United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

MEMORANDUM

To: Members and Alternates
Glen Canyon Dam Adaptive Management Work Group (AMWG)

From: Anne J. Castle, Assistant Secretary for Water and Science AUG 19 2011
Secretary's Designee, Glen Canyon Dam Adaptive Management Work Group

Subject: Desired Future Conditions

The formulation of Desired Future Conditions (DFC) is possibly the most important task the AMWG has undertaken in the last ten years. Inherent in the concept of adaptive management is having goals against which management actions are formulated and measured. The disparate nature of stakeholder missions and interests necessarily means that building a shared set of goals and objectives is an arduous task. I want to congratulate and thank the AMWG for slogging through this process, with dedication and good humor, and reaching the final steps.

Since February 2010, when George Caan and Larry Stevens agreed to serve as co-chairs for the DFC Ad Hoc Group, many people have put significant effort into the final DFC product. Both the federal agencies and the DFC Ad Hoc Group did excellent work on this very difficult set of issues. As you know, the regional directors of the Interior agencies prepared the original draft of the DFCs, based on the strategic goals developed by the AMWG several years ago, and renewed their efforts in 2009. The AMWG then constituted the DFC Ad Hoc Group to take this draft and provide revisions based on AMWG members' input and perspectives. The DFC Ad Hoc group spent several months developing its recommendations, which were then circulated to the full AMWG, which provided further guidance at the August 2010 meeting and sent the document back to the DFC group for revision. In November of 2010, the Ad Hoc Group transmitted its final draft to the Department of the Interior for its consideration, revision, and approval. The AMWG also recommended that the Secretary consider directing the AMWG to use the DFCs as a basis to define quantitative DFCs for the program.

The Department of the Interior agencies and Western Area Power Administration conducted a final review to ensure that the mission responsibilities of those agencies were properly addressed. Interior believes that these DFCs accurately reflect the desired improvement and protection of the resources of Grand Canyon National Park and Glen Canyon National Recreation Area, as required by the Grand Canyon Protection Act and in concert with other appropriate authorities. We also made a number of revisions for consistency and clarity. For example, two of the DFCs included overall policy goals (the Colorado River Ecosystem (CRE) and Power DFCs), and the other two did not. Similarly, the CRE and Power DFCs included a section on relationship to dam operations while the cultural resources and recreation DFCs did not.

Because our ultimate goal was to forward solely the DFCs to the Secretary, we streamlined the document to move some sections to a separate background document (e.g., history, references cited), and in some cases moved language to a different section of the DFC (e.g., in the CRE DFC we moved language from the Overall Policy Goal subsection to the "Why the CRE DFCs are Important" subsection). We eliminated references to the 1996 ROD and similar documents because we anticipate that the LTEMP process currently underway will result in a new ROD and we want the DFCs to be forward looking and not limited by decisions made in the past. We have also made some changes recommended by the Office of the Solicitor (including eliminating the legal compliance sections). In addition, there are also several changes that are merely editorial and made with the goal of providing a "plain English" DFC document.

While we have made the types of changes described above, our overall goal was to preserve to the greatest extent practicable the effort and intent of the DFC Ad Hoc Group, and to maintain its work as the foundation for this final draft of the DFCs. Because, however, there have been changes from the document forwarded by the Ad Hoc Group, we would like to request that the DFC Ad Hoc Group undertake one final review before we forward the DFCs to the Secretary for his consideration. Any AMWG member is welcome to provide comments to the DFC Ad Hoc Group for consideration or to join the Ad Hoc Group for this final review if desired. We look forward to hearing your comments.

As you know, these Phase 1 DFCs are the narrative, qualitative goals and objectives for the Adaptive Management Program (AMP). The Phase 2 DFCs are expected to add measurable, objective, and implementable criteria to those qualitative goals. Development of Phase 2 DFCs will include multiple challenges, many of which were described in the August 9, 2010 memorandum from the DFC Ad Hoc Group. We expect the development of the Phase 2 DFCs will require more time and focus than the Phase 1 DFCs, which by themselves required a substantial commitment of time from all of the stakeholders. We have given considerable thought as to how best to approach the Phase 2 DFC process.

We are starting the scoping of the Long Term Experimental and Management Plan (LTEMP), which will guide the operations of Glen Canyon Dam for the next significant segment of time. The Phase 1 DFCs will provide the objectives against which to test alternatives in the EIS process for the LTEMP. We believe that the LTEMP process can and should include the development of quantitative criteria, based on the Phase 1 DFCs, for measuring the success of the long term plan. We are concerned that establishing an entirely separate process for formulating the Phase 2 DFCs, outside of the EIS, would not only be time consuming and compete with the LTEMP for focus, but could conceivably lead to development of inconsistent parameters. We suggest that it would be preferable to develop these quantitative criteria through the LTEMP process. This approach would allow for inclusion of measurable, objective, and implementable criteria for those parameters addressed by the LTEMP, rather than attempting to complete the entire suite of Phase 2 DFCs in a vacuum.

Finalizing the Phase 1 DFCs is a significant accomplishment. Many commentators on Glen Canyon issues and the AMWG in particular have noted the lack of agreed upon goals as a fundamental flaw in the program. That problem is now corrected. This is a process that has been underway for many years, and it is thanks to the work of the federal agencies involved and the efforts of the DFC Ad Hoc Group and many of you that we are nearing completion. We believe that the final draft provided here is faithful to the work of the Ad Hoc Group, and that this collaborative effort by the federal agencies and by the stakeholders will be a useful tool for the AMWG to use in developing future recommendations to the Secretary. I want to emphasize that these DFCs will be a "living document" that will evolve and change as we continue the learning process that is a vital part of any adaptive management program.

Thanks to each of you for your participation in this significant effort.

PREFACE

The following Desired Future Conditions (DFCs) are intended to be used within the Adaptive Management Program (AMP), including by the Adaptive Management Work Group (AMWG), to help guide the development of recommendations concerning management of Glen Canyon Dam operations and related activities, and its impacts on Grand Canyon National Park (Grand Canyon) and Glen Canyon National Recreation Area (Glen Canyon). The Secretary also is authorized to consider and implement non-operational measures to address downstream effects of Glen Canyon Dam if those measures meet the Grand Canyon Protection Act's goal of protecting, mitigating adverse impacts to, and improving the resources downstream of the dam. The DFCs will assist the AMWG in providing recommendations to the Secretary of the Interior for future decision-making. The DFCs have evolved from discussions during the entire sixteen year history of the AMWG, and were generated in the following form from the concerted work of the DFC Ad Hoc Group and the federal agency regional leadership during 2010 and 2011.

