaptive Management Work Group is a failure. The AMWG is operating at a level far below the vision articulated in the Grand Canyon Protection Act and the AMWG Charter. Water and power politics continue to dominate processes

within the program, preventing you from receiving recommendations consistent with the GCPA. This ongoing obstruction of positive process within the AMWG denies the American public the spectacular and healthy Grand Canyon National Park envisioned by Congress when it passed the GCPA.

The Grand Canyon Trust believes that AMWG reform is necessary and timely. We look forward to working with you to improve AMWG functioning so that you can receive recommendations from this important FACA committee that actually help improve park resources in Grand Canyon.

Thank you, Secretary Salazar, for your consideration of this Minority Report.

Sincerely,

Nikolai Lash  
AMWG member  
Grand Canyon Trust  
2601 N. Fort Valley Rd.  
Flagstaff, AZ 86001  
nikolailash.lash@gmail.com  
928-266-5606

Rick Johnson  
AMWG alternative  
Grand Canyon Trust

cc: Acting Assistant Secretary, Fish and Wildlife & Parks  
Acting Assistant Secretary, Bureau of Indian Affairs  
Commissioner, Bureau of Reclamation  
Director, National Park Service  
Director, Fish and Wildlife Service  
Deputy Director, U.S. Geological Survey

Chief, Grand Canyon Monitoring and Research Center, 2255 N. Gemini Drive,  
Flagstaff AZ 86001  
Attention: Mr. John Hamill

The Mary Orton Company, LLC, 2254 Morning Mesa, Henderson, NV 89052-2627  
Attention: Ms. Mary Orton

AMWG and TWG Members and Alternates  
(via electronic mail)



PO Box 1934  
Flagstaff, AZ 86002  
(928) 773-1075 phone  
(928) 773-8523 fax  
[gcrg@infomagic.net](mailto:gcrg@infomagic.net)  
[www.gcrg.org](http://www.gcrg.org)

## Memorandum

Date: June 10, 2009  
To: Interior Secretary Ken Salazar  
CC: Larry Walkoviak, Alternate for Secretary's Designee, GCDAMP  
From: Grand Canyon River Guides, Inc.  
Re: Minority Report - BHBF

Dear Mr. Secretary,

As you know, the Glen Canyon Dam Adaptive Management Work Group (AMWG) was established in 1997 as a Federal Advisory Committee to the Secretary of the Interior for the purpose of providing stakeholder input regarding the impact of dam operations on the river ecosystem in Grand Canyon National Park. The intent of this memo is to provide you with a 'minority report' on a motion recently voted on by the AMWG, April 29-30, 2009. We wish to provide you a perspective that may not be otherwise apparent from a simple up-down vote of the AMWG.

Grand Canyon River Guides would appreciate your consideration of the following motion, as amended at the April 29<sup>th</sup> AMWG meeting, which reads as follows:

*AMWG recommends to the Secretary of the Interior that during FY10-11 a high flow experiment be conducted if and when sediment-enriched conditions are reached, as described in U.S. Geological Survey, 2006 (USGS, 2006, Assessment of the Estimated Effects of Four Experimental Options on Resources Below Glen Canyon Dam Draft Report dated October 27, 2006), contingent upon satisfying language in section 1.4.2, requiring data analysis and reports in the "Biological Assessment on the Operation of Glen Canyon Dam and Proposed Experimental Flows for the Colorado River Below Glen Canyon Dam During the Years 2008 through 2012."*

*(Note: Please refer to the attached AMWG agenda item sheet for relevant science and background information)*

The motion required a two-thirds majority to pass, but was blocked by a coalition of hydropower and basin states offering little discussion.

*Eight stakeholders voted in favor of this motion, including:*

**Bureau of Indian Affairs**  
**Grand Canyon River Guides**  
**Grand Canyon National Park**  
**Grand Canyon Trust**  
**Grand Canyon Wildlands Council**  
**Hopi Tribe**  
**Hualapai Tribe**  
**Southern Paiute Consortium**

*Abstentions included:*

Bureau of Reclamation  
 Federation of Fly Fishers  
 US Fish and Wildlife Service

This AMWG motion would not affect water distribution between the states. Hydropower revenues may be slightly affected, and although important, are ancillary to the purpose of the dam.

