

# Frequently Asked Questions

Prepared cooperatively by Bureau of Reclamation, National Park Service, U.S. Fish and Wildlife Service, and U.S. Geological Survey

## What is a high-flow experiment?

A high-flow experiment is a release of water from Glen Canyon Dam intended to rebuild high-elevation sandbars, deposit nutrients, and restore backwater channels. For 2008, it is proposed that approximately 41,000 cubic feet per second (cfs) of water be released from Glen Canyon Dam for 60 hours.

## What are the anticipated benefits of a high-flow experiment?

Higher than normal flows are required to deposit sand up and onto eroded Grand Canyon sandbars, which serve as camping beaches for river runners and hikers, provide sediment needed to protect archaeological resources from erosion and weathering, and create habitats used by native fishes, particularly the endangered humpback chub (*Gila cypha*) and other wildlife. The experimental studies associated with the proposed 2008 high-flow experiment are designed to build upon existing scientific knowledge to inform managers about the efficacy of using high flows from the dam to improve a range of resources, including not only sandbars and humpback chub habitat, but also rainbow trout (*Oncorhynchus mykiss*), the aquatic food base, riparian vegetation, archaeological sites, and water quality.

## What is adaptive management?

Adaptive management is generally understood to be a systematic process for continually improving management practices over time by emphasizing learning through experimentation. Adaptive management also incorporates collaboration among stakeholders, managers, and scientists who are knowledgeable about the system being evaluated. The comprehensive, iterative, and collaborative nature of an adaptive management approach is why it was implemented as part of the long-term management strategy for refining operations of Glen Canyon Dam to improve downstream resources.

The Glen Canyon Dam Adaptive Management Program (GCDAMP) was officially established in 1997, under the direction of the Secretary of the Interior, in compliance with the Grand Canyon Protection Act of 1992 (Public Law 102-575), and the 1996 Record of Decision. The GCDAMP

includes the Adaptive Management Work Group, a Federal Advisory Committee that makes recommendations to the Secretary of the Interior on the operation of Glen Canyon Dam and other related management actions. The Secretary appoints the group's 25 members, who include representatives from Federal and State resource management agencies, the seven Colorado River Basin States, Native American tribes, environmental groups, recreation interests, and contractors of Federal power from Glen Canyon Dam.

## **Why was the high-flow experiment proposed?**

The Colorado River ecosystem is currently enriched with sediment as a result of repeated floods from the Paria River—a tributary that enters the Colorado River below the dam—that delivered 2,500,000 metric tons ( $\pm 500,000$  metric tons) of sediment (the largest series of inputs in 10 years). Given the large amount of sand in the system, a high-flow experiment presents a tremendous opportunity to learn more about whether high flows can be used to improve important natural, cultural, and recreational resources in Glen and Grand Canyons. Additionally, high flows that occur when sand supply is abundant in the channel are known to form backwater habitats, or areas of stagnant or low-velocity flows, where young native fish, including the endangered humpback chub, have been found.

## **Why was the high-flow experiment proposed for March 2008?**

March 2008 was proposed for a high-flow experiment because: (1) March is before the flowering of the nonnative tamarisk (*Tamarix ramosissima*), and so would reduce the potential for increasing its distribution; (2) this timing is expected to have moderate to low impact on the production of algae and diatoms between the dam and Lees Ferry and, as a result, should not limit the availability of these food sources for the rainbow trout fishery and native fishes; and (3) a March high-flow release will maximize the potential for newly created sandbars to contribute additional sand to nearby archaeological sites.

## **Will the high-flow experiment have environmental effects such as impacts to endangered species?**

Elevated flows were a part of ecosystem conditions that humpback chub (*Gila cypha*) and razorback sucker (*Xyrauchen texanus*) are adapted to in the Grand Canyon area. With these flows being proposed near the May–June predam elevated flow peak from passage of upper basin snow pack flows, the U.S. Fish and Wildlife Service anticipates that a possible high-flow experiment will not detrimentally impact the species.

The southwestern willow flycatcher (*Empidonax traillii extimus*) uses willow and saltcedar or tamarix stands within the riparian corridor. These flows may improve riparian resources in Grand Canyon by improving marsh vegetation and riparian shrubs and dependent flying-insect food chain components needed for continued maintenance of flycatchers.