They are intended to be statements of qualitative goals and objectives for the AMP, realistic and achievable through the operation of Glen Canyon Dam and related activities, subject to the Law of the River and other laws and authorities and consistent with the Grand Canyon Protection Act. These DFCs may not be entirely or collectively achievable – there will be tradeoffs and inherent limitations. This fact does not diminish their value. These desired future conditions of the affected resources have been identified by the stakeholders as appropriate goals for the AMP and are based on information available this time. As new information develops, the DFCs may need further revision and refinement. Therefore, these DFCs are neither fixed nor final. This is intended to be a "living document" that reflects advances in learning and understanding. This is consistent with the process – and application -- of adaptive management.

The DFCs are broken out into four categories, including the Colorado River Ecosystem, Power, Cultural Resources, and Recreation. There are many direct and indirect, short-term and long-term ecosystem responses to dam existence and operations. These DFCs are directly or indirectly linked on short and long-term bases through dam-related flows, sediment retention and distribution, hydropower production, fish and wildlife populations, recreation, and visitor experience.

DESIRED FUTURE CONDITIONS (DFCS): COLORADO RIVER ECOSYSTEM

DFC Description

Ecosystem Definition:

The Colorado River Ecosystem (CRE) as defined by the AMP encompasses the Colorado River from the forebay of Glen Canyon Dam to its inflow into Lake Mead, and lies between the pre-dam high water zone terraces. The ecosystem also includes relevant additional habitats needed to sustain the CRE or that may be useful as scientific monitoring controls. The CRE includes aquatic and riparian processes and components (e.g., species) as well as terrestrial components that are influenced by riverine processes.

The term **ecosystem** refers to the combined physical and biological components of an environment. An ecosystem is generally an area within the natural environment in which physical (abiotic) factors and processes of the environment, such as geology, climate, and soil development, function along with interdependent (biotic) organisms, such as plants and animals, in the same habitat and create a dynamic and interconnected system. Ecosystems usually encompass a number of food webs. An ecosystem is a functional unit within a given area consisting of living things and the non-living chemical and physical factors of their environment, linked together through nutrient cycle and energy flow.

DFC Background and Legislation:

Glen Canyon Dam has had a profound impact on the aquatic and terrestrial domains of the Colorado River ecosystem from lower Lake Powell downstream to Lake Mead. The CRE DFCs are designed to consistent with the 1992 Grand Canyon Protection Act, Law of the River, and other appropriate laws and mandates. The CRE DFCs apply the requirements of the Grand Canyon Projection Act to "protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park (GCNP) and Grand Canyon National Recreation Area (GCNRA) were established," including natural resources, and are the goals that AMWG members will consider when making recommendations to the Secretary.

Why the CRE DFCs are Important:

These CRE DFCs address the natural resource values for which the GCNP and the GCNRA were established. The DFCs aim to maintain, enhance, and restore native species, natural habitats, and natural ecosystem processes. Native and non-native species are to be managed in accord with Federal regulations, policies, and guidelines. The CRE described herein includes most of the native natural resources found in the Colorado River. Those resources are managed, consistent with the Law of the River, under the National Park Service (NPS) Organic Act, the Redwoods Amendment, NPS 2006 Management Policies, the Wilderness Act, the Antiquities Act, the Endangered Species Act, the Grand Canyon Protection Act, the Fish and Wildlife Coordination Act, and other Federal legislation. The health of the river ecosystem and the protection of the

resource values of GCNP and GCNRA are important to the nation, many Native American Tribes, the economy of the Southwest, and the millions of visitors to the parks and the region.

The CRE DFCs will provide a foundation for and help define the components of the Core Monitoring Program under development by the Grand Canyon Monitoring and Research Center (GCMRC). The Core Monitoring Program will be essential to ultimately quantifying, measuring, and reporting the status of the natural resources, allowing the Secretary and the AMP to track progress toward desired outcomes. DFCs will also provide foundation support in the development of other planning and management assignments associated with the GCDAMP.

CRE DFCs

- **DFC 1** – An aquatic food base capable of supporting viable populations of desired species at higher trophic levels;
- **DFC 2** – Viable populations of existing native fishes, and the prevention of adverse modification to their habitat (including critical habitat);
- **DFC 3** – Restoration of viable populations of extirpated species;
- **DFC 4** – A sustainable recreational trout fishery in the Lees Ferry reach;
- **DFC 5** – Viable populations of the Kanab ambersnail;
- **DFC 6** – Healthy biotic riparian, wetland, spring and old high water zone plant communities and healthy associated biological processes within the CRE (including threatened and endangered species and their habitat);
- **DFC 7** – A level of water quality that supports ecosystem functions (dissolved oxygen, nutrient contributions and cycling, and temperature to the extent feasible consistent with the life history requirements of focal aquatic species;
- **DFC 8** – Levels of sediment storage within the main channel and along shorelines that achieve ecosystem goals.

DFC GOALS AND OBJECTIVES

Sediment-related Resources:

- High elevation open riparian sediment deposits are created, maintained, and enhanced along the Colorado River in sufficient volume, area, and distribution so as to provide habitat to sustain native biota and ecosystem processes, as well as cultural and recreational resources.

    - Maintain adequate sand bars (including camping beaches) for recreation in Glen Canyon National Recreation Area and Grand Canyon National Park and enhance as needed once maintained. Maintain nearshore habitats for native fish and enhance as needed once maintained.

    - Maintain marsh and riparian habitat for fish (food chain maintenance) and wildlife and enhance as needed once maintained.

- Maintain cultural resources and enhance as needed once maintained.

Water Quality:

- Water quality with regards to dissolved oxygen, nutrient concentrations and cycling, turbidity, temperature, etc., is sufficient to support natural ecosystem functions, visitor safety and visitor experience to the extent feasible and consistent with the life history requirements of focal aquatic species

  - Maintain ecosystem-sustaining nutrient distribution, flux, and cycling.

  - Maintain and enhance hydro-physical conditions and characteristics of the Colorado River ecosystem necessary to sustain native aquatic biota.

  - Maintain or enhance water quality for human health and visitor experience.

CRE Aquatic Domain:

- The aquatic food base will sustainably support viable populations of other desired species at all trophic levels.