As you may know, sediment conservation and maintenance of sand bar habitats are primary goals of the Glen Canyon Dam Adaptive Management Program for multiple resource needs. Periodic artificial ‘floods’ serve to rebuild sand bars and beaches and may yet prove to achieve this important goal for the river ecosystem in Grand Canyon National Park.

The purpose of this motion was to engage various agencies in the necessary preparatory activities to best serve the purposes of Congress under the Grand Canyon Protection Act of 1992, the stated goals of the Adaptive Management Program, and the best available scientific advice and recommendations brought forward by the Grand Canyon Monitoring and Research Center. These advance activities include:

- Preparation by the Grand Canyon Monitoring and Research Center (USGS) of a Science Plan for the next optimal high flow experimental release from the dam to meet objectives of the GCDAMP.
- Preparation by the Bureau of Reclamation to complete necessary Environmental Compliance for such a release.
- Preparation by the AMWG to set aside necessary funds from the FY10-11 budget in order to ensure adequate completion of a high flow release.

We hope you will agree that this motion is scientifically reasonable, administratively necessary, and a logical next step to improve ‘adaptability’ allowing for a more nimble response to changing ecosystem conditions and needs.

As the GCDAMP stakeholder representing recreational river running interests, and based on our first-hand knowledge of the Colorado River, we still believe that our motion is grounded in the pressing need to better conserve and protect multiple resources in Grand Canyon. We offer you this memo as a point of reference for your decision on how best to satisfy the will of Congress and the American people. We hope you decide for the Grand Canyon ecosystem and the preservation of its natural and cultural heritage for future generations.

Thank you for your attention to this matter and we look forward to hearing your response.

Sincerely,  
Andre Potochnik, Ph.D.  
Grand Canyon River Guides, Inc.

**Glen Canyon Dam Adaptive Management Work Group**  
**Budget Agenda Item**  
**8:05 am, April 30, 2009**

Additional Information, Grand Canyon River Guides Motion #1:  
 Prepare for a possible high flow experiment in FY10-11

*Note: The proposed motion language has been slightly amended from what was sent out  
 in the original AMWG agenda and packet.*

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Action Requested

√ **Motion requested.** The following motion is proposed by Grand Canyon River Guides. More information on this motion is included under "Background Information," below.

AMWG recommends to the Secretary of the Interior that during FY10-11 a high flow experiment be conducted if and when sediment-enriched conditions are reached, as described in U.S. Geological Survey, 2006.

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Presenter

Andre Potochnik, Grand Canyon River Guides

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Previous Action Taken

√ By TWG:  
 At its early 2009 meeting, discussion with GCMRC on budgeting for the next experimental flow.

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Relevant Science

<sup>1</sup> Grand Canyon Monitoring and Research Center, 2006, Protocols Evaluation Program (PEP-Seds III), Final report of the physical resources monitoring peer review panel October 6, 2006  
 U.S. Geological Survey Field Center, Flagstaff, AZ.

<sup>2</sup> Lovich, S. and T.S. Melis, 2007, The state of the Colorado River ecosystem in Grand Canyon: Lessons from 10 years of adaptive ecosystem management. Intl. J. River Basin Management; v.5:3, pp. 207-221.

<sup>3</sup> Schmidt, J.C., D.J. Topping, P.E. Grams, and J.E. Hazel, 2004, System-wide changes in the distribution of fine sediment in the Colorado River corridor between Glen Canyon Dam and Bright Angel Creek, Arizona. Final Report to Grand Canyon Monitoring and Research Center, Co-operative agreement 1425-98-FC-40-22640, 117 p.