The flows are not expected to have long-term detrimental impacts on Kanab ambersnail (*Oxyloma haydeni kanabensis*). The Arizona Game and Fish Department and USGS Grand Canyon

Monitoring and Research Center would remove—before the proposed experiment—Kanab ambersnail habitat that would be impacted and replace it after the high-flow test, much the same way grass sod is removed and replanted. This measure would be taken if a high flow were to occur in order to conserve snails and their habitat and reduce impacts from the high-flow test. This process would follow the same general procedure that was successful during the 2004 flow test.

## **How will those environmental effects of a high-flow experiment be evaluated?**

As part of compliance with Endangered Species Act, the Bureau of Reclamation (Reclamation) has prepared and transmitted to the U.S. Fish and Wildlife Service (USFWS) a biological assessment on the proposed test that evaluates the impact of the test on listed species. In response, the USFWS is preparing a biological opinion, expected to be complete by late-February. In compliance with National Environmental Policy Act, Reclamation is in the process of preparing an environmental assessment of the proposed test, expected to be available to the public in early February. This assessment evaluates the impact of the test on a wide range of environmental and socioeconomic resources. A decision by the Department of the Interior is anticipated in late February 2008, with plans to conduct the high flow in early March 2008, if a decision is made to move forward with the proposed experiment.

## **What is the role of various Department of the Interior agencies for a high-flow experiment?**

**Bureau of Reclamation:** The Bureau of Reclamation (Reclamation) operates Glen Canyon Dam. The Glen Canyon Dam Adaptive Management Program, which was implemented as a result of the 1996 Record of Decision on the Operation of Glen Canyon Dam Final Environmental Impact Statement, is managed by Reclamation and largely through hydropower revenues, annually funds nearly \$10 million of adaptive management research, monitoring, and resource protection activities in Glen and Grand Canyons.

Together with the membership of the Adaptive Management Work Group (AMWG), Reclamation helps to identify operational experiments for Glen Canyon Dam that enhance learning and protection of the downstream ecosystem and resources to meet the provisions of the Grand Canyon Protection Act and the laws that comprise the Law of the River. Reclamation serves as a lead participant and committee meeting facilitator of both the Adaptive Management Work Group and the Technical Work Group.

The Adaptive Management Work Group is a Federal Advisory Committee to the Secretary of the Interior with representatives from Federal and State agencies, Colorado River Basin States, Native American tribal governments, environmental groups, recreation interests, and contractors for Federal power from Glen Canyon Dam. Reclamation works with the AMWG through a Secretary's Designee to receive recommendations from these varied stakeholder interests and provide recommendations on how to best balance protection of downstream resources and river operations to deliver water and produce hydropower.

**National Park Service:** Through the 1916 National Park Service (NPS) Organic Act and the 2006 NPS management policies, the NPS manages, protects, and preserves the natural, cultural, and recreational resources along the Colorado River downstream of Glen Canyon Dam within Grand Canyon National Park and Glen Canyon National Recreation Area (including those affected by dam operations).

**U.S. Fish and Wildlife Service:** The U.S. Fish and Wildlife Service (USFWS), through their Arizona National Fish and Wildlife Conservation Office, is working with the U.S. Geological Survey's (USGS) Grand Canyon Research and Monitoring Center to conduct research on humpback chub and other native fish in the Grand Canyon as part of the proposed high-flow experiment. These studies will include measuring backwater function and structure, and examining native and nonnative fish densities to establish a baseline prior to the experiment. This office will be available to assist with any related studies per requests from the USGS, Bureau of Reclamation, or National Park Service. The USFWS Arizona Ecological Services Office is preparing a biological opinion in response to receipt of a December 2007 biological assessment from the Bureau of Reclamation. The biological opinion would provide Endangered Species Act compliance for the Bureau of Reclamation's proposed action, which includes both the 2008 high-flow experiment and 5 years of experimental Glen Canyon Dam operations.

**U.S. Geological Survey:** The U.S. Geological Survey's (USGS) Grand Canyon Monitoring and Research Center has responsibility for scientific monitoring and research efforts for the Glen Canyon Dam Adaptive Management Program (see below), including the design and implementation of the scientific efforts associated with the proposed high-flow experiment. The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

## **What can Grand Canyon National Park recreational users expect along the river during the high flow experiment?**

Since 1996, releases from Glen Canyon Dam have averaged from 8,000 to 20,000 cubic feet per second (cfs). The increase to approximately 41,000 cfs will change conditions on the river during the duration of the high-flow event proposed for early March 2008. For example, research has shown that some normally difficult rapids decrease in their technical difficulty, whereas other normally straightforward rapids become more technically challenging. At the same time, the volume of water at approximately 41,000 cfs will change the size and availability of campsites and these changes will occur at different times as the volume increases and moves downstream.