- Assure that an adequate, diverse, productive aquatic foodbase exists for fish and other aquatic and terrestrial species that depend on those food resources.

Native Species:

- Native fish species and their habitats (including critical habitats) are sustainably maintained throughout in each species' natural ranges in the CRE and enhanced as needed once maintained.

  - Maintain a self-sustaining humpback chub (HBC) population in its natural range in the CRE and enhance as needed once maintained.

  - Achieve HBC recovery in accord with the Endangered Species Act (ESA), agency objectives, the HBC comprehensive management plan, and with the assistance of collaborators within and external to the AMP.

    - Ensure an ecologically appropriate habitat is maintained for the HBC in the mainstem and enhance as needed once maintained.

    - Maintain spawning habitat for HBC in the Lower Little Colorado.

    - Establish additional HBC spawning habitat and spawning aggregations within the CRE, where feasible.

- Assure adequate survival of young-of-year or juvenile HBC that enter the mainstem to maintain reproductive potential of the population and achieve population sizes consistent with recovery goals.

- Maintain healthy, self-sustaining populations of other remaining native fish with appropriate distribution (flannelmouth sucker, bluehead sucker, speckled dace and enhance as needed once maintained, so that listing under the ESA is not needed.

  - Manage trout and other non-native fish in Glen and Grand Canyons to meet objectives for a robust native aquatic community in those reaches, and as further described in the Recreation DFC.

  - Minimize emigration of non-native fish from the Lees Ferry reach in Glen Canyon National Recreation Area to downstream locations.

  - Minimize emigration of non-native warm water fish to the mainstem Colorado River.

- Re-establish fishes extirpated from Grand Canyon, where feasible and consistent with recovery goals for humpback chub and the recovery goals for those extirpated fishes or other native species.

Non-fish Biotic Communities:

- Native non-fish aquatic biota and their habitats will be maintained or enhanced with ecologically appropriate distributions.

  - Maintain, enhance, and, where feasible, restore populations of native non-fish species (invertebrates and vertebrates, including Northern Leopard Frog).

  - Assure that the abundance and distribution of non-native species in the riparian corridor is minimized.

  - Protect and improve dam-influenced aquatic, wetland, and springs plant communities and associated biological processes, including threatened and endangered species and their habitats.

CRE Riparian Domain:

- Native riparian systems, in various stages of maturity, are diverse, healthy, productive, self-sustaining, and ecologically appropriate.

  - Maintain native, self-sustaining riverine wetlands, and riparian vegetation and habitat, with appropriate mixture of age classes and enhance as needed once maintained.

- Maintain healthy, self-sustaining populations of native riparian fauna (both resident and migratory) and enhance as needed once maintained.

- Maintain, enhance, and, where possible, restore habitat of sensitive species within the zone of river influence

- Resolve the taxonomic status of the Kanab Ambersnail (e.g., completely describe the taxa and subspecies).

- Maintain and where possible, restore habitat of neotropical migratory birds, waterfowl, and other appropriate native bird species.

- Keep common native species common within the zone of river influence.

- Where feasible and consistent with Federal laws and agency policies, repatriate native species

- Maintain and enhance the ecological function of tributary mouths and riverside springs, including habitat for native species.

CRE DFCs ADDITIONAL INFORMATION

Linkages:

Physical characteristics, including climate, site-specific geomorphology, dam-related discharge and flow, and tributary flows, generally predominate over biological processes. The aquatic and riparian components of the CRE are linked to fluvial habitat distribution and the collection, composition, structure, and population dynamics of living organisms. "Lateral" bio-ecological processes, such as competition, and "top-down" processes, such as predation, parasitism, and decomposition, can influence some elements of these linkages over time.

In addition to physical and biological interactions, the CRE contains and is linked to Native American cultural resources such as archeological sites and cultural properties. Recreational benefits have heretofore been regarded as resulting from healthy ecosystem conditions. Hydropower production and water storage and release are managed through Glen Canyon Dam under the authority of the Secretary of the Interior.

Metrics:

These DFCs are intended to guide the gathering and analysis of data pertinent to the CRE in Grand Canyon National Park and Glen Canyon National Recreation Area. The CRE DFCs and the related documents will be used to provide direction towards development of the core monitoring program under development by the Grand Canyon Monitoring and Research Center

(GCMRC). Through diligent and consistent monitoring, GCMRC may inform the Secretary as to whether as to what degree these DFCs are being achieved.

- Percentage of critical habitat lost or gained
- Condition of species variability (native population, abundance, distribution)
- Carrying capacity thresholds
- Population estimates

POWER DESIRED FUTURE CONDITIONS

DFC DESCRIPTION

Power Definition:

Hydroelectric power is generated by the release of stored water through Glen Canyon Dam. The dam's eight generators can produce up to 1,320 megawatts: enough electricity to serve 1.3 million residential customers. The integration of hydropower and other resources provides an efficient and flexible operation of this region's electrical resources. Releases of water from Glen Canyon Dam are adjusted in part to follow customer loads.

DFC Background and Legislation:

Glen Canyon Dam is an important component of the Colorado River Storage Project (CRSP) which stores water, the West's most vital resource, during wet years for use in times of drought, much like a bank account. As part of the nation's critical infrastructure, the water stored by Glen Canyon Dam is vital to the growing water needs of the Western United States. Over 30 million people depend on the water stored behind the dam for drinking, irrigation, and other municipal and industrial uses.

Revenues from the sale of Glen Canyon hydropower generation and other CRSP facilities are used to repay the reimbursable costs, and interest on the interest-bearing costs of the Federal investment in the CRSP, and are also used to repay over 85 percent of the irrigation costs of the CRSP Federal irrigation projects. These revenues are also used, instead of annual Federal appropriations, to pay for the yearly operation, maintenance and replacement costs of Glen Canyon Dam and other CRSP facilities.

The Reclamation Project Act of 1939 provides that hydropower produced by Glen Canyon Dam and other CRSP facilities be offered for sale first to municipalities and other public corporation and cooperatives and other nonprofit organizations under financed in whole or in part by the Rural Electrification Act of 1936. Customers include rural electric associations, Federal facilities, state agencies, universities, and 57 Native American entities.