<sup>4</sup> United States Geological Survey, 2006, Assessment of the Estimated Effects of Four Experimental Options on Resources Below Glen Canyon Dam Draft Report dated Oct. 27, 2006; Attachment 10a, p. 5-6 at the following link:  
<http://www.usbr.gov/uc/rm/amp/twg/mtgs/06nov08/index.html>

<sup>5</sup> Wright, S.A., J.C. Schmidt, T.S. Melis, D.J. Topping, and D.M. Rubin, 2008, Is there enough sand? Evaluating the fate of Grand Canyon sandbars. GSA Today, v.18:8, pp. 4–10.

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### Background Information

For motion #1: Preparation for a next potential high flow experiment in WY 10-11.

The AMWG and the science community recognize the critical importance of sand bars as an essential ecosystem component for many natural resources, including, near shore habitat for native fishes, availability of nutrients for the aquatic food base, camping beaches for recreational users, and reducing the erosion of archeological sites. It has been shown that high releases from the dam can rebuild sandbars most effectively when conducted under sediment-enriched conditions <sup>5</sup>. Although much has been learned from previous experiments, we still do not know the optimal preconditions to conduct a future high flow experiment, nor do we know the best hydrograph for bar building, nor do we know the optimal flows for conserving the new sand bars once they are built.

A large influx of tributary sediment below the dam will certainly occur in the future <sup>3</sup>. Decisions will be made on whether to run a high flow experiment. It is far more cost-effective to complete all necessary activities prior to an anticipated high flow experiment <sup>2</sup>. The AMP should prepare in advance for the following activities; GCMRC science planning, AMP budgeting, NEPA compliance, and NPS permits. Following the next occurrence of sediment enriched conditions, a high flow experiment can be conducted efficiently to test and refine our knowledge in furtherance of AMP ecosystem goals. The TWG in consultation with GCMRC can provide additional refinements to the next high flow experiment that would advance our understanding of this important tool <sup>2</sup>.

Below is supporting language excerpted from two important GCMRC reports.

Strategic Science Questions developed cooperatively by scientists and managers as a result of the Knowledge Assessment Workshops in 2005.

#### “4.1 Physical Resources

4.1.1 Is there a “Flow-Only” (non sediment augmentation) operation that will restore and maintain sandbar habitats over decadal time scales?

4.1.2 Is there an optimal strategy for BHBF implementation to manage tributary inputs on an annual to inter-annual time scale?

4.1.3 What are the short-term responses of sandbars to BHBFs?

4.1.4 What is the rate of change in eddy storage (erosion) during time intervals between BHBFs?

4.1.5 How does the grain-size distribution of the deposits affect sandbar stability? Main channel turbidity?

- 4.1.6 What are the effects of ramping rates on sediment transport and sandbar stability?  
4.1.7 Can we develop a relationship between suspended sediment concentration and turbidity to support fisheries research?"

Grand Canyon Monitoring and Research Center, 2006, Protocols Evaluation Program (PEP-Seds III)

"The panel stresses the need for more experimental releases in order to assess the adequacy of any model that program scientists use to predict changes in bar distribution and size. Continued experimental flows are critical to resolving the complex uncertainties of bar dynamics in terms of how variations in flow magnitude, duration, and timing influence sand transport and storage. The lack of experimental flows constrains the ability of scientists and managers to learn and predict because experimental flows are not solely research tools, but also function as monitoring and management tools that reflect the outcome of alternative strategies of dam management. Monitoring of system responses to experimental flows will allow identification of flexibility within the river ecosystem with respect to parameters such as ramping rates and daily fluctuations. Experimental flows may provide a better, faster, and cheaper alternative than using a sediment pipeline to restore declining sand bars within the Colorado River ecosystem. Because scientists studying this ecosystem are not yet able to specify the characteristics of experimental floods necessary to preserve or restore sand bars, experimental flows remain critical to monitoring how the system responds to high flows. The crux of adaptive management is to experiment, monitor, design management, and experiment again until the desired state is achieved and, in the Colorado River ecosystem, this process requires experimental flow releases."