**Beginning in 2007, the National Park Service (NPS) implemented a new Colorado River Management Plan that includes a 6.5 month no-motors period from September 15 to April 1. Will the NPS allow motorized science or other administrative trips during the proposed high-flow experiment?**

The National Park Service is in the process of reviewing and analyzing the science river trips during the proposed high-flow experiment. The process includes a “minimum tool analysis” of trips. Some of the science trips being conducted during this period are ongoing projects and have been analyzed through this process and approved as motorized trips. The equipment used for the sediment studies as well as biological work often requires the use of motorized rafts. The NPS will provide specific information on the trips as it becomes available.

**What other actions will Grand Canyon National Park take during the high flow?**

Grand Canyon river and backcountry permit holders affected by the higher flows will be contacted in February and informed as to the potential conditions they can expect during their visit. Staff in the river permits office will be available to answer additional permit questions during the high-flow event and National Park Service patrol rangers will concentrate on high-use areas coinciding with peak flows.

Grand Canyon National Park will have a series of environmental studies taking place following the high-flow event, which include the following assessments: availability of habitat for a variety of wildlife, changes in campsite availability and associated visitor experience, undesired potential for recruitment of invasive plant species, and assisting various American Indian tribes in monitoring culturally significant resources.

**Does the proposed high-flow experiment pose a risk to public safety?**

It could, as there are inherent risks associated with recreational activities along the Colorado River corridor through Grand Canyon. Since 1996, releases from Glen Canyon Dam have averaged from 8,000 to 20,000 cubic feet per second (cfs). The increase to 41,000 cfs will change conditions on the river during the duration of the high-flow event. For example, research has shown that some normally difficult rapids decrease in their technical difficulty, whereas other normally straightforward rapids become more technically challenging. At the same time, the volume of water at 41,000 cfs during the proposed experiment on March 4–10 will change the size and availability of campsites and these changes will occur at different times as the volume increases and moves downstream. All campsites along the river will be affected to varying degrees.

It is suggested that all river and backcountry users check the USGS Grand Canyon Monitoring and Research Center's Web site at [www.gcmrc.gov](http://www.gcmrc.gov) or call Grand Canyon National Park's River Permits Office at 1-800-959-9164 before starting their river or backcountry trip and to be prepared for variable conditions including higher river flows.

## **How will the high-flow experiment affect camping beaches?**

The high-flow experiment will affect all camping beaches along the Colorado River; the flow will change the size and availability of campsites throughout the river corridor at different times as the volume increases and then decreases as the flow moves downstream. Information on inundation times and photographs of a sample of the camping beaches can be found at the USGS Grand Canyon Monitoring and Research Center's Web site at [www.gcmrc.gov](http://www.gcmrc.gov) or Grand Canyon National Park's River Permits Office at 1-800-959-9164. It is suggested that all river and backcountry users check the Web site or speak with Grand Canyon National Park Permits office personnel before starting their river or backcountry trip and be prepared for variable conditions including higher river flows.

## **How could the experiment affect the Lees Ferry fishery?**

Trout fishery users and businesses and local communities have expressed concerns that the high-flow experiment could have financial and economic consequences due to public perceptions associated with the test. These perceptions are associated primarily with potential impacts on the trout population, aquatic food base, and fishing success.

These concerns were also expressed during the 1996 and 2004 experiments. The 1996 experiment also occurred in March and did not adversely impact the rainbow trout population in the Lees Ferry reach. Rainbow trout catch rates (a measure of abundance) and relative condition (a measure of "plumpness") immediately before the 1996 test were similar to those observed immediately after the test. Additionally, seasonal trends in catch rates and condition observed in the months following the test—August and November—were comparable to seasonal trends in the years preceding the test; direct effects to adult trout, if any, are thus expected to be for a short duration of time.

The March 1996 test had an adverse impact on some aspects of the aquatic food base that the trout rely upon, but the effect was transitory and the food base recovered during the growing season that immediately followed the test (April–October). A possible March 2008 test may actually have a positive impact on the aquatic food base and the fishery in Lees Ferry, if it reduces the density of undesirable invertebrates (such as New Zealand mudsnails) and removes senescent (aging) and dead algae stimulating new growth.

Concerns exist that once the experiment occurs, fewer trout would be available to support fishing or that they would be in poor condition; however, the U.S. Geological Survey (USGS) indicates that past monitoring does not suggest this conclusion. The USGS will be monitoring during this experiment to further analyze these concerns.