Glen Canyon Dam is authorized by and subject to the Colorado River Storage Project Act of 1956 and is currently managed in accordance with the October 1996 ROD implementing the Grand Canyon Protection Act of 1992. The goal of the preferred alternative selected in that ROD was not to maximize benefits for the most resources, but rather to find an operating plan for the dam that would permit recovery and long-term sustainability of downstream resources while limiting hydropower capability and flexibility only to the extent necessary to achieve recovery and long-term sustainability. The Secretary is charged with balancing a complex set of interest in operating the dam, including endangered species below the Dam, tribal interests, the seven Colorado River basin states, large municipalities that depend on water and power from Glen Canyon Dam, agricultural interests, the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, and national energy needs.

Why the Power DFC is Important:

- Hydropower is an authorized purpose of Glen Canyon Dam.

- Hydropower is a resource that is under long-term contract to not-for-profit entities and 57 tribal entities.

- Power revenues are a significant funding source (est. $20 million/year) for the AMP, Upper Colorado River and San Juan River Endangered Fish Recovery Programs, and the Colorado River Salinity Control Program.

- Hydropower is a renewable resource that is an important component in the Western Electricity Coordinating Council (WECC). Hydropower production is a national objective to help meet the Nation's needs for reliable, affordable, and environmentally sustainable electricity.

- Glen Canyon generation has the ability to "ramp up" to meet system reliability obligations that are important when regional power shortages or power/transmission system disruptions occur.

Power DFC:

- **DFC 9 –** Maximize hydropower capability and flexibility at Glen Canyon dam by limiting hydropower capability and flexibility at Glen Canyon dam only to the extent necessary to achieve recovery and long-term sustainability of Grand Canyon and Glen Canyon resources.

POWER DFC GOALS AND OBJECTIVES

- Consistent with applicable law, ensure continued delivery of Glen Canyon Dam hydropower to the existing customers who have entered into long-term firm power contracts with WAPA.

- Ensure sufficient and efficient production of Glen Canyon Dam hydropower in order to provide the revenues to support the CRSP facilities and purposes.

- Maintain the operational flexibility (including but not limited to load following capability, ramp rates, and emergency operations allowances) that enable Reclamation and WAPA to meet the system operating and other regulatory requirements of WECC, North American Electric Reliability Corporation and the Federal Energy Regulatory Commission, as well as emergency operating criteria for safety and human health situations.

- Maximize the environmental benefits of hydropower generation at Glen Canyon Dam.

- Minimize carbon emissions through hydropower generation at Glen Canyon Dam.

POWER DFC ADDITIONAL INFORMATION

Linkages:

- Operational changes, including experimentation and management actions, which include changes to volumes, release limitations (minimum and maximum), ramp rates, hourly, daily, monthly and seasonal variability, all potentially impact this resource.

- The above-identified parameters could have impacts to the CRE resources as well as recreational and cultural resources, depending on the operational design.

Metrics:

Undertake an economic analysis of the impact of any operating changes at Glen Canyon Dam looking at, among other things:

- Valuation Metrics (measurement characterization is for an average annual year)
- Electric Generating Capacity (MW)
- Electric Generating Energy (MWH)
- Load Following Capability MW/hr)
- Ramp Rate Capability (MW/hr)
- CO2, SO2 and NOX Emissions (tons)
- Power Plant Water Consumption (acre feet)
- Costs ($ Millions)

CULTURAL RESOURCES DESIRED FUTURE CONDITIONS

DFC Description

Cultural Resources Definition:

Preservation and appropriate management of cultural resources are vital at many levels. At the most basic level, cultural resources are our history; they define and reaffirm us, and provide a tangible record of who we are and where we have been. Their importance may be to the nation as a whole, to a local community, or to a group traditionally associated with the area. This includes resources within the Grand Canyon region, including resources along the river corridor in Glen and Grand Canyons.

DFC Background and Legislation:

Recognition of the importance of cultural resources is codified through numerous statutes and executive orders that mandate protection, consideration, and preservation of cultural resources. Because of the structure of federal law, particularly the National Historic Preservation Act of 1966 (NHPA), cultural resources will be considered below in two broad groupings: **DFC 10A**, those that fall within the purview of the NHPA (National Register Eligible historic properties); and **DFC 10B**, all other resources of traditional cultural importance. This is done for purely pragmatic reasons; there are specific legal requirements for cultural resources that fall under the NHPA umbrella that do not apply to the second class of cultural resources. The Cultural Resources DFCs apply the requirements of the Grand Canyon Projection Act to "protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park (GCNP) and Grand Canyon National Recreation Area (GCNRA) were established," including cultural resources, and are the goals that AMWG members will consider when making recommendations to the Secretary.

Why the Cultural Resources DFCs are Important:

The cultural resources of the Grand Canyon provide a record of human history in the area. They also encompass the traditional cultural use and significance of the Grand Canyon. Maintaining these resources is important to the nation as a whole so we can better understand the long history of the people who came before us and to the traditional groups that consider this area to have traditional significance to them. A number of Native American groups believe the Grand Canyon is their place of origin. These DFCS will help maintain compliance with relevant cultural resource laws; maintain traditional cultural linkage with the Grand Canyon; and maintain traditional cultural access to and use of resources in the Grand Canyon in accordance with applicable law.

Cultural Resources DFC

- **DFC 10** – Preserve, protect, manage and treat the following cultural resources for the inspiration and benefit of past, present, and future generations.
  - DFC 10A – National Register eligible (or potentially eligible) historic properties.
  - DFC 10B – Resources of traditional cultural significance.

DFC 10A GOALS AND OBJECTIVES

DFC 10A National Register Eligible (or Potentially Eligible) Historic Properties:

- These resources are historic properties that are eligible or potentially eligible for inclusion in the National Register of Historic Places. The criteria for inclusion are defined in the NHPA, and are described in more detail in National Register Bulletins 15 and 38. Resources in the Grand Canyon include:

  - Prehistoric archaeological sites (including trails, petroglyphs and pictographs)
  - Historic sites (boats, mining, European exploration, river running)
  - Traditional Cultural Properties - for the Grand Canyon, these include:
    - Archaeological sites
    - Traditional resource use areas
    - Sacred sites
    - Landmarks/geographic features
    - Springs
    - Significant event locations
    - The Grand Canyon itself

DFC 10A Objectives

Prehistoric Archaeological Sites and Historic Sites:

- To the extent feasible, maintain significance and integrity through preservation in place. (On lands administered by the NPS, there is the desire to maintain access to some sites for users of the river corridor as long as the integrity of the sites is not compromised. The NPS classifies these sites as Class I and II sites. Class I sites are sites that have a long history of tourist use, are marked on USGS topographic maps, are described in widely available guide books, are generally known to visitors, or are actively promoted as tourist destinations. Class II sites are more fragile or vulnerable to visitor impacts than Class I or have other concerns that require restricted visitation. Class II site locations may only be disclosed to the public when visitors request the information by site name, photograph or other description).

- On tribal lands, public access to sites is not a desired condition unless the tribal permitting authority specifically authorizes and encourages it.

Traditional Cultural Properties (TCPs):

- To the extent feasible, maintain attributes such that National Register eligibility is not compromised. These attributes will be specific to the traditionally associated peoples and will need to be identified by the federal agencies in consultation with those groups. Attributes may include aspects of location or physical integrity, as well as be intangible elements that link the resource to ongoing traditional cultural practices.

- Maintain the ability of traditionally associated peoples to access and use the resource in accordance with applicable law.

- To the extent feasible, maintain the resource for culturally appropriate condition based on traditional ecological knowledge, and integrate this desired condition into relevant monitoring and management programs.

- Maintain ongoing consultation with the groups for whom the resource has traditional value. Because the desired condition of a TCP needs to be determined by the group for whom it has the traditional value, ongoing consultation is necessary to assess the condition of the resource.

- Mitigate impacts that affect the integrity of the TCPs. How and if effects can be mitigated will need to be developed in conjunction with the traditionally associated peoples for whom the resource holds value.

DFC 10A ADDITIONAL INFORMATION

Linkages:

The goals for the following all have the potential to directly or indirectly affect the condition of the National Register eligible properties (including some examples of effects):

- Flow
  - Direct inundation
  - Levels of sediment deposition
  - Fluctuation frequency and range
- Sediment
  - Distribution (laterally and vertically)
- Vegetation
  - Species composition
  - Density
- Recreation
  - Camping locations
  - Recreational visitation

- Trailing

Additionally, management and research actions have the potential to directly or indirectly impact these resources.

Metrics:

- Erosion (or deposition) rates of substrates in which the sites are contained
- Impacts at sites that will affect eligibility

DFC 10B GOALS AND OBJECTIVES

DFC 10B Description – Resources of Traditional Cultural Significance:

- These are resources of cultural significance to a traditionally associated people, often Native American tribe, that do not meet some aspect for eligibility for inclusion in the National Register of Historic Places. A common reason that a resource does not meet National Register eligibility is that the resource lacks a clearly defined boundary or does not remain in a fixed location. Resources that have the potential to be considered of traditional cultural significance in the Grand Canyon include:

  - Animal resources
  - Geologic materials
  - Landscapes
  - Plant resources
  - Soundscapes
  - Viewscapes
  - Water

DFC 10B Objectives

- Maintain the ability of traditionally associated peoples to access and use the resource in accordance with applicable law.

- Maintain culturally appropriate resource conditions based on traditional ecological knowledge, and integrate this desired condition into monitoring and management programs.

- Maintain effective consultation with the groups for whom the resource has traditional cultural significance.

DFC 10B ADDITIONAL INFORMATION

Linkages:

The goals for the following resources all directly or indirectly affect the condition of resources with traditional cultural significance:

- Flow
- Sediment
- Vegetation
- Recreation

Also, management and research actions have the potential to directly impact these resources.

Metrics:

Because culture defines the roles that resources play in that culture, only members of that culture can assess the status or health of the resources. Therefore, measures for resource status or health and appropriate management will need to be determined individually by the federal agencies in consultation with the traditionally associated peoples.

RECREATION DESIRED FUTURE CONDITIONS

DFC DESCRIPTION

Definition:

The Recreation DFCs are meant to describe goals and objectives for human use of the Colorado River Ecosystem (CRE) through GCNRA and the GCNP. They are intended to include not only traditional recreational activities such as whitewater rafting, camping, and fishing, but also such things as educational activities, spiritual engagement, and other appropriate activities and values. Grand Canyon and Glen Canyon offer many ways for people to experience, appreciate, and learn from them, even to those who never visit in person.

DFC Background and Legislation:

Recreational use began before there were any dams on the Colorado River, though the exact beginnings are unknown. Recreational and other activities and values in the Grand Canyon and Glen Canyon have increased greatly since the time of the construction of Glen Canyon Dam.

The Recreation DFC applies the requirements of the Grand Canyon Projection Act to "protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park (GCNP) and Grand Canyon National Recreation Area (GCNRA) were established," including visitor use/recreation, and the goals that AMWG members will consider when making recommendations to the Secretary.

Why the Recreation DFC is Important:

Grand Canyon National Park: The Grand Canyon is a unique place in this world. Its natural beauty, challenging environment, fascinating history, wilderness character, biodiversity and sheer size offer a rare and valuable experience. The river corridor is at the heart of the Grand Canyon. The river corridor and the canyon are worthy of the greatest possible respect, treatment, and protection that we can afford them. They must be kept vital and intact for future generations.

Glen Canyon National Recreation Area: The river corridor through the GCNRA provides opportunity to enjoy outdoor beauty with relatively easy access. It supports a valuable and high quality trout fishery and offers excellent outdoor opportunities that are more accessible and less demanding than those of the Grand Canyon. It is deserving of our respect and protection, while also providing the recreational opportunities for which it was established.

Recreation DFC

- **DFC 11** - Maintain or improve the quality of recreational experiences for users of the Colorado River ecosystem, within the framework of ecosystem goals.

DFC GOALS AND OBJECTIVES

DFC Objectives:

The Recreation DFCs have been divided in to four subcategories, each corresponding to a different section of the overall ecosystem or type of use:

- **River Recreation in Grand Canyon National Park**
  - Stewardship worthy of the Grand Canyon so that it can be passed from generation to generation unimpaired.
  - Provide maximum opportunity to experience the wilderness character of the canyon. Wilderness experiences and benefits available in the canyon include solitude, connection to nature, personal contemplation, joy, excitement, the natural sounds and quiet of the desert and river, and extended time periods in a unique environment outside the trappings of civilization.
  - A river corridor landscape that matches natural conditions as closely as possible, including extensive beaches and abundant driftwood.
  - A river corridor ecosystem that matches the natural conditions as closely as possible, including a biotic community dominated in most instances by native species.
  - A dynamic river ecosystem characterized by ecological patterns and processes within their range of natural variability.
  - Numerous campable sand bars distributed throughout the canyon.
  - Minimize impacts to recreational and wilderness experiences from research and management activities.
  - River flows that continue to be within a range that is reasonably safe, given the inherent risks involved in river recreation.
- **River Recreation in Glen Canyon National Recreation Area**
  - Maintain and improve the quality of the recreation experience in Glen Canyon.
  - Maintain camping beaches suitable for recreational use.