## **How will visitor services at Glen Canyon National Recreation Area (Lake Powell) be affected by the high-flow test?**

The level of Lake Powell is expected to drop by a very small amount, approximately 2.6 feet over the course of a week, if the test releases are made. There should be no significant disruptions to boaters or visitor services on Lake Powell as a result of the proposed test flow. Colorado River Discovery is a concessioner authorized to operate guided float trips for visitors on the Colorado River between the Glen Canyon Dam and Lees Ferry. These float trips will not occur around the time of the test flow.

The water released during the proposed experiment would not change the amount of water to be released from Glen Canyon Dam during 2008. The current plan of operations calls for releasing 8.23 million acre-feet of water that is sent down river and captured in Lake Mead for use by the Lower Colorado River Basin States and Mexico. The high-flow experiment will be factored into that annual volume. Flows later in the year would be adjusted downward to factor in the additional water released during the proposed March 4–10, 2008, test.

## **Given the drought, will a high-flow experiment result in a loss of water?**

No, the experiment will not change the amount of water that would be sent down the Colorado River from Glen Canyon Dam and captured in Lake Mead over the next year. During the period from October 1, 2007, to September 30, 2008, (known as the “water year”) 8.23 million acre-feet is scheduled to be released from Glen Canyon Dam. The proposed experiment would release more water in March 2008 and adjust flows later in the 2008 water year to ensure that the same amount of water is released as would be if the experiment were not undertaken. Monthly releases later in the year would be adjusted downward to account for the water released during the proposed experiment.

## **How much will the proposed scientific studies associated with the high-flow experiment cost?**

The total cost of the research activities associated with a possible 2008 high flow is approximately \$3.73 million for fiscal years 2008–09.

## **How will hydropower resources be affected and what are the costs of replacement power?**

The U.S. Department of Energy’s Western Area Power Administration estimates that if the proposed high-flow experiment were to occur in March 2008, the cost of replacement power would be approximately \$3.3 million.

## **What has been learned from previous high-flow releases?**

The design of the potential 2008 high flow and the accompanying experimental studies builds on learning that occurred during the two previous tests in 1996 and 2004. For example, as a result of the 1996 test, scientists learned that tributary-supplied sand does not accumulate on the riverbed over multiyear periods under typical dam operations. Additionally, the 1996 experiment was conducted when sand in the system was limited, especially in Marble Canyon, and, as a result, the low-elevation parts of upstream sandbars were eroded during the test. This information was used to strategically time high-flow testing in 2004 to take advantage of episodic tributary floods.

The 2004 high-flow release resulted in an increase of total sandbar area and volume in the upper half of Marble Canyon, but further downstream, where sand was less abundant, a net transfer of sand out of eddies occurred. These findings indicate that substantial increases in total eddy-sandbar area are only possible when high-flow tests are conducted under sediment-enriched conditions. However, more sediment will be required than was available during the 2004 high-flow test (800,000 to 1,000,000 metric tons) to achieve increases in total sandbar area and volume throughout all of Marble and Grand Canyons; the current sediment-enriched conditions in Marble and Grand Canyons are expected to provide enhanced sediment conditions to analyze the potential benefits from this high-flow experiment.

## **When will the results of the experiment be available to the public?**

Data on the effects of the high-flow experiment on various resources in Glen and Grand Canyons will be collected through the fall of 2008 and additional time will be required to analyze and interpret this data. Initial reports will be provided in late 2008 and 2009; a complete synthesis of the results including comparisons with results of the 1996 and 2004 tests will be provided in 2010. The U.S. Geological Survey is committed to providing information to the public and the Glen Canyon Dam Adaptive Management Work Group is as soon as it becomes available in the form of presentations, reports, images, and fact sheets.

The proposed high-flow release from Glen Canyon Dam is one step in a lengthy process to understand how downstream resources are affected by and respond to high-flow releases. Interpreting the large volume of data that are collected before, during, and after the two and one-half day high-flow release will take from months to years.

## **Where can I get more information?**

The most current information about the proposed 2008 high-flow experiment is available at [www.gcmrc.gov](http://www.gcmrc.gov). It is suggested that all river and backcountry users check this Web site or call Grand Canyon National Park's River Permits Office at 1-800-959-9164 before starting their river or backcountry trip. The Bureau of Reclamation, National Park Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, and Glen Canyon Dam Adaptive Management Program are working cooperatively to provide information related to the high flow—safety information, hydrographs, maps, and fact sheets high-flow test—as soon as it becomes available.