- A setting and ecosystem that is as close to natural conditions as possible.

➢ **Trout Fishery in Glen Canyon National Recreation Area**
- Maintain a high-quality sustainable recreational trout fishery in the river corridor in GCNRA, while minimizing emigration of non-native fishes.

- Operate Glen Canyon Dam to achieve the greatest benefit to the trout fishery in GCNRA without causing excessive detriment to other resources.

➢ **River Corridor Stewardship**
- Stewardship worthy of the Grand Canyon, so it can be proudly passed from generation to generation unimpaired.

- Management of Glen Canyon Dam that is significantly driven by concern for the cultural values and ecological integrity of the river corridor through the Grand Canyon, with preservation and protection considered over the long term (multiple generations

DFC ADDITIONAL INFORMATION

Linkages:

➢ The river corridor ecosystem:
- A natural, healthy, and protected ecosystem is a fundamentally key element to the recreation experience and wilderness character of the river corridor.

➢ Cultural resources within and near the river corridor:
- The history of human habitation and use is an important part of the recreation experience. Individual sites are valuable whether they are open for visitation or designated off-limits.

➢ Socio-economic values of quality recreation opportunities:.
- Outfitters and guiding opportunities
- Local businesses

Metrics:

- Socio-economic value of river recreation in GCNP.

- Socio-economic value of the river corridor and the Grand Canyon itself, as a whole.

- Economic effects of Grand Canyon tourism.

- Factors that make up the "wilderness character" of the river corridor.

- Number and size of campable beaches, safe flows for an optimal recreation experience
- Socio-economic value of river recreation in GCNRA.
- Socio-economic value of the river corridor itself in GCNRA.
- Socio-economic value of the fishery in GCNRA.
- Effect of the trout on the ecosystem in GCNP and the social and economic costs of mitigation.
- Characteristics most valued for the fishery; for example, the number, condition, and size of fish, and the ease or challenge of catching them.

DFC BACKGROUND

General Comments Regarding Phase 1 Process

The process to complete the DFCs generated a number of common themes that we thought would be better relayed in an attachment to the transmittal letter. These comments are grouped as follows:

- Dam Operations, Limitations and Constraints
- Science and Monitoring
- Phase 2 DFCs Challenges and Recommendations
- Compliance Responsibilities, Laws and Regulations

DAM OPERATIONS, LIMITATIONS, AND CONSTRAINTS

Almost every means or fundamental DFC resource or process in the Colorado River ecosystem (CRE) in Glen and Grand Canyons has some nexus to the operations of Glen Canyon Dam, and the existence of the dam is a given. The Grand Canyon Protection Act (GCPA) and the Adaptive Management Work Group (AMWG) Charter frame the discussion of system limitations and constraints. Pursuant to your direction, our DFCs Phase 1 discussions focused on the definition of reasonableness and achievability of the DFCs proposed; however, many uncertainties exist over the nature and extent of dam impacts. Some resources, such as power, are clearly affected by Glen Canyon Dam operations, while the impacts of dam operations on other resources (e.g., water quality) are less clear.

The DAHC engaged in a rigorous discussion over what could be managed with dam operations and which resources and processes were not affected, or were only partially affected, by dam operations. Teasing apart the ecosystem impacts of dam existence versus dam operations remains a challenge, both in terms of science and agency policy dynamics. For example, dam construction greatly reduced annual flow variability, and the potential ecological benefits and policy implications of Modified Low Fluctuating Flows (MLFF) flows with relatively small (45,000 cfs) high flow experiments are still being evaluated. It was agreed that additional direction and science are needed to help improve understanding of these relationships, limitations, and operational constraints, and that those topics should be key components of Phase 2 DFCs discussions.

The GCPA provides for management actions other than dam operations, and therefore may expand river ecosystem management tools. The AMWG charter states, “the AMWG may recommend research and monitoring proposals outside the Act, which complement the Glen Canyon Dam Adaptive Management (AMP) process, but such proposals will be funded separately, and do not deter from the focus of the Act.” Phase 2 DFCs discussions will need to distinguish between dam operations and non-flow management responsibilities and actions. The DAHC will forward to the AMWG for considerations recommendations to the Secretary for appropriate long-term flow and non-flow management actions for implementation, addressing the funding for non-flow actions.

SCIENCE AND MONITORING

A rigorous, credible science program is essential for all aspects of DFCs monitoring, research, and reporting, for development of AMP advice to the Secretary. At present, science services are provided to the AMP primarily by the U.S. Geological Survey through the Grand Canyon Monitoring and Research Center (GCMRC). While a DFC specifically for science integrity was considered by the DAHC, we view the need for AMP science and monitoring as programmatic, extending to all elements of the AMP. Therefore, achieving DFCs as well as AMP goals requires the following from its science program(s).

1) Scientific information used for the AMP process must be reliable, of high quality, and rigorously reviewed. At present, the AMP relies on dialogue between stakeholders and the GCMRC to establish research and monitoring tasks and priorities. Continued and even more rigorous review of scientific research plans and projects should be performed by the independent Science Advisors, and their recommendations should be seriously considered and implemented where appropriate.

2) Peer-reviewed publication of scientific findings in major scientific journals is the gold standard for scientific credibility, and peer-reviewed publication amplifies the credibility of the overall AMP to the scientific community and to the public. Peer-reviewed publication is the norm for all scientific organizations; and we strongly recommend that all major AMP projects undertaken by the USGS be prepared and submitted for peer-review publication, rather than being left in report form.

3) AMP data, reports, hard copy field notes and maps, meeting documentation, and other information should be compiled and archived in a fashion that makes it easy to access and easy to relate to contemporary and emerging issues. AMP information management, through both GCMRC and Reclamation, occasionally should be reviewed by the Science Advisors or by external information management experts, and recommendations from those reviews should be followed. A summary of findings and conclusions to date should be developed, maintained, and modified as appropriate to further guide the AMP process. An annotated, searchable administrative history of the AMP would be useful and improve information availability, project completion, AMP progress, and education of new AMWG members, and should help prevent duplication of effort over time.

4) Uncertainties, unrecognized linkages, unanticipated ecosystem events and processes, changing policies, and biases are abundant and affect our understanding of the CRE and its dynamic character. Consequently, much uncertainty exists over CRE management appropriateness and effectiveness, particularly involving direct and indirect impacts of dam operations on biota, processes, and interactions. The implications of this uncertainty often are not clearly acknowledged or embraced in science planning. The extent, impacts, and risks of scientific uncertainty on monitoring, research, and management program success should be more clearly identified, assessed, and communicated to the AMWG.

Phase 2 Recommendations: How to Move Forward

PHASE 2 CHALLENGES

The Phase 1 DFCs clarify the DAHC vision for the Colorado River socio-ecosystem. Further DOI review of these DFCs is expected to help focus the AMP. Several conflicts and assumptions over AMP direction challenged the development of Phase 1 DFCs and remained unresolved.

- General programmatic conflicts are listed in the Policy Issues Ad Hoc Committee report (2009) and primarily involve conflicts among mandates and establishment of clear priorities. It would be advantageous for the DOI to resolve intra-departmental conflicts, and to identify a resolution strategy for inter-departmental conflicts that would help the AMP find a balance among competing laws and mandates.

- An assumption that perpetuates conflicts in development of the DFCs appears to be the direction and magnitude of the AMP: if environmental impacts stemming from dam operations can be successfully addressed, and other problems can be solved or mitigated outside the AMP, will the size and cost of the AMP program decrease?

- Phase 2 DFCs quantification will require clarification of the scope of the AMP. Previous efforts have attempted to identify which elements lie within or outside the scope of AMP, but all issues have not been resolved or agreed to and they perpetuate controversy within the AMP. For example, how can the AMP be limited to dam operations if a fisheries recovery program addresses non-flow management activities? The scope of AMP activities may still need to be addressed through further discussion in the AMWG and the DOI.

- Phase 2 should be structured to prioritize "fundamental resource" over "means" DFCs or to identify obstacles (including uncertainties) to that prioritization where possible. A prioritized approach will help define and clarify the supporting ecological and sociological linkages needed to achieve DFCs, and move towards those goals through appropriate scientific endeavors.

- The relationship between the NPS and the AMP must be made clear. Grand Canyon National Park represents both itself and Glen Canyon National Recreation Area on the AMWG. It can be argued that the NPS has full jurisdiction over all DFCs, except those for hydropower and the Tribal and joint-use lands in the river corridor. Other government agencies also claim shared responsibility for some cultural and natural resources in the river corridor (e.g., Tribal responsibilities for cultural resources, Arizona's responsibilities for fish and wildlife). Reclamation, in full cooperation with the Colorado River Basin States and other stakeholders, has responsibility for water storage, delivery, and dam operations. Clarification and balancing of jurisdictional responsibilities will help improve the overall adaptive management process.

- In relation to the above, discussion on establishing a reference condition for management of the CRE has been a persistently divisive and controversial issue within AMWG.

Should the reference point be the pre-dam condition, or is it one or more post-dam reference years (e.g., 1984 or the initiation of the AMP in 1997), varying among resources? Resolution of this issue is needed for DFCs quantification in Phase 2.

Many of these issues are controversial. Therefore, we recommend that the Phase 2 DFC discussion be facilitated to identify, define, and resolve or clarify these and other conflicts prior to, and during, the Phase 2 DFCs quantification process.

PHASE 2 DFCs PROCESS RECOMMENDATIONS

We believe a number of steps should be taken as part of the Phase 2 process. The following is a list of some steps that might be considered.

- Design and conduct a facilitated AMP policy issues discussion process—perhaps as a workshop—to clearly identify, define, discuss, and, where possible, promote resolution of key issues of conflict among agencies. This process should focus initially on contentious issues among DOI agencies, such as NPS management for the natural (pre-dam) condition of the CRE and Reclamation's dam management policies and consequences. Progress on DFCs quantification in Phase 2 also will require determining whether and how inter-agency conflicts may limit achievement of DFCs and how to resolve those conflicts.

- Establish priorities among fundamental and means DFC elements by considering ranking and weighting by: perceived importance, certainty of beneficial impact, agreement on methods and metrics to be used (standardized metrics may be most useful), legal requirements, compliance/acceptability, cost, time frame, and linkage to other prioritized actions (i.e., implications for quantification of some DFC variables that affect quantification of other variables). Towards this end, completion and utilization of the comprehensive, long-term planning process would likely prove beneficial.

- Determine how Phase 2 DFCs priorities relate to AMP and GCMRC strategic plans and readjust monitoring priorities if necessary.

- After the development of the quantified Phase 2 DFCs, Interior should propose or develop a draft Phase 2 DFCs implementation plan and funding strategy for review by all stakeholders, GCMRC and the Science Advisors.

- A final Phase 2 DFCs implementation plan should be provided to the AMWG by the Secretary for guidance.

COMPLIANCE RESPONSIBILITIES, LAWS, AND REGULATIONS

Each DFC has associated laws, regulations, and compliance responsibilities. A section was included in the DFC template to identify specific legal and compliance issues in each DFC. Many of these regulations are common to all DFCs but may be interpreted and applied differently, creating challenges in understanding linkages. We have provided a list of these laws

and regulations below in order to facilitate the discussions that will occur during later phases of the project.

Partial List of Authorities (chronological if noted)

- Reclamation Act (1902)
- Grand Canyon National Monument (1908)
- National Park Service Organic Act (1916)
- Migratory Bird Treaty Act and Bald Eagle (1918)
- Grand Canyon National Park (1919)
- The Colorado River Compact- Law of the River (1922 and ongoing)
- Fish and Wildlife Coordination Act (1934)
- Bald and Golden Eagle Protection Act (1940)
- Upper Colorado River Basin Compact (1948)
- Colorado River Storage Project Act of (1956)
- Wilderness Act (1964)
- National Historic Preservation Act (1966) Sections 106 and 110
- Colorado River Basin Project Act (1968)
- National Environmental Policy Act (1969)
- Endangered Species Act (1973)
- Grand Canyon Enlargement Act (1975)
- DOE Organization Act (1977)
- Redwoods Act (1978)
- Archeological Resource Protection Act (1979)
- Native American Graves Protection and Repatriation Act (1990)
- Grand Canyon Protection Act (1992)
- Religious Freedom Restoration Act (1993)
- GCNP General Management Plan (1995)
- Record of Decision, Operation of Glen Canyon Dam Final Environmental Impact Statement (1997)
- Grand Canyon National Park Resource Management Plan (1997)
- Energy Policy Act (2005)
- Colorado River Management Plan (2006)
- NPS Management Policies (2006)
- Natural Environment Research Council NERC/WECC Standards (2007)
- NPS management statutory authorities for Glen Canyon National Recreation Area and Grand Canyon National Park
- Executive Order 11593-Protection and Enhancement of the Cultural Environment
- Executive Order 13007-Indian Sacred Sites
- Executive Order 13175-Consultation and Coordination with Indian Tribal Governments
- Secretary Order 3206-American Indian Tribal Rights, Federal-Tribal Responsibilities and the Endangered Species Act
- Arizona Revised Statutes Title 49
- Arizona Revised Statutes Title 17

CRE Relationship to Dam Operations:
There are many direct and indirect, short-term and long-term ecosystem responses to dam existence and operations. Many of these are discussed in the SCORE Report (Gloss et al. 2005*; Fig. 1). This and the other three proposed DFCs are directly or indirectly linked on short and long-term bases through dam-related flows, sediment retention and distribution, hydropower production, fish and wildlife populations, recreation, and visitor experience. Figure 1 illustrates the complicated linkage among the dam operations and natural as well as socio-cultural resources in the CRE, and the extent of coverage of the proposed DFCs described in this document.

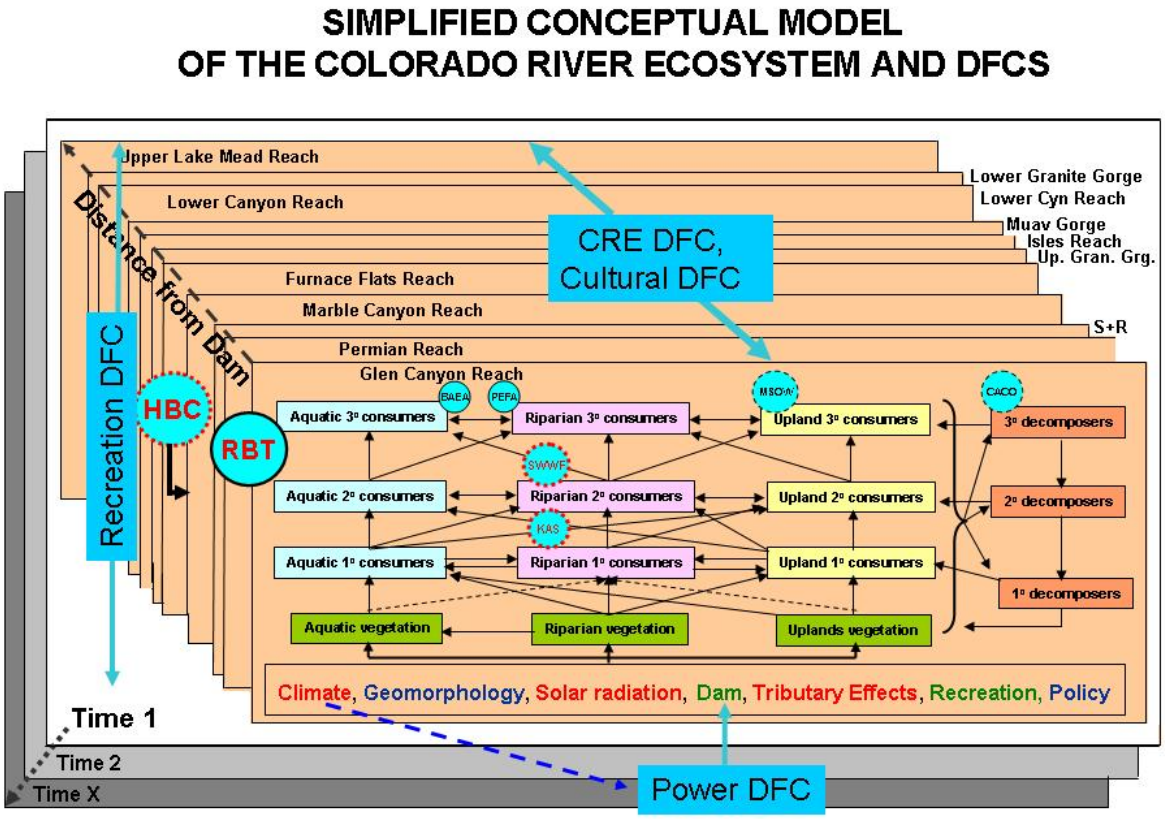

Figure 1: A schematic of the Colorado River ecosystem in relation to Glen Canyon Dam. Abbreviations: BAEA – Bald Eagle, CACO – California Condor, DFC – desired future conditions, HBC – Humpback Chub, MSO – Mexican Spotted Owl, PEFA – Peregrine Falcon, RBT – Rainbow Trout, S+R – Supai and Redwall reaches (Miles 11-39), SWWF – Southwestern Willow Flycatcher.

- **CRE REFERENCES CITED**

- Schmidt, J.C., Webb, R.H., Valdez, R.A., Marzolf, R. and Stevens, L.E. (1998). "Science and Values in River Restoration in the Grand Canyon," Bioscience, 48, 735-747.

- Schmidt, J.C., and Graf, J.B, 1990, Aggradation and degradation of alluvial sand deposits, 1965-1986, Colorado River, Grand Canyon National Park, Arizona: U.S. Geological Survey Professional Paper 1493, 74 p.

- Stevens L.E., Schmidt J.C., Ayers T.J., Brown B.T. (1995) Flow regulation, geomorphology, and Colorado River marsh development in the Grand Canyon, Arizona. 1025-1039.

- Stevens L.E., Ayers T.J., Bennett J.B. *et al*. (2001) Planned flooding and Colorado River riparian trade-offs down-stream from Glen Canyon Dam, Arizona. 701-710.

- U.S. Department of the Interior. 1996. *Record of Decision on the Operation of Glen Canyon Dam Final Environmental Impact Statement*. Upper Colorado Region, Bureau of Reclamation, Salt lake City, UT.

- Gloss, S.P., and Kennedy, T.A., eds., 2005, The state of the Colorado River ecosystem in Grand Canyon (SCORE), U.S. Geological Survey Circular 1282, pp. 87-98. Figure 1 pg 80.